APP Corporation

Collector Wind Farm
Environmental Assessment

June 2012

STATEMENT OF VALIDITY

Submission of Environmental Assessment

Prepared under Part 3A of the *Environmental Planning and Assessment Act 1979* by:

Name:	APP Corporation Pty Ltd
Address:	Level 7, 116 Miller Street North Sydney NSW 2060
In respect of:	Collector Wind Farm Project

Applicant and Land Details

Applicant name	RATCH Australia Corporation Limited
Applicant address	Level 13, 111 Pacific Highway North Sydney NSW 2060
Land to be developed	Land 6,215ha in area within the Upper Lachlan Shire, located along the Cullerin Range, bound to the north by the Hume Highway and to the south by Collector Road, comprising the lots listed in Table 1 of the Environmental Assessment.
Proposed development	Construction and operation of up to 68 wind turbines with installed capacity of up to 228MW, and associated electrical and civil infrastructure for the purpose of generating electricity from wind energy.
Environmental Assessment	An Environmental Assessment (EA) is attached.
Certification	I certify that I have prepared the contents of this EA and to the best of my knowledge: • it contains all available information that is relevant to the environmental assessment of the development to which the EA relates; • it is true in all material particulars and does not, by its presentation or omission of information, materially mislead; and • it has been prepared in accordance with the *Environmental Planning and Assessment Act 1979*
Signature	
Name	**NICK VALENTINE**
Qualifications	BSc (Hons), MAppSc
Date	30 June 2012

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Executive Summary

Executive Summary

This Environmental Assessment (EA) has been prepared in accordance with the Director-General's Requirements (DGR's) issued by NSW Department of Planning and Infrastructure (DoPI). The objective of the EA is to support the application by Transfield Services Wind Developments Pty Ltd (the Proponent) for Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the proposed Collector Wind Farm (the Proposal).

This EA identifies the potential environmental impacts relating to the construction, operation and decommissioning of the Proposal, and includes a draft Statement of Commitments which details proposed environmental safeguards and mitigation measures the Proponent will implement to minimise any adverse impacts.

This EA has been prepared by APP Corporation Pty Limited on behalf of the Proponent. It includes the findings from specialist technical assessments and inputs from consultation with the Collector community and other stakeholders.

The Proposal

The Proposal involves the construction, operation and decommissioning of a wind farm comprising up to 68 wind turbine generators (WTGs) and associated electrical and civil infrastructure.

Noise performance analysis has determined that the proposal for up to 68 WTGs is compliant with all relevant operational noise criteria, including the *Draft NSW Wind Farm Noise Guidelines*. The maximum number of turbines that can be installed on the site, whilst remaining fully compliant with noise guidelines, is dependent on the type of turbine used. Several WTG models are under consideration for the Proposal. Depending on the WTG model, and subject to conditions of approval which may be imposed on the Proposal, there could be fewer than 68 WTGs eventually installed.

The specific WTG chosen for the project will be determined through a competitive tender process. The Proposal will have an installed generating capacity of up to 228 megawatts (MW) depending on the capacity and number of WTGs installed.

The Proposal includes electrical and civil infrastructure associated with the WTGs. This includes access roads, underground cabling, a control building, substation, connection to the transmission grid, and wind monitoring masts. Additional infrastructure will be required during the construction phase, including a construction compound and potentially an on-site concrete batching plant (which would be subject to a separate development application).

The Proposal will be located in the Upper Lachlan Shire Local Government Area (LGA) approximately 55 kilometres (km) north-east of Canberra and 35km south-west of Goulburn. Situated in the NSW Southern Tablelands along the Cullerin Range, the project site is bounded to the north by the Hume Highway and to the south by the Collector-Gunning Road and is bisected by Lerida Road South. The population within a 5km

radius of the Proposal is approximately 350, with the majority residing in Collector village, approximately 3.5km to the south-east of the Project site.

Following selection of the turbine model and determination of the final number of WTGs, the wind farm layout would be subject to minor adjustments - 'micro-siting' - prior to construction in response to various factors including:

- environmental constraints, such as avoidance of significant vegetation, drainage lines, and geological conditions;
- final wind speed and energy yield analysis;
- detailed site survey and geotechnical/civil engineering analysis; and
- turbine manufacturer's recommendations.

Statutory Context

The Proposal was declared a Major Project under Part 3A of the EP&A Act by the Minister for Planning on 15 February 2010. Through an Instrument of Delegation (14 September 2011), the Minister for Planning and Infrastructure delegated the determination of the Proposal to the Planning Assessment Commission. The Proposal was declared to be a "critical infrastructure project" under Section 75C of the EP&A Act, being a wind energy project with a "…*capacity to generate at least 30 megawatts*". Hence, the Proposal has been assessed in accordance with Part 3A of the EP&A Act.

This Environmental Assessment (EA) was prepared in accordance with the DGRs issued under section 75F of the EP&A Act. The DGRs, which were issued on 15 October 2010 in response to a Major Project Application made by the Proponent on 17 September 2010, identify the key issues that must be assessed in this EA.

The relevant local government planning instrument is the Upper Lachlan Local Environmental Plan 2010 (LEP). The Proposal will be situated on land zoned RU2 Rural Landscape under the LEP and is permissible with development consent.

Draft NSW Wind Farm Guidelines were released by the NSW Government in December 2011. In accordance with instructions from the Department of Planning and Infrastructure, the Proponent has had regard to these guidelines in the preparation of this document.

Strategic Justification

In August 2009, the Federal Government implemented the Renewable Energy Target (RET) scheme, which aims to "…*ensure that 20 per cent of Australia's electricity supply will come from renewable sources by 2020*". On 1 January 2011, the Large-scale Renewable Energy Target (LRET) - covering large-scale renewable energy projects including wind farms – was introduced.

The NSW Government – through the *State Plan NSW 2021: A Plan to Make NSW Number One* – has committed to 20% renewable energy by 2020 "…*by promoting energy security through a more diverse energy*

mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources". To support this policy, the Government has appointed a Parliamentary Secretary for Renewable Energy and is developing a 2020 NSW Renewable Energy Plan. The Government has also maintained the Renewable Energy Precincts initiative, which designates six areas of the state where significant renewable energy development is anticipated. The Proposal is situated within NSW/ACT Cross Border Region Precinct.

The Proposal will contribute to the Federal and State Government strategic initiatives by generating up to 586 gigawatt-hours (GWh) of electricity per annum, equivalent to powering approximately 80,000 homes. Over the projected life of the Proposal (approximately 25 years) emissions of up to 11 million tonnes of greenhouse gases will be avoided through substitution for fossil-fuelled energy generation,.

Local employment will be generated by the Proposal through direct employment during construction and operational phases of the project. It is anticipated that there will be economic benefits to the local community from the flow on effect of construction activity. By taking into consideration stakeholder concerns and requirements in the iterative development of the Proposal, including conserving biodiversity values and mitigating environmental impacts, the Proponent intends to sustain the broad community support for renewable energy developments in the region, as expressed in community perception surveys which are described in more detail in the EA.

Visual Impact Assessment

The Landscape and Visual Impact Assessment (LVIA) of the Proposal involved a comprehensive evaluation of the visual character of the landscape in which the Proposal would be located, consideration of community values of the local and regional amenity, and an assessment of the potential visual impacts from the construction and operation of the Proposal, taking into account feasible and reasonable mitigation measures. The LVIA considered the largest dimensioned WTG model under consideration for the Proposal – the Vestas V112, with a tower height of 94m and a blade length of 56m – as the worst case scenario.

The LVIA determined the landscape within the Proposal viewshed has a medium sensitivity to accommodate change, with this capability derived from the presence of large-scale and open landscape across the project site and its relatively low settlement density. In the context of landscape sensitivity, the LVIA determined that the wind farm would not be an unacceptable development within the viewshed, which in a broader context also contains approved wind farm developments and other built elements such as roads, agricultural industry, aircraft landing strips, telecommunications towers, and power lines.

The LVIA assessed both 114 residential and nine public view locations within 10km of the wind farm. The assessment concluded that six of the 114 residential view locations (or 5%) would experience a high visual impact and four would experience a moderate to high impact. Eighty-six residences (75%) would experience a low or nil visual impact. All nine public view locations assessed would experience low visual impact. Three of the residences determined to have a high visual impact are project-involved residences and two non-involved residences are situated on the same property. Of the non-involved residences within 2km of a proposed

turbine, two are expected to experience a high visual impact and the third a low to moderate impact, given the screening vegetation within the residential curtilage.

This LVIA determined the Proposal is unlikely to result in any significant 'direct', 'indirect' or 'sequential' cumulative visual impact resulting from associated views toward existing wind farm developments within a 10km viewshed, including the Cullerin Range, Gunning and Capital/Woodlawn Wind Farms.

Measures are proposed to minimise and mitigate visual impacts by reducing the visual contrast between the turbines and the landscape, designing and siting ancillary infrastructure sympathetically, providing the option of screening views from specific locations, and minimising visibility during construction. These measures are outlined in the draft Statement of Commitments.

Noise Assessment

The potential noise and vibration impacts from the construction, operation and decommissioning of the Proposal were assessed using relevant construction, wind farm and traffic noise guidelines.

Operational noise was assessed in accordance with the South Australia Environment Protection Authority (SA EPA) *Wind Farms – Environmental Noise Guidelines* (2003) (SA EPA Guidelines) and the NSW Wind Farm Noise Guidelines (2011). The Proposal took a conservative approach by adopting the base noise criterion of 35dBA for non-involved receivers stipulated in the SA EPA guidelines. Noise criteria based on background noise were not used to assess compliance of the Proposal as the background noise monitoring data set was considered inconclusive due to uncharacteristic night time noise readings at some of the background noise monitoring locations.

For project-involved receivers, reference was made to the European Working Group on Noise from Wind Turbines document ETSU R-97 *The Assessment and Rating of Noise from Wind Farms*, which recognises that where landowners have a financial involvement with the wind farm, higher noise levels are acceptable. The noise assessment for the Proposal adopts the recommended criteria of 45dBA for involved receivers, which is in agreement with the World Health Organisation (WHO) criterion for protection of amenity and avoidance of sleep disturbance as published in the document *Guidelines for Community Noise* (1999).

Noise levels were predicted for three different wind turbine models - Suzlon S88-2.1MW,V3, REPower 3.4M 104 and Siemens SWT-2.3-101 - which represent a range of sound power levels. The results show that to be able to achieve the target noise criterion of 35dBA for all non-involved residences, some turbines would need to be removed from the layout for the turbine models with higher sound power levels. The current Proposal is for a maximum of 68 WTGs, with the number of turbines to be eventually included in the Proposal depending on the wind turbine model to be selected and governed by noise compliance.

The potential impact of low frequency noise from the operation of the WTGs was also considered as part of the noise impact assessment in accordance with *NSW Wind Farm Noise Guidelines* (2011). The predicted low frequency noise levels are below the 65dBC (day) and 60dBC (night) trigger levels requiring further detailed low frequency noise assessments.

An assessment of potential cumulative noise effects associated with the combined operation of the existing Cullerin Range Wind Farm and the proposed Collector Wind Farm has been carried out. This assessment demonstrated compliance with the 2003 SA Guideline limits.

Flora and Fauna Assessment

A Biodiversity Assessment has been undertaken to assess biodiversity values of the project site, identify and assess potential impacts to these values and develop mitigation measures to avoid or otherwise minimise the potential impact of the Proposal on these biodiversity values. The assessment was carried out in stages, allowing for three survey periods across seasons thereby maximising opportunities for detecting and identifying target species. The assessment focused on the development envelope - the area within which infrastructure may be located - plus a significant buffer zone to allow micro-siting of the wind turbines after the final model is selected. The field survey also covered relevant habitat areas outside the project site, including Lake George.

Areas of two vegetation communities listed under the *Threatened Species Conservation Act 1995* (TSC Act) as Endangered Ecological Communities (EECs) – Box-Gum Woodland and Tablelands Snow Gum Grassy Woodland – were identified at the Project site. Box-Gum Woodland is also listed as a Critically Endangered Ecological Community (CEEC) under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Consequently, the matter was referred to the Minister for Sustainability, Environment, Water, Population and Communities for assessment. The Proposal is not a “controlled action” and hence does not require further assessment and approval under the EPBC Act.

The EECs described above will be directly impacted by vegetation clearing for the Proposal infrastructure, mainly for access roads. The Ecological Assessment concluded that the clearance areas of Box-Gum Woodland EEC and Tablelands Snow Gum Grassy Woodland EEC is not considered to be significant if the recommended management measures as outlined in the draft Statement of Commitments are implemented. The key management measure is the implementation of an Offset Plan to meet the ‘maintain or improve’ test for biodiversity values, The Proponent has secured an adequate potential offset area within the project envelope and it is intended that this offset will be formalised through a Property Vegetation Plan. The offset plan will also include specific habitat elements such as tree hollows.

The Proposal could potentially impact directly on threatened fauna, mainly birds and bats, through collision with turbines, and through loss or degradation of their habitats. Species listed under the TSC Act with the potential to be impacted by the Proposal include raptors, woodland birds and microbats. Species listed under the EPBC Act with the potential to be impacted include the Vulnerable Superb Parrot and Migratory-listed White-bellied Sea Eagle. The assessment of significance of impacts for these species showed that the potential impacts from risk of collision and loss of habitat arising from the Proposal are not considered significant.

Indigenous Heritage

An archaeological assessment of the project site was undertaken in accordance with the draft *Guidelines for Aboriginal Cultural Impact Assessment and Community Consultation* (DEC, July 2005). As part of this assessment, consultation was undertaken with the aboriginal community and stakeholders, in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCRP) (DECCW, 2010).

The *Aboriginal Heritage Information System* (AHIMS) database identified three known sites of Aboriginal archaeological heritage in the vicinity to the project site. Following the desktop analysis, archaeological surveys were undertaken across the project site. A total of five Aboriginal object locales containing stone artefacts were identified and four trees were recorded as possible Aboriginal scarred trees. None of the five Aboriginal locales were assessed to be of archaeological significance.

Ground disturbance activities during the construction and decommissioning stages of the Proposal may impact areas or items of indigenous cultural heritage. Considering the relatively minor significance of the identified Aboriginal object locales and scarred trees and their sparse distribution within the project site, it is unlikely that construction of the Proposal would disturb an item or area of archaeological significance.

Traffic and Transport

A traffic and transport assessment was undertaken in accordance with the NSW RTA *Guide to Traffic Generating Developments* and the DGR's to evaluate the potential impacts of the Proposal on traffic and public road infrastructure.

The primary access to the project site would be via the Hume Highway and Lerida Road South. Access to turbine locations within the project site would be through Lerida Road South, existing Crown roads and new internal access roads to be constructed where there are no existing roads. All access roads will be constructed or upgraded to handle construction loads. Internal roads will be maintained for operational and maintenance access after construction.

For the purpose of this EA it has been assumed that the wind turbine components would be transported to the project site from Port Kembla via the Southern Freeway/Mt. Ousley Road, Picton Road and Hume Highway. The intersection of Hume Highway and Lerida Road South will be upgraded to enable oversize vehicles that will float construction plant and deliver wind turbine components to safely turn into the site.

Hazards and Risks

Aeronautical

An aeronautical impact assessment of the Proposal considered in detail the likely impact of the location, height and blade rotation of the Proposal's wind turbines on the nearest aerodromes, air navigation and air traffic management services, transiting air routes, designated airspace, other aviation activity, and electromagnetic interference with airborne radio.

The assessment found that the Proposal will not impact upon aircraft operations to and from Canberra or Goulburn or the private aerodromes at Gundaroo and Winderadeen. Furthermore, it will not interfere with airborne radio or navigation aid performance. Flights operating under Visual Flight Rules (VFR) are not likely to be affected as these are conducted well above the level of the turbines which will be sufficiently conspicuous by day; night VFRs fly at or above the published lowest safe altitude (LSALT) for the route and would be sufficiently clear of the wind turbines. Similarly, Instrument Flight Rules (IFR) flights fly at or above LSALT. The risk to civil aviation activities posed by the Proposal is considered trivial; hence the Proponent does not propose to install aviation obstacle lighting.

The Proposal would not affect the safety of aerial agricultural operations near the site nor hang gliding activities near Collector.

Telecommunications

A telecommunications impact assessment identified the potential impacts from the Proposal on existing telecommunications services and any required mitigation measures. Outcomes from preliminary consultation and assessments have been considered in iterations of the turbine layout development, resulting in the relocation or removal of several turbines from the preliminary layout to mitigate against potential telecommunications impacts. Once the locations of wind turbines are finalised, the Proponent will verify the coordinates of the communications towers, the status of the services and the requirements of the telecommunications licensees.

Fire and Bushfire Impacts

Construction activities, including the handling and storage of flammable substances, would increase the risk of fire in the project site. These risks would be managed in accordance with a Bushfire Risk Management Plan to be prepared in consultation with the Rural Fire Service (RFS) and the NSW Fire Brigade. The plan would restrict certain activities on high fire-risk days and would provide for basic fire fighting equipment at active work sites, among other measures.

The potential for fires occurring in wind turbines or fire caused by the operation of a wind farm is considered to be extremely low (1 in 14,000 years). However, factors such as overheating of machinery, electrical faults and lightning strikes can initiate a fire. The Proposal will incorporate fire safety features such as automatic shutdown, alarm for electrical faults, and lightning arresters to minimise the risk of equipment initiating fires. Moreover, buffers would be maintained around the control room and substation buildings to prevent the spread of fire from these structures.

Wind Farm Noise and Health

Concerns have been expressed by members of the Collector community over the potential impacts of wind turbine noise on human health, in particular low frequency noise. Low frequency noise is generally defined as noise in the range of 10-200 hertz (Hz), with noise levels at frequencies below 20Hz often referred to as infrasound. Low frequency noise is part of the environment, emitted from man-made sources including

machinery and traffic, and natural sources including wind, sea and thunder. In the design of older wind turbines, where the rotor assembly was placed downwind from the tower, low frequency noise was produced when turbulence created by the tower was cut through by the blades. This issue has been rectified in modern turbines designed with the rotor assembly placed upwind of the tower, resulting in much lower levels of low frequency sound.

A review of the literature on environmental noise from wind farms noted that whilst noise generated by wind turbines has an infrasound component, the actual levels of infrasound from modern wind turbines would not be perceptible at receiver locations beyond 200 metres (m).

Electromagnetic Fields

There is limited possibility for the general public to be exposed to electric and magnetic fields (EMF) from the Proposal as it is located entirely on private land. Access to these areas by persons other than those involved in agricultural activities on the land would be restricted to appropriately trained and qualified maintenance staff. Property owners accessing the project site would not be expected to spend long periods near the wind turbines which are located away from frequent use areas such as sheds, yards and residences.

Water Quality

The project site sits on the drainage divide between the Lerida Creek and Frankfield Creek catchments to the west, which are within the Upper Lachlan River catchment, and the Collector Creek catchment to the east. The majority of the project site is drained by intermittent (non-perennial) streams. Most of the Proposal infrastructure will be sited on elevated locations along the Cullerin Range which are sufficiently offset from drainage lines.

Construction activities involving earthworks, including hardstand and access track construction, and cable trench installation, could impact surface water quality through sedimentation and contamination. Potential impacts to surface water and groundwater quality will be mitigated through the measures outlined in the Statement of Commitments, including erosion and sediment controls, progressive rehabilitation, proper drainage design and proper storage and handling of potential contaminants.

Stakeholder and Community Consultation

The DGRs require that the consultation process include measures for disseminating information about the Proposal to increase awareness and active engagement of stakeholders on issues of interest/concern to them. In addition, the level of consultation is required to be commensurate with the level of interest/concern or likely impact. As the project site is situated in a rural area near the village of Collector, the focus of consultation activities was on the local community including village residents and landowners adjoining the project site. Consultation efforts undertaken in conjunction with the environmental assessment process include the following:

- Newsletters;

- Website launch;
- Community open house forums;
- Question and answer newsletter;
- Advertising and media releases; and
- One-on-one consultation.

Relevant stakeholders identified in the DGR's were consulted in preparation of this EA and are listed in the table below.

Group	Stakeholder
Local Council	Upper Lachlan Council Yass Valley Council Goulburn Mulwaree Council
Government	NSW Office of Environment and Heritage NSW Office of Water NSW Roads and Traffic Authority Department of Defence NSW Rural Fire Service Murrumbidgee Catchment Management Authority Lachlan Catchment Management Authority Civil Aviation Safety Authority Airservices Australia
Community	Local Community Collector Community Association Friends of Collector
Non-Government and Heritage	Aerial Agricultural Society of Australia; Pejar Local Aboriginal Council; Onerwal Local Aboriginal Land Council; Ngunawal Native Title Claimant Group. Gunning Historical Society; Goulburn and District Historical Society;

Statement of Commitments

RATCH-Australia Corporation Limited is committed to achieving a sustainable project which minimises the potential impacts on the environment and community whilst remaining economically viable. Given the extent and nature of the development, RATCH-Australia Corporation Limited will commit to a detailed list of mitigation measures in a draft Statement of Commitments (SoC) to ensure such balances are achieved and maintained throughout all project phases. For the purpose of canvassing the full scope of issues, the draft SoC has been prepared in relation to those issues outlined within the EA.

Conclusion

The potential environmental impacts associated with the proposed Collector Wind Farm have been assessed in this Environmental Assessment. The proposal involves the construction, operation and decommissioning of up to 68 wind turbine generators and associated civil and electrical infrastructure along the Cullerin Range in the Upper Lachlan Shire and within the NSW/ACT Border Region Renewable Energy Precinct. There are already a number of operating and approved wind farms within this precinct.

With an installed capacity of up to 228MW, the Proposal would generate for the NSW network electricity from renewable energy, which translates to a reduction in greenhouse gases from fossil fuel-based power plants generating an equivalent output. The Proposal is consistent with the State's priorities to secure a reliable electricity supply with an increased renewable energy component, and contributes significantly to the achievement of the State's renewable energy target.

This EA has demonstrated that the potential impacts of the Proposal could be avoided or otherwise mitigated to reduce any residual environmental risks to insignificant levels.

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APP Corporation

Introduction

1. Introduction

APP Corporation Pty Ltd (APP) has prepared this Environmental Assessment (EA) to accompany a Project Application for the proposed Collector Wind Farm (the Proposal). This EA has been prepared on behalf of the proponent RATCH-Australia Corporation Limited (RAC) in accordance with Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This EA satisfies the Environmental Assessment Requirements issued by the Director-General of the Department of Planning and Infrastructure (DoPI) dated 15 October 2010 (the Director-General's Requirements [DGRs]) (**Appendix A**). It describes the proposed development, including the site and its environs, and identifies and assesses the potential environmental impacts arising from the Proposal. The EA also proposes environmental safeguards and mitigation measures to ensure the identified potential impacts are minimised.

This EA is supported by technical assessments that cover the key assessment requirements identified in the DGRs. These assessments are summarised in this document and the technical reports are included as appendices.

1.1. Objectives of the Assessment

This EA identifies potential environmental impacts relating to the construction, operation and decommissioning of the Proposal. In accordance with the General Requirements of the DGRs this document includes:

- an executive summary;
- a detailed description of the Proposal;
- consideration of relevant statutory provisions;
- an assessment of key environmental issues;
- a draft Statement of Commitments for environmental management and monitoring;
- justification for the project taking into consideration the environmental, social and economic impacts of the Proposal;
- certification by the author that the assessment is neither false nor misleading; and
- details of consultation with community groups, local residents and key stakeholders.

1.2. The Proposal

The Proposal involves the construction and operation of a wind farm comprising up to 68 wind turbine generators (WTGs) and associated electrical and civil infrastructure for the purpose of generating electricity from wind energy for the NSW electricity network.

Various WTG models are being considered for the Proposal, with the final model to be selected following a competitive tender process. Depending on the WTG model selected, and subject to conditions of approval

which may be imposed on this Proposal, there could be fewer than 68 WTGs installed. The final turbine model will determine the Proposal's installed capacity, which could be up to 228 megawatts (MW).

The associated infrastructure includes access roads, underground cabling, control buildings, substation, connection to the transmission grid, monitoring masts and temporary construction facilities.

1.3. Overview of the Planning Process

This Environmental Assessment was prepared and is submitted for assessment under Part 3A of the EP&A Act, which was repealed on 1 October 2011. Transitional arrangements for declared Part 3A projects were documented in Planning Circular PS 11-021 (30 September 2011) as follows:

> *…Part 3A continues to apply to most undetermined project and concept plan applications where Director-General's (of the Department of Planning and Infrastructure) environmental assessment requirements (DGRs) were issued before 1 October 2011 and a current major project declaration remains in force.*
>
> *These undetermined applications will continue to be assessed and determined under Part 3A, as in force immediately before its repeal.*

Accordingly, DoPI will assess the Proposal in accordance with Part 3A of the EP&A Act.

State Environmental Planning Policy (Major Development) 2005 (SEPP Major Development) identifies development to which the development assessment and approvals process under Part 3A of the EP&A Act applies.

Clause 24 of Schedule 1 of SEPP Major Development classifies

> ...*development for the purpose of a facility for the generation of electricity or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that has a capital investment value (CIV) of more than $30 million*

as Major Development to be assessed under Part 3A of the EP&A Act. The Proposal, which has a CIV of approximately $350 million falls within this description. On 15 February 2010 the Minister for Planning formed the opinion that the Proposal is development of a kind described in Schedule 1 of the SEPP Major Development (see **Appendix A)**.

Section 75C of the EP&A Act provides that a project to which Part 3A applies may also be declared a critical infrastructure project if it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental and social reasons. In 2009, the Minister declared renewable energy projects with a peak generating capacity of 30MW or more to be critical infrastructure. The declaration was published in the NSW Government Gazette on 27 November 2009. The Proposal, being a renewable energy development with an installed capacity of up to 228MW, falls under this description and is therefore a critical infrastructure project for the purposes of Part 3A of the EP&A Act.

1.4. The Proponent

Transfield Services Wind Developments Pty Ltd (the Proponent) is a subsidiary of RATCH-Australia Corporation Limited (RAC), formerly known as Transfield Services Infrastructure Fund (TSIF). Following the completion of an ownership and corporate restructuring in July 2011, the company is now 80%-owned by Ratchaburi Electricity Generating Holding PCL (RATCH) and 20% by Transfield Services Limited (TSE).

RAC is an independent power producer with a portfolio of Australian power generation assets consisting of five thermal power stations and three operating wind farms: Starfish Hill (South Australia), Toora (Victoria) and Windy Hill (Queensland). In addition, RAC owns the rights to a further 11 wind farm development projects throughout Australia.

RATCH is a leading Thailand-based power generation company and is the owner of approximately 14% of the installed generation capacity in Thailand. TSE delivers essential services to key industries in the resources and industrial, infrastructure services and property and facilities management sectors and is a leading Australian provider of operations, maintenance, and asset and project management services. TSE continues to provide operations and maintenance services for the RAC power generation facilities. TSE is publicly listed in Australia and included in the S&P/ASX 100.

1.5. NSW Renewable Energy Precincts

The NSW Government, through the Office of Environment and Heritage (OEH), established six renewable energy precincts within which significant renewable energy development is encouraged, especially wind farms. These precincts are New England Tablelands, Upper Hunter, Central Tablelands, NSW/ACT Border Region, Cooma-Monaro and the South Coast. The Proposal falls within the NSW/ACT Border Region precinct (**Figure 1**). There are a number of operating wind farm developments within this Precinct, together with approved projects and those currently under assessment.

1.6. Document Structure

This EA has been prepared in accordance with the DGRs issued for the Proposal under Part 3A of the EP&A Act and provides a detailed assessment of potential environmental impacts resulting from the development and operation of a wind farm.

The EA is in two volumes: Volume 1 – Environmental Assessment (this document) and Volume 2 – Appendices. This document has the following structure:

- Executive Summary
- Introduction and Project Description (**Chapters1 – 2**)
- Statutory, Policy and Planning Context (**Chapter 3**)
- Strategic Justification of the Project (**Chapter 4**)
- Assessment of Key Issues (**Chapters 5 – 13**)
- Stakeholder Engagement and Consultation (**Chapter 14**)
- Environmental Risk Analysis (**Chapter 15**)

- Statement of Commitments (**Chapter 16**)
- Conclusion (**Chapter 17**)
- References

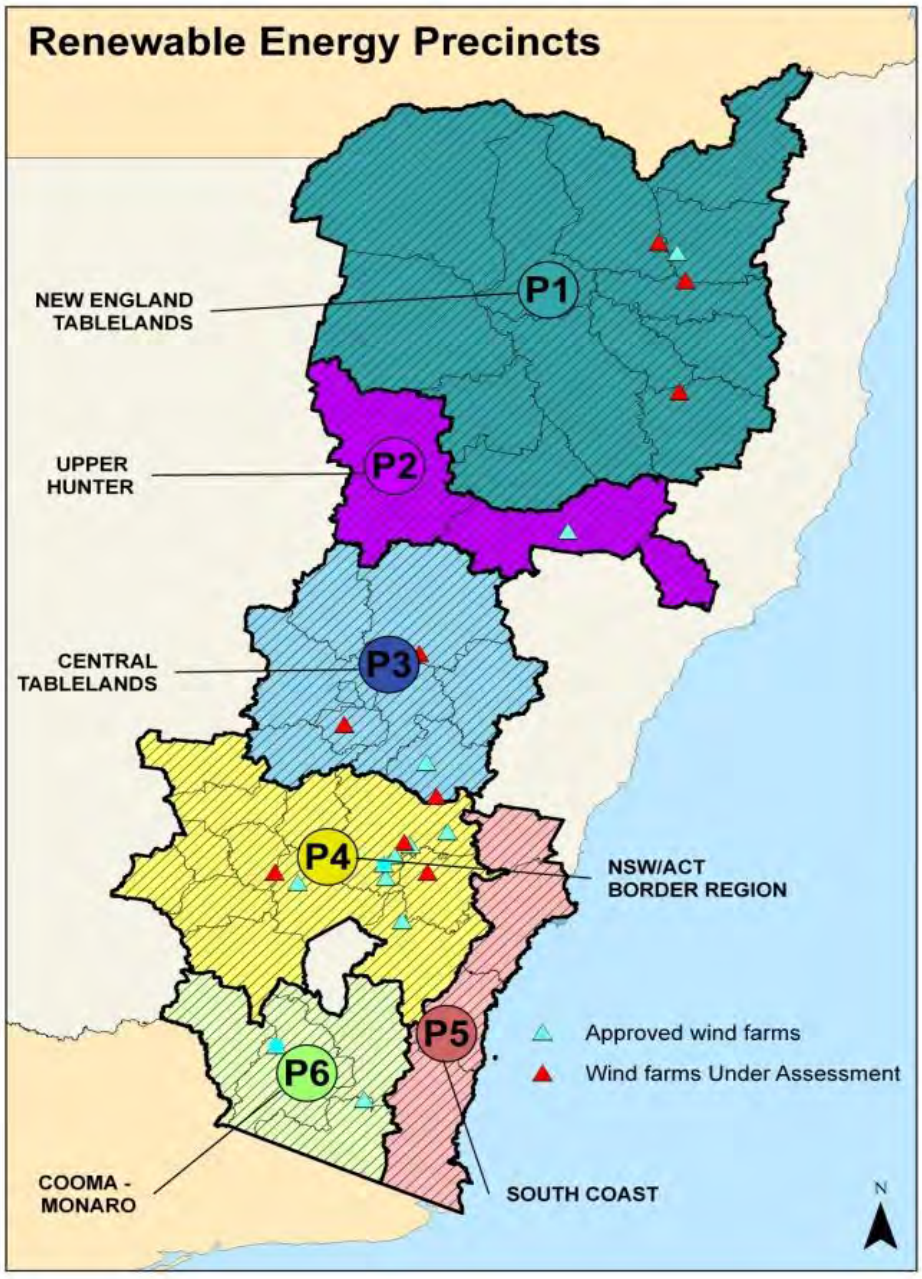

Figure 1 NSW Renewable Energy Precincts

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APP Corporation

Description of the Proposal

2. Description of the Proposal

This chapter provides a detailed description of the Proposal including project components, construction, operation and decommissioning details, and resource requirements.

2.1. Key Terms

The following terms are used to refer to the Proposal throughout this EA:

- **Project site:** the land within the cadastral boundaries of all properties involved with the Proposal, comprising an area of 6,215 hectares (ha).
- **Development envelope:** the area of the project site in which the wind farm infrastructure (turbines, hardstands, access roads, electrical cables and substation) could potentially be sited, comprising an area of approximately 800ha. The development envelope was the subject of detailed environmental investigations, including flora and fauna and indigenous heritage.
- **Development footprint:** the final locations of the wind farm infrastructure. This includes the infrastructure footprint - the area occupied by turbines, access tracks, substation etc. during the operational phase (approximately 29ha) - and other areas that will be affected by construction (approximately 45ha) (for example, cable trench easements, construction phase access track width, construction compound, crane pads) which can be rehabilitated post-construction.

2.2. Location and Project Components

The Proposal location is within the Upper Lachlan Shire local government area approximately 55 kilometres (km) north-east of Canberra and 35km south-west of Goulburn (**Figure 2**). The project site is in the NSW Southern Tablelands along the Cullerin Range, which is the northern continuation of the Lake George Range. Elevations in the project site range between 700 and 900 metres (m) Australian Height Datum (AHD). The project site is bounded to the north by the Hume Highway and to the south by Collector Road. The Cullerin Range Wind Farm is located north of the project site across Hume Highway. The settlement closest to the project site is the Collector township, which is approximately 3.5km to the south-east (**Figure 2**).

For the purposes of community engagement, the Proponent undertook primary consultation with residents within a 5km radius of the development footprint. The 5km radius was adopted from the *Upper Lachlan Development Control Plan 2010* and is the notification area for wind farm development applications under the DCP. The area circumscribed by a 5km radius generally coincides with the Collector Census Region defined by the Australian Bureau of Statistics allowing the following inferences based on 2006 Census data:

- the population is approximately 350, mostly residing within Collector village;
- the population comprises approximately 100 families; and
- there are approximately 120 dwellings within the area.

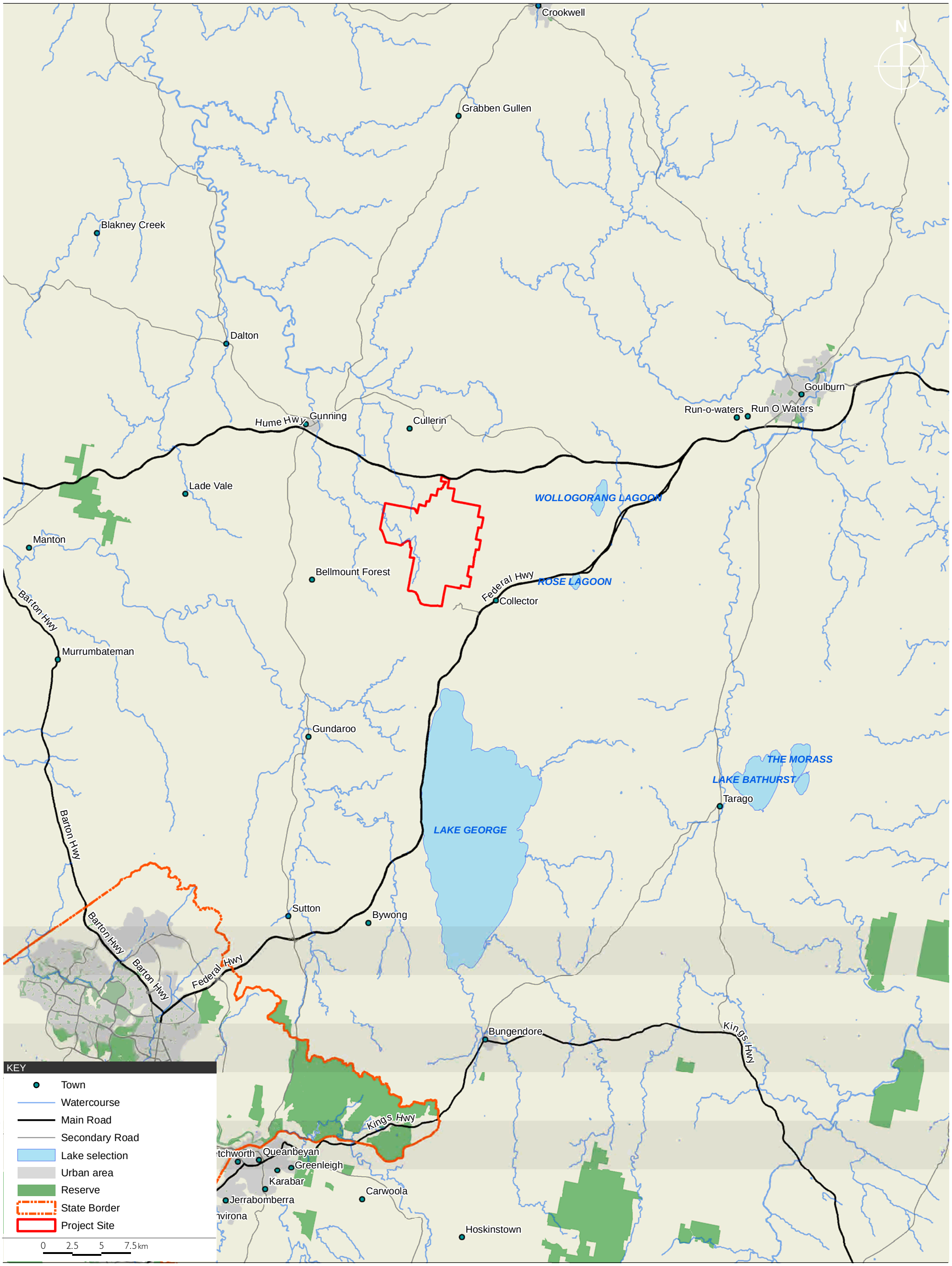

Figure 2: Location of Project Site

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Collector Wind Farm Environmental Assessment

2

Detailed wind energy yield and layout studies have been previously commissioned for the general area of Collector to confirm its suitability for wind farm development. Further detailed wind turbine layout studies considered access to turbine sites (landowner agreement) and environmental constraints such as ecologically sensitive areas and potential adverse impacts on the local community, especially noise and visual impacts.

The operating wind farm will include the following components:

- up to 68 wind turbines with a maximum height of 150m;
- hardstand areas adjacent to each wind turbine site for crane operations during the construction, operation and decommissioning phases;
- a wind farm substation and overhead turn-in connection to the existing 330 kilovolt (kV) transmission network, which traverses the northern part of the project site; this overhead turn-in connection to the transmission network would be subject to a separate development approval;
- underground 33kV electrical connection and control cables between each wind turbine and the substation/control room;
- access roads connecting the public road network to each wind turbine site and to the wind farm substation;
- control room and maintenance facilities; and
- up to four wind monitoring masts.

During the construction phase additional project components include the construction compound (including site offices and storage areas) and potentially an on-site concrete batching plant, the latter to be subject to a separate development approval.

Land portions owned by seven individual landowners make up the project site. A lot and deposited plan schedule is shown in **Table 1**.

Table 1 Properties to be involved in the Collector Wind Farm Project

Lot Number	Deposited Plan	Lot	Deposited Plan
7004	94490	159	750031
1	119192	160	750031
2	126022	161	750031
1	126023	168	750031
1	126027	181	750031
1	126038	182	750031
2	126038	191	750031
3	126038	196	750031
1	126056	197	750031

Lot Number	Deposited Plan	Lot	Deposited Plan
1	126060	198	750031
9	133758	201	750031
10	133758	203	750031
1	191728	206	750031
2	304983	207	750031
M	400627	208	750031
O	403201	210	750031
C	403577	215	750031
D	403577	221	750031
E	403668	222	750031
F	403668	223	750031
H	403670	225	750031
J	403670	37	754110
K	404449	145	754110
L	404449	146	754110
G	404619	147	754110
5	439996	3	754127
221	652223	10	754127
23	735248	15	754127
15	750008	19	754127
18	750008	20	754127
40	750008	23	754127
41	750008	24	754127
43	750008	26	754127
44	750008	28	754127
50	750008	29	754127

Lot Number	Deposited Plan	Lot	Deposited Plan
51	750008	30	754127
53	750008	31	754127
54	750008	32	754127
55	750008	33	754127
77	750008	34	754127
81	750008	35	754127
83	750008	36	754127
84	750008	37	754127
85	750008	38	754127
86	750008	39	754127
87	750008	41	754127
88	750008	42	754127
89	750008	43	754127
90	750008	44	754127
91	750008	46	754127
92	750008	47	754127
93	750008	48	754127
94	750008	52	754127
95	750008	53	754127
96	750008	54	754127
97	750008	55	754127
118	750008	56	754127
127	750008	57	754127
129	750008	58	754127
188	750008	59	754127
106	750031	65	754127

Lot Number	Deposited Plan	Lot	Deposited Plan
107	750031	76	754127
108	750031	77	754127
109	750031	107	754127
110	750031	120	754127
111	750031	122	754127
112	750031	131	754127
113	750031	140	754127
114	750031	146	754127
115	750031	156	754127
158	750031	1	878685

Table 2 summarises the approximate dimensions of the various project components, with a detailed description of each included in the following sections.

Table 2 Project Component Dimensions

Infrastructure	Quantity	Width (m)	Length (m)	Total Area (ha)
Turbine footing[a]	68	25	25	4.25
Crane hardstand[a]	68	15	32	3.26
Crane operation area (includes footing and hardstand)[b]	68	50	50	17.00
Access roads (construction)[b]	1	8	40,000	32
Access roads (permanent)[a]	1	6	40,000	24
Compound for Substation and control building[a]	1	50	150	0.75
Construction compound/storage[b]	1	300	100	3.0

Notes: *a = operation phase*
b = construction phase only, footprint to be rehabilitated

2.3. Wind Farm Infrastructure

2.3.1. Wind Turbine Generators

A wind turbine generator (WTG) converts the kinetic energy from wind to mechanical energy to drive a generator for electricity production. Depending on the wind regime at the wind farm site and the WTG operating parameters, a WTG can produce electricity at 23% to 42% of its generating potential running at full load (i.e. its installed capacity).

The specific wind turbine model to be used in the Proposal has not been determined at this stage and will be subject to a competitive tender process. The general characteristics of each wind turbine include the following:

- upwind pointing horizontal axis wind turbine;
- three-bladed design with blade lengths between 41m and 56m (82m to 112m diameter);
- turbine capacity between 2.1MW and 3.4MW;
- 80m to 100m tall cylindrical steel towers; and
- total height to blade tip between 124m and 150m.

Figure 3 shows the major components comprising a wind turbine. These components are described below.

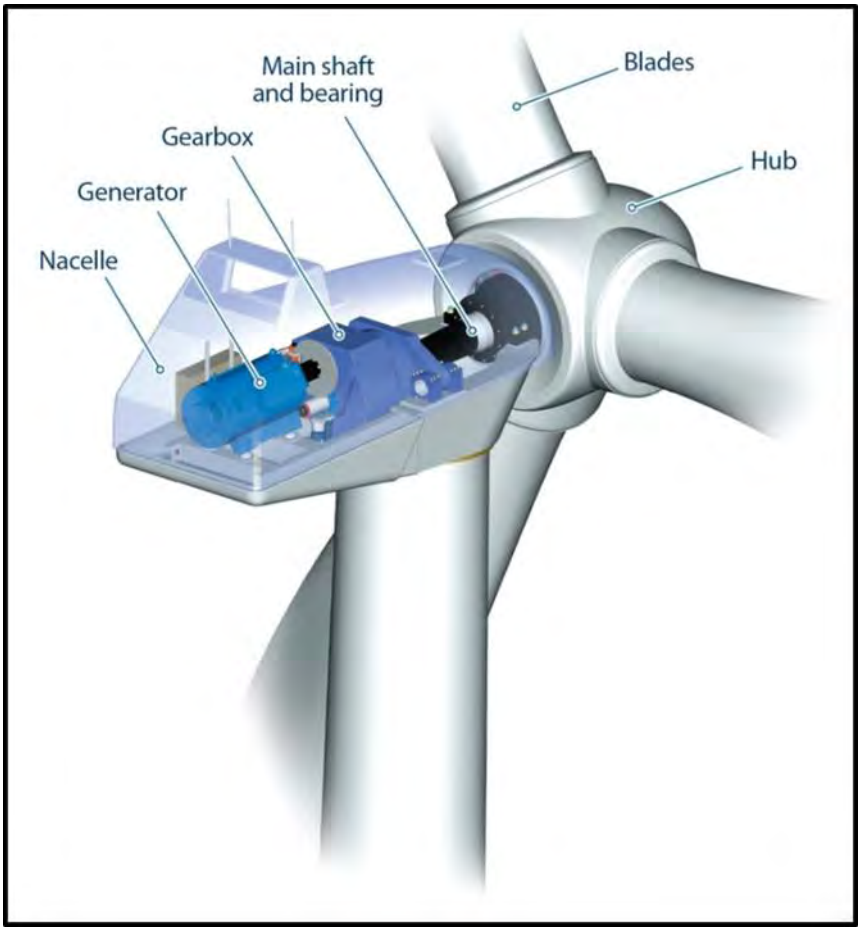

Figure 3 Wind Turbine Generator Components

Rotor

The wind turbines to be used for the Proposal would have a three-bladed rotor. Each blade is attached to a central hub which is connected via a horizontal axis to a drive train and generator. Blades are generally manufactured from fibreglass with a steel flange for attaching to the rotor hub. Blade lengths are variable depending on the size of the generator and the wind characteristics under which the turbine would operate. Various wind turbine models are under consideration with blade lengths ranging between 44m and 56m, giving a rotor swept area of between 6,080 and 9,850 square metres (m²).

The rotor assembly, comprising the three blades attached to the rotor hub, is connected to a drive train normally comprising a gearbox and generator. The rotor hub contains a pitch control mechanism, allowing each blade to be rotated longitudinally, or feathered, with respect to the wind. Pitch control also allows the rotor speed to be controlled for better performance and braked for emergency and maintenance purposes.

The wind turbines under consideration for the Proposal operate between wind speeds of approximately 15 kilometres per hour (km/h) (4 metres per second (m/s)) – the "cut-in speed" – and 90km/h (25m/s). Where wind speeds exceed 90km/h the wind turbine is shut down for safety reasons. On the Beaufort Wind Scale, 90km/h is considered a storm-force wind, which is rarely experienced inland.

Nacelle

The nacelle is the housing used to contain the drive train and electricity generator and has dimensions of approximately 10m length x 4m width x 4m height. The nacelle protects the various components from the weather and provides an acoustic enclosure to reduce mechanical noise emission. The various components within the nacelle are shown in **Figure 3** and described below.

The rotor assembly is connected through a horizontal shaft to a gearbox or via a direct drive to the generator. The generator produces electrical energy which is transmitted via cable to the base of the tower before entering the underground collection system. The drive train also incorporates a brake mechanism to allow the rotor to be stopped and locked for maintenance or emergency purposes. Each nacelle is fitted with meteorological equipment to allow climatic conditions, such as wind speed and direction, to be measured and used in the operational control of the turbine.

The nacelle's connection to the tower includes a yaw drive which enables the turbine to be rotated toward the prevailing wind direction, allowing maximum power generation from the available wind resource.

Tower

The nacelle and rotor assembly are mounted on a tubular steel tower up to 100m in height. The tower diameter ranges from approximately 4.5m at the base to 2.5m at the nacelle. Towers are generally manufactured in three sections to allow transport to the project site, where they are bolted together. The tower houses control and power cables and is fitted with either an access ladder or lift for maintenance purposes.

Wind Turbine Selection

Wind turbines represent a large proportion of the capital cost of a wind farm project. Hence the selection of the optimum turbine for a particular site is critical to maximise energy production and ensure the project's financial viability. Manufacturers of wind turbines which are suitable for Australian conditions include Siemens (Germany), Acciona (Spain), Enercon (Germany), REPower (Germany), Vestas (Denmark), GE Wind (USA) and Suzlon (India).

Wind turbine design parameters vary between manufacturers and each manufacturer has a number of turbine models suitable for different wind regimes and particular site conditions. For this reason, wind turbine selection for the Proposal will be subject to a competitive tender process, with several manufacturers to be invited to submit tenders.

Table 3 shows the various turbine models currently under consideration. Each turbine model has particular characteristics in terms of suitability for the wind regime at the project site, energy production and noise emissions; however, the fundamental design characteristics as described in this chapter are common.

Table 3 Wind Turbine Models under Consideration

Turbine Supplier	Turbine Model	Capacity (MW)	Blade Length (m)	Hub Height (m)	Maximum Tip Height (m)
Siemens	SWT-2.3-101	2.3	50.5	79.5/90	140.5
Acciona	AW-109/3000	3	54.5	90	144.5
Enercon	E82/2300	2.3	41	85/98	139
REPower	3.4M104	3.4	52	80	132
Vestas	V112-3.0	3	56	84/94	150
GE Wind	2.75-100	2.5	48.7	85/100	148.7
Suzlon	S88-2.1MW	2.1	44	80/100	144

2.3.2. Wind Farm Layout

The proposed wind turbine layout used as the basis for the environmental assessment of the Proposal – comprising a maximum of 68 WTGs - is shown in **Figure 4**. In developing this layout a number of factors were taken into consideration including:

- the project site extent, comprising the cadastral boundaries of the involved landowners;
- the location of non-involved residences in the vicinity of the project site;
- site topography;

- wind speed data collected from two monitoring towers over a five-year period;
- turbine spacing;
- compliance with noise criteria; and
- telecommunications paths from nearby installations.

The proposed layout can accommodate any of the wind turbine models under consideration for the Proposal, as listed in **Table 3**. These models produce different noise levels. Depending on the WTG model to be selected, the actual number of wind turbines in the final wind farm layout will be determined by compliance at the closest non-involved residences with the relevant noise criteria contained in the *Environmental Noise Guidelines: Wind Farms* (South Australia Environment Protection Authority, 2003). The SA EPA Guidelines allow either 35dBA or background noise level plus 5dBA, whichever is the greater, as the operational noise criteria for non-involved receivers.

The Proposal has taken the conservative approach of seeking to keep the wind farm operational noise levels at or below 35dBA at non-involved receivers. This is because non-typical night time noise readings at some locations during background noise monitoring make the current background noise data set inconclusive as the basis for setting operational noise limits based on background noise in accordance with the SA EPA guidelines. Details of the operational noise assessment are provided in **Chapter 7**.

Therefore, while the proposed layout shows the locations for up to 68 WTGs, it is noted that the number of WTGs may be reduced depending on the turbine model selected for the Proposal to achieve compliance with relevant operational noise limits.

Once the wind turbine model is chosen and the number of WTGs determined, the individual wind turbine locations may be subject to minor adjustments, or 'micro-siting', prior to construction in response to various factors including:

- environmental constraints, such as avoidance of significant vegetation, and prevailing geotechnical conditions;
- final wind speed and energy yield analysis;
- detailed site survey and geotechnical/civil engineering considerations;
- turbine manufacturers recommendations; and
- resource and cost-efficiency.

Section 75W of the EP&A Act permits a project to be modified without the Minister's approval if the modification *will be consistent with the existing approval*. The NSW Land and Environment Court (*Taralga Landscape Guardians v. Minister for Planning* [NSWLEC 2007]) considered, in relation to turbine or other component relocation at the Taralga Wind Farm project, that *a "…250m relocation of any of the elements is not unreasonable"*. Further, the Department of Planning (DoP), in its Project Approval for the Boco Rock Wind Farm, defines *micro-siting as "…a location allowance of 100 metres radius for project components as long as impacts remain consistent with that assessed*." (DoP, 2010; p. 4)

To allow design flexibility to accommodate possible layout variations between wind turbine models and the other variables listed above, a number of scenarios were considered in this environmental assessment:

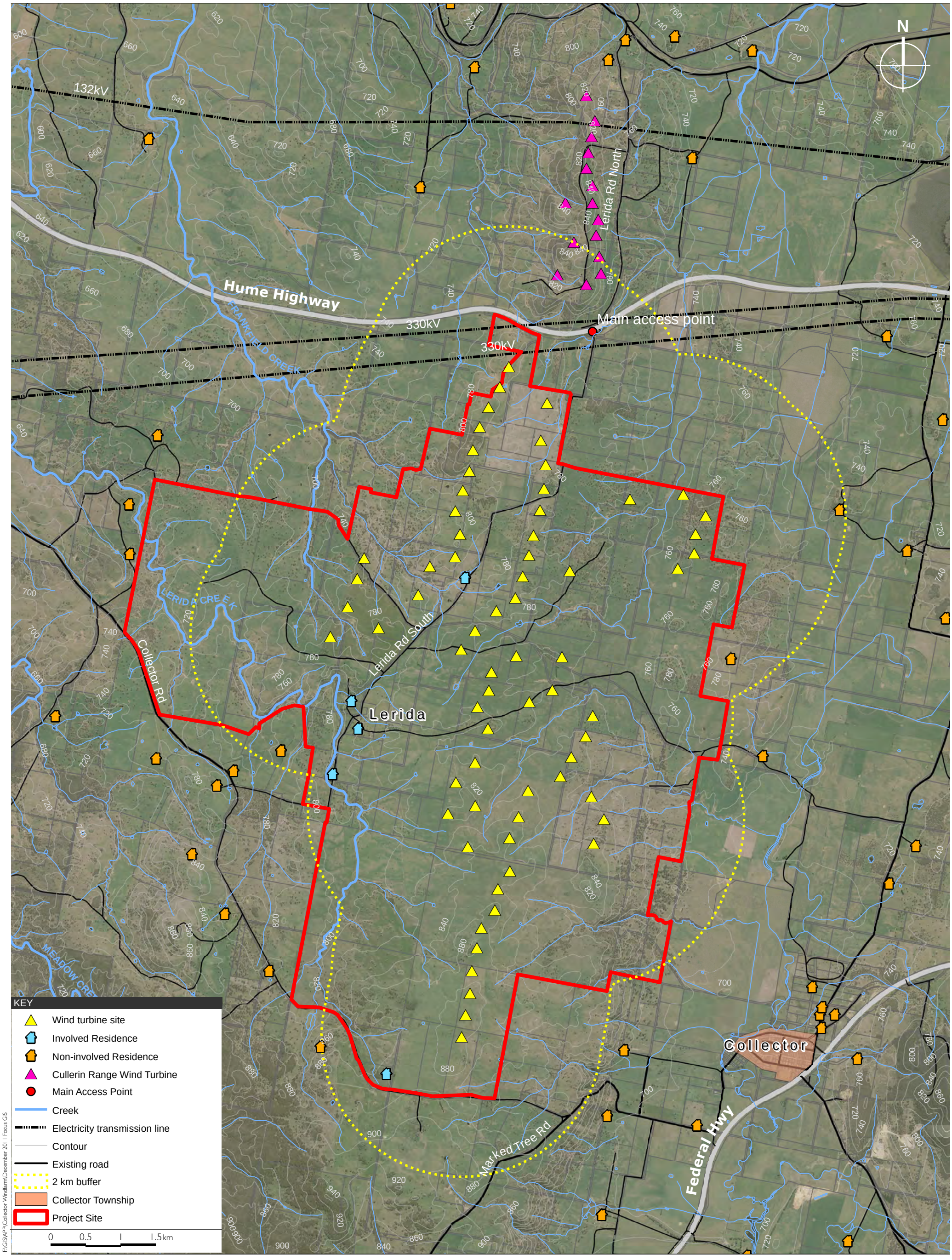

Figure 4: Wind Layout Turbine

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- ecological and heritage assessments were undertaken within a development envelope, which included a buffer around the proposed turbine sites (100m radius), roads (25m wide corridor) and cable routes (10m wide corridor). This will allow for minor relocation of infrastructure within the assessed area or corridor without the need for further assessment;
- noise assessments were undertaken for three turbine models representing a range of noise levels;
- the visual, aeronautical and telecommunications assessments were based on the Vestas V112 wind turbine which has the largest dimensions of the turbines under consideration, comprising a 56m blade length and 94m hub height giving a maximum height of 150m.

The coordinates for the individual wind turbine sites are listed in **Table 4** and their locations are shown in **Figure 4**.

Table 4 Wind Turbine Generator Locations

No.	Easting*	Northing*	Elevation (m)**	No.	Easting*	Northing*	Elevation (m)**
1	718433	6143522	800	**35**	718149	6138894	790.5
2	718303	6143229	789.2	**36**	717983	6138633	800
3	718143	6142944	800	**37**	718151	6138319	800
4	718016	6142661	800	**38**	718725	6138734	780
5	717904	6142363	800	**39**	719054	6138902	773.5
6	717719	6142098	800	**40**	717702	6137589	820
7	717778	6141753	780	**41**	717952	6137867	800
8	717667	6141456	800	**42**	717564	6137136	820
9	717785	6141101	797.4	**43**	717954	6137251	820
10	717665	6140808	786.4	**44**	717848	6136663	840
11	717320	6140637	780	**45**	719615	6138475	767.7
12	717140	6140259	780	**46**	719525	6138182	780
13	716368	6140791	760	**47**	719408	6137894	788.7
14	716268	6140490	760	**48**	719170	6137671	798.9
15	716132	6140145	780	**49**	718708	6137467	800
16	715885	6139665	780	**50**	718574	6137092	820

No.	Easting*	Northing*	Elevation (m)**	No.	Easting*	Northing*	Elevation (m)**
17	716574	6139788	780	**51**	718443	6136785	840
18	718974	6142972	780	**52**	718448	6136312	860
19	718891	6142467	770.5	**53**	718277	6136058	843.3
20	718968	6142095	777.5	**54**	718233	6135757	860
21	718935	6141776	780	**55**	718042	6135504	864.6
22	720164	6141628	760	**56**	717928	6135211	880
23	718878	6141471	780	**57**	717905	6134890	877.8
24	718797	6141157	780	**58**	717877	6134568	880
25	718729	6140856	780	**59**	717815	6134260	880
26	719281	6140624	780	**60**	717758	6133946	880
27	718632	6140529	780	**61**	719683	6136711	800
28	718513	6140188	780	**62**	719774	6137001	786.1
29	718219	6139988	780	**63**	719660	6137340	775.2
30	717952	6139751	780	**64**	720847	6140638	760
31	717751	6139480	780	**65**	720994	6140911	761.3
32	718184	6139157	782.7	**66**	721033	6141180	780
33	718539	6139389	780	**67**	721176	6141420	763.6
34	719117	6139394	780	**68**	721332	6141638	760

Notes: ** MGA94 Projection*

*** Australian Height Datum*

Hardstands

A hardstand of approximately 480m² (32m x 15m) will be constructed at each wind turbine location. The hardstand will be required for crane operations during the erection of the towers and wind turbine components and also for maintenance activities during the wind farm operational phase. The hardstands will be maintained throughout the operational phase to enable scheduled maintenance activities whenever required.

Foundations

Each wind turbine tower will be erected on a concrete and steel foundation. Foundations would be of either a gravity or rock-anchor type, depending on the geotechnical conditions at each wind turbine site.

Gravity foundations are essentially reinforced concrete slabs which support the wind turbine tower by gravitational mass. This type of foundation is a standard type for wind turbines and requires approximately 450 cubic metres (m^3) of material to be excavated up to a depth of approximately 2.5m. The foundation is constructed from concrete with reinforcing steel.

Rock anchor foundations utilise a series of tensioned steel cables (or tendons) installed into competent rock to a depth of approximately 20m below ground. Each cable is secured to a concrete slab at the surface and tensioned prior to erection of the tower. Rock anchor footings require excavation of approximately $100m^3$ of material.

A combination of both these foundation types may be required, depending on the specific geology at each nominated wind turbine site. Geotechnical investigations will be undertaken during the pre-construction phase at each wind turbine site to determine the foundation type required.

Material excavated from the footings will be stockpiled for beneficial reuse on the project site for constructing hardstand areas, filling road embankments and other earthworks requirements. Excess excavation spoil will be disposed offsite.

Wind Monitoring Masts

Two temporary wind monitoring masts are currently installed in the vicinity of the project site, one situated on-site and the other to the south of Collector Road. These 65m tall monitoring masts have recorded wind data which has been utilised for the Proposal's development and planning.

Up to four permanent wind monitoring masts will be installed within the development footprint to monitor the performance of the wind turbines against the manufacturer's power-generation guarantees. Each monitoring mast, comprising a lattice structure supported by steel guy cables, will be fitted with equipment such as anemometers, wind vanes, temperature sensors, etc., to measure climatic conditions in the vicinity of the wind turbines. The final location for these masts will be determined once the wind turbine model is selected.

2.4. Site Access

2.4.1. External Access

Access to the project site is directly from the Hume Highway via Lerida Road South. No construction access is proposed via the Collector-Gunning Road as topographical and alignment constraints make this road unsuitable for construction access. However, this route would be available for emergency egress if required.

The Lerida Road South/Hume Highway intersection would require upgrading and traffic management to ensure safe entry and exit and to allow passage for large vehicles during the construction phase. This

intersection upgrade and any other required road upgrade works will be the subject of an environmental assessment under Part 5 of the EP&A Act. Further details on traffic and transport are provided in **Chapter 10**.

2.4.2. Internal Access Roads

Internal roads would be constructed to provide access to each wind turbine site. Where possible these routes would follow existing Crown roads or farm tracks; however, there would be a requirement to widen the existing roads or to construct new access roads where the existing are unsuitable or do not provide direct access to turbine sites.

Existing roads and tracks within the project site would require upgrades to support construction phase traffic and allow all-weather access during the operation phase.

For the construction phase of the Proposal, access roads within the project site would be constructed to an average of 8m formed widths but up to 10m wide in some cases to allow access for the large crane required to erect the wind turbine structures. The 8 to 10m width would only be required for the construction phase, with the operation phase road formation requirement reduced to 6m wide only. Following the construction phase, the redundant 2-4m road width would be rehabilitated or stabilised.

Figure 5 shows the location of proposed access roads within the project site. The exact routes would be determined at the micro-siting/ design stage and would avoid significant vegetation, property assets and drainage lines. Approximately 42km of access road would be required, with approximately 25% of this length following existing Crown roads or farm tracks. Access roads would be constructed to established engineering standards to permit all-weather access to the turbine sites. Gravel for road construction would be sourced locally where possible in consultation with Upper Lachlan Shire Council.

2.4.3. Electrical Infrastructure

The electrical infrastructure at the wind farm will convey the electricity generated by the WTGs to the electricity transmission grid. This infrastructure comprises the following elements which are described in detail below:

- WTG transformers at each wind turbine site;
- a wind farm substation with two 130 megavolt-ampere (MVA) transformers, switch gear and circuit breakers;
- approximately 35km of 33kV underground electrical and control cabling to connect each wind turbine to the substation;
- an overhead transmission connection to the existing 330kV transmission line; and
- an operations building containing control and communications equipment.

Wind Turbine Generator Transformers

The WTG housed in the nacelle would produce electricity at approximately 0.7kV. This output will be transferred via cable to a transformer located either at the base of the tower or on the hardstand next to the

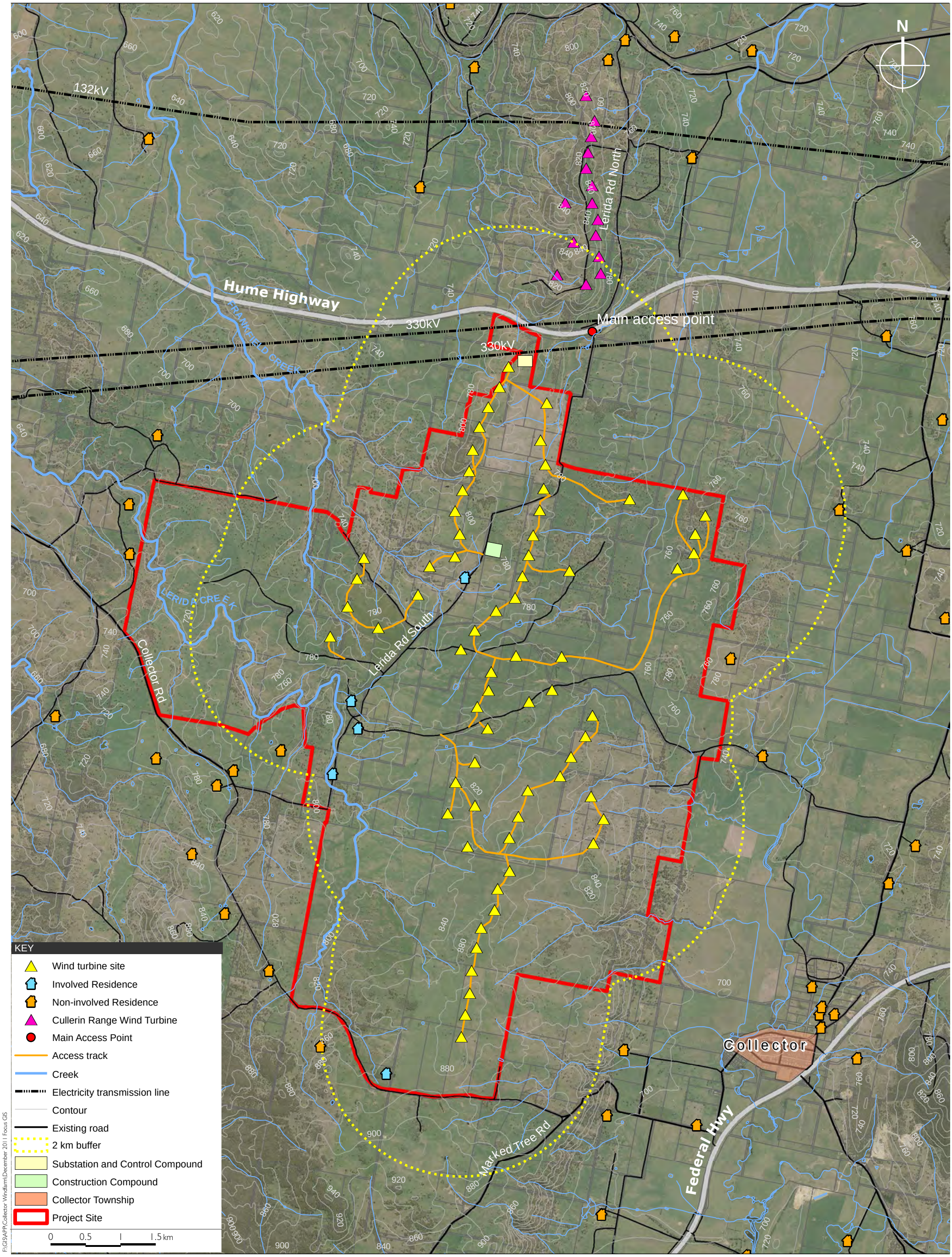

Figure 5: Wind Farm Infrastructure

tower. This transformer would step-up the voltage from 0.7kV to 33kV to allow transmission via the underground cable system to the wind farm substation.

Wind Farm Substation

The wind farm substation would be situated in close proximity to the existing TransGrid 330kV transmission line traversing the northern portion of the project site (see **Figure 5**). This would limit the length of the overhead transmission line required to connect to the grid. The substation, which will sit on a compound of approximately 50m by 150m, is proposed to be located near the wind farm's northernmost wind turbine.

The connections between the incoming 33kV cabling, the wind farm transformer and the 330kV transmission line would involve various components including busbars, circuit breakers and isolators. The design specifications will be prepared to meet the requirements of the transmission network owner TransGrid.

Electrical infrastructure within the substation compound will be founded on concrete slabs with gravel surrounds. The compound itself would be enclosed to restrict unauthorised access. The transformers will be placed on concrete pads with protective bunding to contain any leak or spill of transformer oil.

Underground Cabling

Underground 33kV electrical cables will connect each wind turbine to the wind farm substation. Placement of the cables underground will minimise the visual impact of overhead lines. The proposed underground cable routes would generally follow the access tracks as shown on **Figure 5**.

Control cables would connect each wind turbine to a computerised operation system in the wind farm control room, allowing turbines to be monitored and managed at all times. Individual turbines can be automatically controlled for start-up and shut-down. In addition, wind speed and direction will be monitored allowing individual turbines to be adjusted to suit the prevailing wind conditions to maximise energy production.

Overhead Transmission Connection

As the proposed substation site is located adjacent to the existing TransGrid 330kV transmission line, the new turn-in connection will consist of approximately 250m long overhead transmission line between the wind farm substation and the connection point along the 330kV TransGrid transmission line.

A separate development approval for the turn-in connection will be sought under Part 5 of the EP&A Act by TransGrid, who will be the proponent for this element of the Proposal. Noise impacts associated with the turn-in connection have been considered in this EA (**Section 7.6.5**); however, other potential environmental impacts associated with the transmission connection will be considered under a future Part 5 environmental assessment.

Operations and Maintenance Building

An operations and maintenance building will be constructed within the substation compound. This building will house the wind farm operational infrastructure, including monitoring and communications equipment. Maintenance facilities would include a store, work area and staff amenities, supported with rainwater tanks

and a septic system. Car parking for operations and maintenance staff and visitors will also be provided adjacent to the substation compound.

2.5. Wind Farm Development Program

Following the planning and approvals phase the Proposal would involve four primary phases which include the following:

- pre-construction;
- construction;
- operation and maintenance (including refurbishment); and
- decommissioning.

The estimated duration of each phase is shown in **Table 5** and the main activities associated with each phase are described in the following sections.

Table 5 Estimated Duration of Wind Farm Project Phases

Project Phase	Duration
Pre-construction	9 Months
Construction	24 Months
Operation and Maintenance	20 - 25 Years
Decommissioning	12 Months

2.5.1. Pre-construction Phase

The pre-construction phase of the development would involve engaging contractors/turbine manufacturers, carrying out detailed site investigations, preparing detailed design and undertaking pre-construction works. This phase would be approximately nine months in duration.

Detailed Design and Contracting

Following the development approval process, a tender would be let for the Proposal's detailed design and construction. The successful tenderer would be responsible for the detailed design of the wind farm which would involve the final micro-siting of the wind turbines and site infrastructure within the boundaries imposed by the conditions of the project determination.

The detailed design process would also involve preparation of an Environmental Management Plan (EMP) for the construction phase. The EMP content would be determined by the Proponent's commitments, conditions of approval and any licensing requirements. The EMP would likely be subject to the approval of the DPI prior to works commencing. The EMP would be a component of the contract specifications for the design and construction contractor/s.

During this phase the community would be provided with details of the forthcoming construction activities. Community consultation will continue throughout the construction phase at key stages and the community will be advised of any changing circumstances. A dedicated community liaison officer will be employed by the Proponent to consult with the community and resolve issues that may arise.

Pre-construction Works

Prior to the main construction commencing, a number of enabling works and further site investigations would be undertaken by the selected Contractor, including:

- geotechnical investigations at each wind turbine site to determine the required foundation;
- upgrading existing roads and constructing new access roads within the project site, including upgrades at the Hume Highway/Lerida Road South intersection and installation of signage;
- stripping of surface vegetation and topsoil from infrastructure locations;
- stockpile establishment;
- establishment of a temporary construction compound;
- preparation works for siting of a mobile concrete batching plant (if required); and
- detailed survey and pegging of infrastructure locations and exclusion areas (e.g. significant vegetation).

The final location for the construction site compound will be subject to discussions and agreement with the host landowner. The proposed location is shown on **Figure 5**. In selecting the compound site, consideration would be given to logistical requirements, avoidance of endangered ecological communities and drainage lines, and limiting the visual and noise impact to nearby residences. The construction site compound would cover an area of approximately three hectares and would include storage and laydown areas of equipment, materials and machinery; site offices and amenities; and parking areas. This area will be rehabilitated after construction.

2.5.2. Construction Phase

The main stages of the wind farm construction program and the associated activities are outlined in **Table 6** and further discussed below. It is anticipated the duration of the construction phase would be up to 24 months.

Access Roads, Hardstands and Cabling

Site access roads within the project site and crane hardstands will need to be constructed to a standard to support construction traffic and machinery. This will involve excavation of the road and hardstand areas to a suitable depth and the laying of all-weather road base. A proportion of the road base material would be sourced from excavations for turbine foundations, with the remainder sourced by the construction contractor from established facilities off-site in the local area.

For the construction phase, access roads will be constructed to an average width of 8m to allow for movement of large construction plant, including heavy lift cranes and long and wide loads. For the operation phase, access roads would be reduced to a width of 6m, with the redundant width from the construction phase rehabilitated.

Underground cable installation would initially involve excavation of trenches to nominal depths of 1.2m along the designated cable routes. A ditch digger, or similar machine, would be used to excavate the trench at a width of approximately 0.5m. Excavated material would be stockpiled in windrows adjacent to the trench for subsequent backfilling. Cables would be laid and the trench backfilled and compacted, prior to rehabilitation with vegetation or suitable surface stabilising material. Cable routes would be marked with warning signs at the surface and works-as-executed drawings will be held in the project operations office.

Table 6 Main Stages in the Construction Program

Construction Stage	Summary of Works
Access Roads, Hardstands and Cabling	• Construction of internal access roads to turbine sites • Excavation and compaction of crane hardstands • Trenching and cable laying
Foundation Construction	• Excavation and preparation of foundations • Footing construction according to geotechnical conditions
Substation Civil and Electrical Works	• Site survey, clearing and levelling, foundations and fencing • Erection and fit-out of control buildings • Installation of transformers, busbars, earthing system etc.
Turbine Erection	• Delivery of tower and turbine components (tower sections, turbine blades, generator/nacelle assembly) • Tower erection and nacelle installation • Rotor assembly and installation • Electrical connections
Wind Farm and Substation Commissioning	• Turbine testing and commissioning • Testing and commissioning transformers, cables, switchgear, SCADA, communications, earthing
Grid Connection	• High voltage connections and commissioning • System energisation and turbine connection

Foundation Construction

If gravity foundations are required, the construction of the foundation for each wind turbine would involve the excavation of approximately 450m^3 of ground material to a depth of approximately 2.5m. Steel reinforcement would then be installed and concrete poured to form the foundation base. For purposes of this environmental assessment, it is assumed that a gravity foundation would require up to 450m^3 of concrete.

Rock anchor foundations would involve the excavation of approximately 100m^3 of ground material to a depth of approximately 2.5m. Individual rock anchor cores would be drilled into bedrock to a depth of approximately 20m, with rock anchor tendons grouted into place, stressed and secured at the surface.

Substation Civil and Electrical Works

The substation compound area will be approximately 0.75 hectares (i.e. 50m x 150m or similar dimensions). The compound yard would be surfaced with compacted gravel to form a hardstand. Reinforced concrete pads and footings would be constructed to support electrical infrastructure and buildings. Infrastructure to be installed within the substation yard includes the two units 33/330kV step-up transformers, switchgear and the operation facilities building.

Turbine Erection

The turbine components would be delivered to the project site on semi-trailers. Each tower would be delivered in three parts, and blades would be delivered in single units. Nacelles and turbine substations would also be delivered as individual loads.

The construction method would involve a small mobile crane (up to 100 tonne) for the erection of the bottom two tower sections and the assembly of the rotor unit. A larger 600-1,000 tonne crane would be required to erect the top tower section and install the nacelle and rotor unit. Turbine erection is expected to take approximately 2 to 3 days per turbine.

Wind Farm and Substation Commissioning

The wind farm would be commissioned progressively in 'strings' of turbines. Each string would comprise the number of turbines within a cable circuit. There will be six to eight strings of WTGs for the Proposal.

The wind farm substation would be commissioned in conjunction with TransGrid to ensure viable connections from the WTGs to the substation and the substation to the transmission line. Once the electrical system has been energised, the wind turbines would be put into service.

2.5.3. Operation and Maintenance

Once operational, the wind farm would be continuously monitored by staff. Operations staff would be responsible for wind farm operations management, environmental monitoring, routine servicing, malfunction rectification and site visits.

Maintenance would be undertaken on a routine basis, with major servicing undertaken approximately six-monthly on each wind turbine. Each major service visit would involve a number of service vehicles. Maintenance staff would also respond to problems as they arise, with turbine downtime dictated by the complexity of maintenance required. Unscheduled maintenance on equipment such as turbine blades may require the use of large cranes and associated equipment. This can result in a turbine being offline for several weeks whilst the appropriate equipment and materials are sourced.

After approximately 20 to 25 years of operation (or sooner if technology developments allow) the blades, nacelles and towers could be removed and replaced with more efficient component parts. Redundant equipment would be removed from site for recycling and new components installed on existing or new foundations. Refurbishment could extend the life of the Proposal for a further 20 years.

2.5.4. Decommissioning

At the end of the operational life of the Proposal, the turbines and all above-ground infrastructure would be dismantled and removed from the site. This includes all the above-ground electrical and substation infrastructure. Foundations would be cut back to below cultivation depth and soil profiles re-established over the footing.

Internal access roads, if not wanted by the landowner, would be removed and the land rehabilitated to as close as possible to the original condition. All decommissioning would be the responsibility of the wind farm owner and would be governed by the conditions of project approval, with decommissioning clauses included in landowner leases. Decommissioning of wind farm infrastructure would take up to 12 months.

A Decommissioning and Rehabilitation Plan is included as **Appendix B**.

2.6. Resource Requirements

2.6.1. Water supply

The construction phase of the project will require water for the following uses:

- moisture conditioning of earth fill;
- equipment washdown;
- dust suppression;
- potable water for site personnel; and
- fire fighting.

The potential sources of water would depend on the water quality requirement for each application.

Water for moisture conditioning of fill and for dust suppression can be sourced from sedimentation basins which may be built to settle silted run-off from construction areas, or from external sources. It is estimated that about 20 kilolitres (kL) per day (or two 10kL water cart loads) would be sufficient for moisture conditioning and dust suppression.

Potable water will be required for the consumption of the construction workforce and site visitors. The estimated potable water requirement during construction is estimated to reach a maximum of 42kL per day, based on a peak number of 120 workers and 20 site visitors, if the average daily consumption is conservatively assumed to be 300L per person. (On average, per capita household water consumption in Australia is 285L per day, according to the Australian Water Association).

As there is no supply at the project site, potable water will be delivered by tankers. Potable water requirements during the operational phase will drop dramatically as the number of permanent staff on site is not expected to exceed 25.

Water storage tanks will be provided within the construction compound (during construction) and control building compound (during operation) for bulk potable water storage. Provisions will also be made to allow collection and storage of rainwater from the roof of site buildings. Water will be made available in site storages for fire emergency response.

If required, water will be accessed from an unregulated water source under the relevant water permits from the NSW Office of Water. The Proposal does not anticipate constructing any new bores to access groundwater during construction or operation.

2.6.2. Gravel

Gravel and aggregates will be required by the Proposal for the following:

- concrete for WTG foundations, hardstands and building slabs;
- pavement material for upgrading of existing or construction of new access roads; and
- surface overlay for hardstands, and some of the drainage channels and outlet structures.

For a worst case of using all gravity foundations for the maximum 68 WTGs, the concrete requirement is estimated to be 30,600m^3 (based on the conservative estimate of 450m^3 concrete required per foundation), which would require an estimated 20,000m^3 of aggregates. Should geotechnical investigations indicate that a rock anchor foundation is suitable for some of the WTG locations, the concrete requirement would reduce significantly as this type of foundation requires only about 100m^3 excavation. If the concrete requirement for the Proposal will be provided by an external supplier, this supplier will source its own aggregate requirement. If the Proponent establishes an on-site batching plant, aggregate will be delivered in bulk to the project site from local sources.

The construction and operation traffic along Lerida Road South will be mainly confined to the section from Hume Highway up to the crossing of Lerida Creek as this section and the Crown roads that branch from it provide the connection to the proposed internal roads that lead directly to the WTG sites (**Figure 5**). An assessment of the traffic and transport requirements for the Proposal (**Chapter 10**) recommended that sections of Lerida Road South and Crown roads be upgraded to an all-weather formed pavement using crushed quarry materials or natural gravels, to be able to handle construction loads. It is estimated that the section of Lerida Road South (approximately 7.5km long) and sections of Crown roads (approximately 12km combined length) to be upgraded may require up to 40,000m^3 of gravel material to build up and/or widen the existing pavement (for road formation up to 10m width during the construction phase).

The internal roads will also be built, or upgraded where there is an existing farm road, to take construction loads. This would require an estimated 60,000m^3 of crushed quarry material or natural gravel for the placement of two pavement layers over subgrade on an average 8m formation width for an estimated

combined length of 30km. Fill for road subgrade construction, if required, will be sourced from suitable materials won from the excavation of foundations.

The above estimates of gravel or crushed quarry material requirements for road construction and upgrade are considered to be conservative. The condition of existing roads will be assessed prior to the commencement of construction to more accurately establish the extent of upgrading required.

It is anticipated that the aggregate requirement for concrete batching, and the gravel and/or crushed quarry material for access road pavement construction or upgrade, can be adequately sourced from operating quarries in the area, with preference given to sources in close proximity to the project site to reduce transport costs and traffic impacts.

3

APP Corporation

Statutory, Policy and Planning Context

3. Statutory, Policy and Planning Context

This chapter addresses the statutory regulations and prescribed guidelines considered and referenced in the preparation of this EA. The EA, including the technical appendices, has been prepared in accordance with Part 3A of the EP&A Act and the *Environmental Planning and Assessment Regulation 2000*. In addition, Commonwealth, State and local government guidelines and planning controls are referenced where relevant.

3.1. Commonwealth Legislation

3.1.1. Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of the environment, especially matters of national environmental significance (MNES). Under the EPBC Act, a person must not take an action that has, will have, or is likely to have a significant impact on any MNES without approval from the Federal Minister for Sustainability, Environment, Water, Population and Communities (the Minister) or the Minister's delegate. MNES include World Heritage places, national heritage places, wetlands of international importance, the Commonwealth marine environment, nuclear actions, listed migratory species, and listed threatened species and ecological communities.

Whilst the biodiversity assessment (**Chapter 8**) undertaken for this EA concluded that the Proposal would be unlikely to result in significant impacts on matters of NES, a referral to the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) was made. SEWPaC determined that the Proposal is not a controlled action and does not require further assessment under the EPBC Act.

3.1.2. Civil Aviation Act 1998

Under the *Civil Aviation Act 1998, the Civil Aviation Regulations 1998* (CAR) or the *Civil Aviation Safety Regulations 1998* (CASR), the proponent of a structure "…*the top of which will be 110m or more above ground level…"* has a duty to notify the Civil Aviation Safety Authority (CASA) of its intention and provide the height and location of the structure. In accordance with CASR Circular #139.370 CASA may determine, after conducting an aeronautical assessment, that an obstacle, building or structure is or will be hazardous to aircraft operations. Should such an obstacle, building or structure be deemed hazardous to aircraft operations CASA may direct the proponent to light or mark the hazard in accordance with the Manual of Standards (MOS) - Part 139 Aerodromes.

Section 11.1 details the potential impacts of the Proposal on aeronautical operations and addresses the regulatory requirements under the *Civil Aviation Act 1998.*

3.1.3. Radio Communications Act 1992

Part 4.1 of the *Radio Communications Act 1992* are intended to make systems, such as wind turbines, efficient, flexible and responsive to the potential interference of radio emissions. The standards also require an adequate level of immunity from electromagnetic disturbances. As wind turbines and other ancillary structures

produce electromagnetic fields, the Proposal has the potential to impact radio communications. An assessment of the potential impacts of the Proposal on radio communications is provided in **Section 11.2.**

3.2. Commonwealth Policy

3.2.1. Renewable Energy Target

In August 2009, the Government implemented the Renewable Energy Target (RET) scheme, which is designed to ensure that 20 per cent of Australia's electricity supply will come from renewable sources by 2020. The RET expands on the previous Mandatory Renewable Energy Target (MRET), which began in 2001. Further reforms to the RET were introduced on 1 January 2011, splitting the scheme into two parts: Small-scale Renewable Energy Scheme (SRES) and Large-scale Renewable Energy Target (LRET).

Liable entities will need to meet obligations under both the SRES and LRET by acquiring and surrendering Renewable Energy Certificates (RECs) created from renewable energy schemes. Collector Wind Farm is considered a large-scale renewable energy project and therefore falls under the requirements for the LRET. **Section 4.3.1** discusses the strategic justification of the Proposal in relation to the RET.

3.3. State Legislation

3.3.1. Environmental Planning and Assessment Act 1979

On 15 February 2010 the Department of Planning (DoP), formed the opinion - under clause 6 of *State Environmental Planning Policy (Major Development) 2005* (Major Development SEPP) that the proposed Collector Wind Farm was development of a kind described in the SEPP (Schedule 1, Group 8, clause 24) as:

> *Development for the purpose of a facility for the generation of electricity or heat or their co-generation (using any energy source, including gas, coal, bio-fuel, distillate and waste and hydro, wave, solar or wind power), being development that:*
> *(a) has a capital investment value of more than $30 million…*

Consequently, the project was declared to be a Major Project to which Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) applied. The purpose of Part 3A of the EP&A Act is to facilitate major project and infrastructure delivery and encourage economic development, while implementing environmental safeguards and involving the community through consultation. Part 3A consolidates the assessment and approvals process for major developments, providing a streamlined assessment and determination process for major infrastructure and other projects of State or regional significance.

Part 3A of the EP&A Act was repealed on 1 October 2011. Transitional arrangements for existing projects were documented in Planning Circular PS 11-021 (30 September 2011) as follows:

> *…Part 3A continues to apply to most undetermined project and concept plan applications where Director-General's (of the Department of Planning and Infrastructure) environmental assessment requirements (DGRs) were issued before 1 October 2011 and a current major project declaration*

remains in force.These undetermined applications will continue to be assessed and determined under Part 3A, as in force immediately before its repeal.

The correspondence declaring the Proposal a Major Project is included in **Appendix A**.

Under section 75C of the EP&A Act, the Minister for Planning declared developments such as the Proposal to be critical infrastructure projects (*NSW Government Gazette No. 184*, 11 November 2009):

I, the Minister for Planning, having formed the opinion that the category of development referred to in Schedule 1 is essential for the State for economic reasons, and for social reasons, and for environmental reasons, declare project within that category to be critical infrastructure projects under Section 75V of the Environmental Planning and Assessment Act 1979.

…

Schedule 1

Development for the purpose of a facility for the generation of electricity derived from renewable fuel sources (that is, wind energy, solar energy, geothermal energy, hydro energy, wave energy and bio energy), being development that:

(a) is the subject of an application lodged pursuant to section 75E or section 75M of the Environmental Planning and Assessment Act 1979 lodged after the date of this declaration; and

(b) is the subject of an application that proposes a development with a capacity to generate at least 30 megawatts.

Part 3A of the EP&A Act integrates the assessment and approval regime for all Major Projects that require the approval of the Minister for Planning. Under the Part 3A process, projects are exempt from several statutory provisions which would otherwise require detailed consideration and subsequent licences/approvals. Projects approved under Part 3A of the EP&A Act do not require separate authorisation under the following Acts:

- *Fisheries Management Act 1994;*
- *Heritage Act 1977;*
- *National Parks and Wildlife Act 1974;*
- *Rural Fires Act 1997;*
- *Water Management Act 2000;*
- *Threatened Species Conservation Act 1995;*
- *Protection of the Environment Operations Act 1997;* and
- *Local Government Act 1993.*

In addition, section 75V provides that in circumstances where nominated authorisations are required then an application for such authorisation cannot be refused if the works proposed are consistent with the Part 3A approval and are necessary for carrying out the approved project. This applies, for example, to authorisations under section 138 of the *Roads Act 1993* to undertake work in, on or over a public road.

Section 5 of the EP&A Act outlines the following objectives:

a) *To encourage:*
   - *i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, mineral, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and better environment,*
   - *ii) the promotion and coordination of the orderly and economic use and development of land,*
   - *iii) the protection, provision and coordination of communication and utility services,*
   - *iv) the provision of coordination of community services and facilities,*
   - *v) the protection of the environment including the protection and conservation of native animals and plants including threatened species, populations and ecological communities and their habitats,*
   - *vi) ecologically sustainable development,*
   - *vii) the provision and maintenance of affordable housing,*

b) *to promote the sharing of the responsibility for environmental planning between the different levels of government in the state, and*

c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

The Proposal is consistent with these in that it:

- conserves natural resources and promotes a better environment through the generation of electricity via renewable energy sources;
- provides mitigation measures which will ensure the proper management of the development thereby promoting the social and economic welfare of the community;
- proposes the efficient and orderly use of the land, enabling the co-location of viable agricultural activity with renewable energy generation;
- facilitates the generation of electricity in a sustainable and environmentally friendly manner;
- includes the environmental protection measures which will ensure the protection of the environment; and
- supports the principles of ecologically sustainable development.

Prior to 28 May 2011, determination of Part 3A projects was the responsibility of the Minister for Planning and Infrastructure. Under an Instrument of Delegation (28 September 2011), the Minister delegated certain decisions to the Planning Assessment Commission (PAC). The PAC was established on 3 November 2008, with certain functions under section 23D of the EP&A Act including the determination of a project or concept plan when delegated by the Minister. The PAC has a delegation to make decisions on major project applications and modifications submitted by a private proponent, where:

- There has been 25 or more objections to the application; or
- The local council has objected; or
- There has been a reportable political donation in connection with the application, or to a previous related application.

It is anticipated that the Proposal will be determined by the PAC.

3.3.2. Protection of the Environment Operations Act

The *Protection of the Environment Operations Act 1997* (POEO Act), administered by the Office of Environment and Heritage (OEH), includes a licensing regime to control the air, noise, water and waste impacts of a scheduled activity. Schedule 1 of the POEO Act lists the activities requiring a licence. As the source of energy generation for the Proposal is wind power, a licence for the operation of the Proposal is not required under the POEO Act. Should an on-site concrete batching plant be required for the Proposal, a licence will be obtained.

3.3.3. Roads Act

The *Roads Act 1993* provides for certain rights of the public with respect to public roads and the regulation of activities relating to public roads. The Proposal would require upgrade works to the Hume Highway/Lerida Road South intersection, Crown roads and internal access tracks to accommodate construction vehicles. Under Section 138 of the *Roads Act 1993*, approval is required from the appropriate road authority for proposed upgrade works on public roads. An assessment under Part 5 of the EP&A Act will be required for any public road upgrade works.

3.3.4. Crown Lands Act

Under the *Crown Lands Act 1989* any person proposing access via a Crown road to serve a proposed development must obtain the approval of the Land and Property Management Authority (LPMA). These works must be approved by LPMA under sections 71 or 138 of the *Roads Act 1993* on behalf of the Minister for Lands as Roads Authority. As portions of some access tracks are proposed over Crown roads, this approval would be obtained.

3.4. Strategic Planning

3.4.1. NSW State Plan

The NSW Government – through the State Plan NSW 2021: A Plan to Make NSW Number One – has committed to 20% renewable energy by 2020 *"…by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources*". To support this policy, the Government has appointed a Parliamentary Secretary for Renewable Energy and is developing a 2020 NSW Renewable Energy Plan. The Government has also maintained the Renewable Energy Precincts initiative, which designates six areas of the state where significant renewable energy development is anticipated. The Proposal is situated within NSW/ACT Cross Border Region Precinct.

3.4.2. Draft NSW Planning Guidelines Wind Farms

The *Draft NSW Planning Guidelines: Wind Farms* (DoPI, 2011) were released for public exhibition on 23 December 2011. DoPI issued an *Interim Wind Farm Planning Policy* (April 2012) to provide direction on the

application of the guidelines to transitional Part 3A wind farm projects, such as the Proposal. The Interim Policy notes, in relation to applications for which DGRs have been issued but are yet to be exhibited, that:

> *The guidelines will apply to the maximum extent possible to all wind farm applications for which the DGRs have been issued, but an environmental assessment has not yet been exhibited.*
>
> - *Proponents are encouraged to adopt relevant provisions of the guideline relating to the construction and operation of wind farms in their environmental assessment, in particular relating to noise assessment, visual assessment, aviation safety, bushfire hazards, construction, decommissioning, monitoring and compliance programs.*
> - *Proponents should consult with all neighbours with dwellings within 2km of proposed wind turbines to identify any issues and potential approaches to mitigate any adverse impacts. Proponents should, where possible, seek the written agreement from neighbours with a dwelling within 2km of a proposed wind turbine.*
> - *It is strongly recommended that proponents, if not done so already, immediately establish a Community Consultation Committee to provide for ongoing communication with the local community.*

The Policy Statement was accompanied by a check list of key matters from the Guidelines to be considered in this environmental assessment. **Table 7** is a reproduction of the checklist cross-referenced to the relevant sections of this report.

3.5. Environmental Planning Instruments

3.5.1. State Environmental Planning Policy (Major Development)

State Environmental Planning Policy (Major Development) 2005 (SEPP Major Development) specifies classes of development to which Part 3A of the EP&A Act applies. These types of development are referred to as Part 3A projects. As discussed in **Section 3.3.1**, clause 24 of Schedule 1 of the SEPP identifies an electricity generation facility that has a capital investment value of greater than $30 million and which uses wind generation as a type of development to which Part 3A applies. The DPI has declared the Proposal as a Major Project to which Part 3A of the EP&A Act applies (**Appendix A**).

3.5.2. State Environmental Planning Policy (Rural Lands)

State Environmental Planning Policy (Rural Lands) 2008 (Rural Lands SEPP) aims to:

a) *facilitate the orderly and economic use and development of rural lands for rural and related purposes;*
b) *identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State;*
c) *implement measures designed to reduce land use conflicts;*

d) *identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,*

e) *amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.*

The Rural Lands SEPP does not directly impact the land use suitability of the Proposal, rather the aims of the Rural Lands SEPP are to ensure agricultural lands are not compromised by the pressure for other land uses, especially more intensive uses, such as residential subdivision. The Proposal is consistent with the Rural Lands SEPP as the development and operation of the Proposal can occur in unison with the continuing use of the land for rural purposes.

Table 7 NSW Planning Guidelines Checklist

Issue	Issues for Consideration	Section
Consultation	Form a Community Consultation Committee.	14.1
	Document the consultation process undertaken, including stakeholders consulted. Identify and tabulate issues raised by stakeholders during consultation. Describe how issues raised have been addressed.	14.2
	Consult with all neighbours with dwellings within 2km of a proposed wind turbine. Identify the neighbours' issues and potential approaches to mitigate any adverse issues.	14.2
	Consider seeking agreement with neighbours with dwellings within 2km of a proposed wind turbine.	14.2
Landscape and visual amenity	Provide photomontages from all non-host dwellings within 2km of a proposed wind turbine.	App E
	Identify the zone of visual influence of the wind farm (no less than 10km) and likely impacts on community and stakeholder values	6.4, App C
	Outline mitigation measures to avoid or manage impacts	6.11, App C
Noise	Undertake assessment based on separate daytime (7am to 10pm) and night-time periods (10pm to 7am).	7.6, App F
	Predict noise levels at all dwellings within 2km of a proposed turbine.	7.5, 7.6, App F
	Consider special audible characteristics; including tonality, amplitude modulation, and low frequency noise (apply penalties where relevant).	7.6, App F
	Outline measures to avoid, minimise, manage and monitor impacts	7.7, 7.8, App F
Health	Consider and document health issues, focusing on neighbours' with dwellings within 2km of proposed wind turbines.	11.4

Ecological Issues	Consider potential impacts on birds and bats, particularly migratory species and outline the proposed monitoring and mitigation strategy	8.3, App G
Aviation Safety	Outline current agricultural aerial uses on neighbouring properties	11.1
	Consider the potential for the proposed wind farm to impact on aviation safety associated with aerial agricultural uses consistent with the draft guidelines.	11.1
Bushfire hazard	Consider bush fire issues consistent with the draft guidelines, including the risks that a wind farm will cause bush fire and any potential impacts on the aerial fighting of bush fires.	11.3
Blade throw	Assess blade throw risks consistent with the draft guidelines.	11.7
	Outline measures to avoid, minimise, manage and monitor impacts	11.7
Mineral resources	Consider potential to impact upon mining/petroleum leases and exploration licences. If relevant, consult with the Minerals and Petroleum Division of the NSW Department of Trade and Investment, Regional Infrastructure and Services.	13.6
Property values	Consider whether the wind farm use is consistent with local or regional land use planning strategies	3.4, 3.5, 4.3
	Consider any potential impacts upon property values consistent with the draft guidelines, including properties within 2km.	13.5
Decommissioning	Include a Decommissioning and Rehabilitation Plan in the EA, including proposed funding arrangements.	App B
	Confirm that the proponent not the landowner is responsible for decommissioning.	2.6.4
Council planning controls	Outline whether the proposal is consistent with any relevant provisions of the relevant Council's Development Control Plan and list any variations	3.5.4

3.5.3. Upper Lachlan Local Environmental Plan 2010

The project site falls within the Upper Lachlan Shire Local Government Area (LGA) where the principal planning instrument is the Upper Lachlan Local Environmental Plan 2010 (ULLEP). All land within the development envelope is zoned *RU2 Rural Landscape* as shown in **Figure 6**.

Under the ULLEP the Proposal is considered to be "*electricity generating works"*, which is defined as "…*a building or place used for the purpose of making or generating electricity."* Electricity generating works are a type of development permitted with consent in the RU2 zone. The RU2 zone objectives are listed below together with a description of the Proposal's compatibility with these objectives:

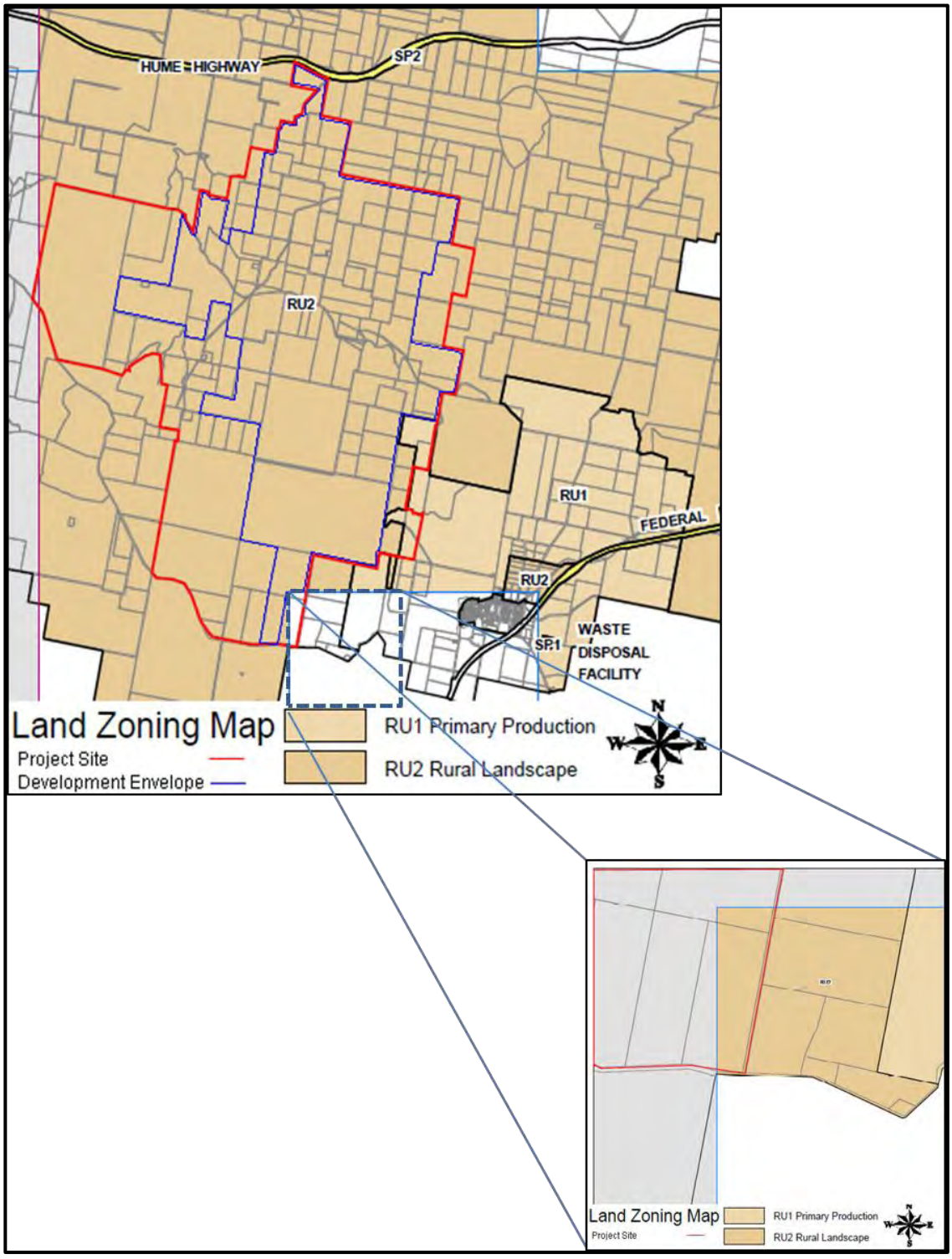

Figure 6 Land Use Zones of the Project Site

- to encourage sustainable primary industry by maintaining and enhancing the natural resource base;

  The Proposal is capable of being developed and operated concurrent with the existing primary industry production. The natural resource base will be maintained.

- to maintain the rural landscape character of the land;

The rural and agricultural land use present today will continue to exist. The Proposal will introduce a new element into the landscape; however the rural landscape character will be maintained during both the operational phase and post-decommissioning.

- to provide for a range of compatible land uses, including extensive agriculture;

  The Proposal is compatible with the existing land use, which generally comprises extensive sheep and cattle grazing. Both land uses can operate concurrently.

- *to preserve environmentally sensitive areas including waterways and prevent inappropriate development likely to result in environmental harm;*

  The Proposal will not impact environmentally sensitive areas as defined in clause 3.3 of the ULLEP. The siting and design of the Proposal and the mitigation measures proposed seek to prevent or mitigate environmental harm arising from the Proposal.

- to protect the Pejar catchment area from inappropriate land uses and activities and minimise risk to water quality;

  The project site is not in the Pejar catchment area.

- to minimise the visual impact of development on the rural landscape;

  The Proposal will introduce new visual elements into the rural landscape. The visual impact on the rural landscape from the erection of the wind turbines will be minimised by the following measures:

  - use of low glare and non-reflective colours;
  - limiting the extent of disturbance to construct access roads;
  - micro-siting of the wind turbines and infrastructure;
  - provision of screening vegetation at dwellings with a high visual impact;
  - clearing vegetation only to the extent required; and
  - rehabilitation of construction areas not required for the operation phase.

- to minimise the impact of development on the existing agricultural landscape character;

  The rural and agricultural land use present today will continue to exist. The Proposal will introduce a new element into the landscape; however the agricultural landscape character will be maintained during both the operational phase and post-decommissioning.

- to protect and enhance the water quality of watercourses and groundwater systems and to reduce land degradation;

  The Proposal is not expected to have a significant impact on groundwater systems. An environmental management plan will be implemented during all phases of the development to protect water quality.

- to maintain areas of high conservation value vegetation.

The Proposal will involve clearance of small areas of high conservation value vegetation as classified under NSW and Commonwealth legislation. The overall conservation value of the landscape will be maintained or improved through a dedicated vegetation offset to be facilitated through a Property Vegetation Plan.

The ULLEP does not contain any specific objectives or controls applying to electricity generating works.

3.5.4. Upper Lachlan Development Control Plan 2010

Upper Lachlan Development Control Plan (DCP) 2010 came into force on 9 July 2010 and contains detailed provisions relating to the development of land in Upper Lachlan LGA. The following sections identify and discuss the relevant provisions of this DCP and their consistency with the Proposal.

(a) *The development should be sited and carried out to minimise impacts on, or restrictions to grazing, farming and forestry practices*

The land on which the proposed infrastructure is to be developed is privately-owned farmland used primarily for sheep and cattle grazing. There will be minimal impact on existing farming activities, allowing the land to remain productive.

(b) *The development should be carried out in a way that minimises any physical adverse effects on adjoining land and the development site, including, but not limited to:*

(i) land degradation

The Proposal will not cause any significant land degradation. In the short-term, only a small percentage of the project site will be alienated from agricultural production. At the conclusion of the project life, the land will be rehabilitated to its former use.

(ii) alteration to drainage patterns

The Proposal will have only minor interaction with drainage features, through infrastructure crossings of creek lines. This is not expected to have any significant impact on drainage patterns.

(iii) pollution of ground water

The risk of groundwater pollution from the Proposal is low. All hazardous substances will be appropriately stored to prevent spills and the wind turbine foundations are unlikely to affect groundwater conditions.

(iv) spread of noxious plants and animals, and

A Weed Management Plan will be developed to avoid spread of noxious plants to or from the site. The Proposal will not introduce noxious animals to the site.

(v) bushfire hazard

The Proposal is not expected to increase bushfire hazard (see **Section 11.3**). Conversely, the ability of wind turbines to conduct lightning strikes safely to the ground, may reduce the bushfire hazard.

(c) *The developer must assess the visual impact of the project including an assessment of scenic value. The developer must consult with the Council and the community on appropriate visual impact measures*

A Landscape and Visual Impact Assessment (LVIA) is presented in **Appendix C** and summarised in **Chapter 6**. Consultation has been undertaken with the Council and the community in the preparation of this EA and this consultation will continue through subsequent phases of the development.

(d) *The developer must assess the cumulative impact of the development having regard to wind farms in existence and those approved but yet to be constructed. Council does not favour large expanses of ridgelines being covered with wind farms and turbines;*

The LVIA includes a cumulative visual impact assessment of the operational Cullerin Range Wind Farm to the north and Capital Wind Farm to the east of the project site. Similarly, the Noise Assessment (see **Chapter 7** and **Appendix F**) has considered the cumulative impacts associated with these projects.

(e) *Proposed wind turbines shall comply with the South Australia Environment Protection Authority Wind farms environmental noise guidelines (July 2009) or any replacement guidelines.*

The Noise Assessment (see **Chapter 7** and **Appendix F**) was prepared in accordance with the South Australian Environment Protection Authority *Noise Guidelines for Wind Farms* (February 2003) as required by the Director-General's Requirements. The assessment has also had regard to the draft *NSW Planning Guidelines: Wind Farms (*December 2011).

(f) *Turbines shall not be located within 2.0 kilometres of any dwelling not associated with the development or from any lot upon which a dwelling may be constructed. The 2.0 kilometre setback proposes utilising a precautionary principle in addressing perceived visual and health concerns;*

Three non-involved dwellings are situated within 2km of wind turbines. These dwellings have been considered in accordance with Department of Planning and Infrastructure advice (**Appendix A**) on the application of the *Draft NSW Planning Guidelines: Wind Farms* (2011).

(g) *Turbines shall not be located within a distance two times the height of the turbine (including the tip of the blade) from a formed public road. A greater distance may be required by the road authority.*

The largest turbine under consideration is 150m tall. Five proposed wind turbine sites are within 300m of Lerida Road South, a public road. This inconsistency is considered acceptable given the very low traffic volumes on Lerida Road South and the extremely low risk of blade throw (see **Section 11.4.4**).

(h) *Turbines shall not be located within a distance two times the height of the turbine (including the tip of the blade) from a non-related property boundary*

Several turbines are situated within 300m of non-related property boundaries. This is considered acceptable given the extremely low risk of blade throw (see **Section 11.4.4**).

(i) *Existing and proposed screenings may be used to minimise visual impacts to non-related properties. However, due to the height of turbines, screening is not the preferred method of minimising visual impact. Turbines shall be located in positions so as to have minimal visual impact on nearby properties, especially existing dwellings and lots on which dwellings may be constructed;*

Wind farms, by virtue of the requirement to be situated on elevated terrain, are conspicuous. The wind farm layout has been designed to minimise the visual impact on nearby properties. Where the visual impact is considered unacceptable by a property owner, vegetative screenings at the dwelling will be offered as a mitigation measure.

(j) *Turbine locations are to be sensitive to existing related dwellings on the subject site. Noise and shadow flicker should be minimised and turbines should not be located in close proximity to existing dwellings;*

The wind farm layout has been developed in full consultation with host landowners. Where turbines are located in close proximity to involved dwellings, mitigation measures will be offered to the host landowner.

(k) *Turbine locations shall not surround a non-related property. Turbines shall be located with the specified setbacks from property boundaries to minimise the visual impact of the development on adjacent and nearby non-related property. Cumulative impacts, having regard to existing turbines and turbines approved but yet to be constructed, should be assessed;*

The are no circumstances where wind turbines surround a non-related property. The Proposal has been amended to reduce the visual impact at non-related properties.

The cumulative impact associated with the Cullerin Range and Capital wind farms has been assessed in terms of noise and visual impact.

(l) *A communications study should identify the existing status of communications and detail the proposed method of dealing with potential communication interference.*

A telecommunications assessment is included as **Appendix K** and summarised in **Section 11.2**. The assessment concluded that there would be minimal impact on telecommunications infrastructure and that this impact can be readily mitigated through the micrositing of WTGs. If the development detracts from local telecommunications reception, the proponent will undertake necessary remedial work.

(m) *Construction vehicles, including concrete trucks, carriers of turbine components, and related heavy vehicles (including relevant contractors) shall only travel on an approved route. This route shall be identified and approved in accordance with this Plan;*

It is proposed that the main access to the project site will be via the Hume Highway and Lerida South Road. Relevant approvals will be obtained from Roads and Maritime Services and Upper Lachlan Shire Council for use of this route.

(n) *A report detailing investigations into the impact of construction vehicles on the proposed route shall accompany the development application. Detailed road condition reports will be required as part of any consent.*

Appendix I and **Chapter 10** include an assessment of traffic and transport impacts from the Proposal.

(o) *Council will require road works to cope with the over size and overweight traffic movements related to the construction of a wind farm. Bonds will also be required for any potential damage to roads during the construction phase.*

The intersection of Hume Highway and Lerida South Road will require upgrading to accept oversize and heavy vehicles during the construction phase. In addition, suitable upgrades to Lerida South Road and other Crown roads will be made to cope with construction vehicles.

(p) *The construction and maintenance of internal roads (roads within the property subject to the development) shall be the responsibility of the developer. Council will require proof that they have been adequately designed and constructed for their purpose.*

All internal access roads will be constructed by the proponent to established engineering standards to permit all-weather access to each WTG site.

(q) *All infrastructure related to the wind farm should be included in the development application. Management of temporary facilities, waste, numbers of contractors/employees, etc, should be part of the Development Application information. All infrastructure should be located in low visual impact locations and interconnection cables/wiring and the like should be underground;*

A description of the Proposal, including all associated construction and operation phase infrastructure is included as **Chapter 2**. As far as possible infrastructure has been sited to minimise visual impact. All internal cabling will be installed underground.

(r) *Developers shall consider and refer to all relevant polices and legislation applicable to the proposed development.*

This chapter details the statutory context of the Proposal, including all applicable policies and legislation. The Proposal has been considered in accordance with the *Draft NSW Planning Guidelines: Wind Farms*, in accordance with DoPI instructions.

(s) *If appropriate, the development application should include details of a viewing area where safe vehicle and pedestrian movements can view the wind farm.*

A viewing area is not part of the current Proposal.

(t) *Within six months of the wind turbine generators ceasing to operate, any rights of carriageways that were created to enable maintenance to be conducted on the wind turbine generators are to be extinguished by the developer and the land made good, unless otherwise agreed with the landowner.*

Decommissioning of the wind farm will occur over a 12 month period. All access tracks not required by the landowner will be removed and the land rehabilitated.

(u) *Within twelve months of the wind turbine generators ceasing to operate, they are to be fully dismantled and removed from the site.*

Wind turbine generators and associated above-ground infrastructure will be removed within 12 months of wind farm closure. A decommissioning plan is included as Appendix B. All decommissioning would be the responsibility of the Proponent and would be governed by conditions of approval. Decommissioning clauses will be included in landowner leases.

(v) *Details of the proposed connection to the electricity reticulation network shall be included as part of the Development Application Environmental Assessment.*

The wind farm connection to the electricity grid will be the subject of a separate development approval to be prepared under Part 5 of the EP&A Act.

4

APP Corporation

Strategic Justification of the Proposal

4. Strategic Justification of the Proposal

This chapter provides strategic justification for the Proposal. The use of renewable wind energy to provide additional or alternative capacity for electricity generation in NSW supports state and Commonwealth government policy objectives to combat climate change through a reduction in greenhouse gases. The chapter also outlines the suitability of the project site in terms of wind energy potential and compatibility with existing land uses.

4.1. Energy Demand Projections

Energy demand in the NSW region is projected to grow by 2.3% summer peak demand (14.05 to 19.27GW) and 2.2% winter peak demand (13.09 to 18.41GW) for the for the period 2010-11 to 2019-20 (estimated with 10% probability of exceedance) (TransGrid 2010). These rates are marginally higher than the 2.0% rate of growth in summer and winter peak demand for the period 2000-01 to 2009-10. The higher energy demand is expected to be met by a 2.2% increase in electricity generation in NSW, from 80 Terawatt-hours (TWh, one thousand GWh) in 2007-8 to 127TWh in 2029-30 (ABARE 2010). Wind energy is projected to contribute significantly to this increase in generating capacity. In NSW, wind energy (from generators with 30MW and above installed capacities) is projected to contribute 106MW (at an assumed 5% availability of installed capacity) to the 19.27GW summer peak demand for 2019-20 (TransGrid 2010).

Aside from generating capacity, the contribution of wind energy in general and the Proposal in particular, in terms of avoiding greenhouse gas emissions and addressing climate change, is discussed in more detail in the following sections.

4.2. Climate Change

Since 1988 the scientific findings on atmospheric change and the potential for human induced changes in the Earth's climate have been reviewed and summarised by the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established by the United Nations Environment Programme and World Meteorological Organisation to examine the links between greenhouse gas emissions and climate change.

Climate change is defined by the IPCC as a change in the state of the climate that can be identified by changes in the mean (and/or the variability), and that persists for an extended period, typically decades or longer. The Fourth Assessment Report on the physical science basis of climate change (IPCC 2007a) concluded that:

- Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.
- Warming of the climate system is unequivocal as is now evident from observations of increases in global average air temperatures, widespread melting of snow and ice, and rises in global average sea level.
- Most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations. Continued greenhouse gas

emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

- Even if greenhouse gas concentrations were to be stabilised, anthropogenic warming and sea level rise would continue for centuries, due to the time scale associated with climate processes.

The messages from the IPCC are that;

- global warming from climate change is real;
- humans activities are very likely to be causing climate change; and
- it is very likely that there will changes in the global climate system in the centuries to come larger than those seen in the recent past.

Future changes to the global climate have the potential to have a major impact on human and natural systems throughout the world.

The IPCC, in its report *Renewable Energy Sources and Climate Change Mitigation* (IPCC, 2012), notes that:

> *Climate change is one of the great challenges of the 21st century. Its most severe impacts may still be avoided if efforts are made to transform current energy systems. Renewable energy sources have a large potential to displace emissions of greenhouse gases from the combustion of fossil fuels and thereby to mitigate climate change. If implemented properly, renewable energy sources can contribute to social and economic development, to energy access, to a secure and sustainable energy supply, and to a reduction of negative impacts of energy provision on the environment and human health.*

In *State of the Climate 2012*, CSIRO/BoM (2012) note:

> *Multiple lines of evidence show that global warming continues and that human activities are mainly responsible. The fundamental physical and chemical processes leading to climate change are well understood. CSIRO and Bureau of Meteorology observations provide further evidence that climate change is real. The scientific understanding and the observations show that global trends in temperatures and sea level rise since the mid-20th century have been caused predominantly by human activities. Natural climate variability also affected global-mean temperature and sea level during the past century, but much less than increasing greenhouse gases. It is clear that increasing greenhouse gas concentrations will result in significant further global warming.*

The Commonwealth Government position paper *Adapting to Climate Change in Australia* (Department of Climate Change, 2010) has as its key message that some climate change in the world today is unavoidable as the opportunity to avoid climate change altogether has passed. Efforts therefore are being directed to minimise the extent of change and the consequences of that change, including a commitment to reduce and stabilise Australia's greenhouse gas emissions.

The position paper identifies the effects of climate change currently being experienced, including the following:

> *Rainfall in south-west Western Australia has dropped by about 15 per cent. Stream flow into Perth's dams between 1976 and 2000 almost halved as a result. Research indicates that climate change has*

> *contributed to this. There is also evidence that reduced rainfall in south-eastern Australia – Victoria and the southern part of South Australia – cannot be explained by natural variations alone. Temperatures have risen across Australia and a number of consequences are already evident. We experience more hot days and fewer cold nights. Droughts are more severe because higher temperatures increase evaporation. The incidence of extreme fire weather in south-eastern Australia has increased. Warmer temperatures have led to a decline in spring snow cover in alpine regions of Australia, and there have been a number of serious bleaching events on the Great Barrier Reef over the last decade.*

The *NSW Climate Impact Profile* (DECCW, 2010) - which provides an assessment of the likely impacts of future climate change on NSW's biophysical environment - states:

> *The natural, social and economic systems of NSW have all evolved under certain climatic conditions. NSW supports a range of industries such as agriculture, forestry and fishing, which have all developed based on the particular rainfall and temperature patterns of a region. Species and ecosystems have evolved to survive in a particular climate. The design of buildings and critical infrastructure such as roads, stormwater drains and dams are based on certain assumptions about temperature and extreme weather events. Our society and the natural resources on which we depend are all finely attuned to our climate.*

In this context, the report notes that Australia is vulnerable to the impacts of climate change. NSW, in particular – with 34% of the national population, coastal settlement patterns susceptible to sea level rise, highly variable climate and highly productive agricultural areas – is likely to experience significant impacts from climate change. Some of the predicted changes in the NSW climate include:

- NSW is expected to become hotter, with higher maximum and minimum temperatures very likely to be experienced across the state in all seasons.
- North-eastern NSW is likely to experience a slight increase in rainfall during summer while the south-western regions are likely to experience a significant decrease in winter rainfall. Many parts of the state will experience a shift from winter-dominated to summer-dominated rainfall.
- Higher temperatures are likely to result in significantly increased evaporation across much of the state by 2050.
- Physical responses such as sea level rise; changes in run-off patterns; increased flood frequency, height and extent; and increased fire frequency, including larger and more intense fires.

Projected responses to climate change include:

- Land impacts including increased soil erosion, mass movement and wind erosion; changes to soil salinity; and threats to coastal dune systems;
- Impacts on coastal settlements and infrastructure from sea level rise and extreme storm impacts, including exacerbated flooding; and
- Impacts on ecosystems from temperature increases, changing rainfall patterns, altered hydrology and changing fire regimes; changes that may well favour introduced and pest species.

4.2.1. Greenhouse Gas Emissions in NSW

The NSW DECCW, in its 2010 Emissions Overview paper, identified the main contributor to greenhouse gas build up as the release of carbon dioxide from the burning of fossil fuels. The IPCC nominates six sectors of human activity responsible for the generation of greenhouse gas emissions, primary among these is the energy sector which is broken down into stationary energy (electricity and heating/cooling), transport and fugitive emissions (fossil fuel gases such as methane gas which escapes during extraction of fossil fuels).

Coal-fired electricity generation accounts for 75% of all stationary greenhouse gas emissions in NSW. In 2007, the Australian Department of Climate Change and Energy Efficiency (DCCEE) estimated Australia's greenhouse gas emissions and recorded that NSW produced 163 million tonnes of CO_{2e} (carbon dioxide equivalent), representing 27% of Australia's emissions, with 47% of the total generated by stationary energy or coal-fired electricity generation.

In 2010 NSW annual emissions were 23.6 tonnes CO_{2e} per capita as compared to just over 10 tonnes for the UK, Germany and Japan, with 13 tonnes being the average for industrialised nations. The trend in emissions in NSW between 1990 and 2007 showed a growth of 21% primarily in the industrial and fossil fuel burning sector which included an increase in that period of 38% in the emissions from electricity generation.

4.3. Government Policy Position

4.3.1. Commonwealth Renewable Energy Target

The Renewable Energy Target (RET) aims to (Commonwealth of Australia, 2012):

- *encourage the additional generation of electricity from renewable sources;*
- *reduce emissions of greenhouse gases in the electricity sector; and*
- *ensure that renewable energy sources are ecologically sustainable.*

The RET comprises two parts: the Small-scale Renewable Energy Scheme (SRES) and the Large-scale Renewable Energy Target (LRET). The Proposal would be considered to meet the requirements of the LRET. The primary objective of the LRET scheme is to encourage additional and continuing generation of electricity from renewable energy sources and achieve a real reduction in the greenhouse gas emissions generated by the electricity sector. The scheme relies on electricity retailers obtaining a target amount of electricity from renewable energy sources such as the Proposal. If the targets are not met then the retailer incurs a financial penalty. The mechanisms to achieve these aims are:

- the creation of online certificates – previously known as Renewable Energy Certificates (RECs) and now termed Large-scale Generation Certificates (LGCs) – based on the amount of electricity generated (in megawatt hours) by eligible renewable energy sources, such as the Proposal; and
- placing a legal obligation on liable entities (usually electricity retailers) to purchase and surrender a certain amount of these certificates each year.

The trade in these certificates provides financial incentives for investment in renewable energy power stations such as wind farms.

4.3.2. NSW Government Objectives

The NSW Government – through the State plan *NSW 2021* (Department of Premier and Cabinet, 2011) – has committed to 20% renewable energy by 2020 "…*by promoting energy security through a more diverse energy mix, reducing coal dependence, increasing energy efficiency and moving to lower emission energy sources*". To support this policy, the Government has appointed a Parliamentary Secretary for Renewable Energy, is developing a *2020 NSW Renewable Energy Plan* and has maintained the Renewable Energy Precincts initiative.

4.4. Greenhouse Gas Abatement

The *NSW Wind Farm Greenhouse Gas Savings Tool* allows calculation of the volume of greenhouse gases that will be saved through the operation of a wind farm, the amount of electricity generated annually and the equivalent number of homes this electricity would power each year. The emissions calculation for the Proposal – assuming a 230 MW wind farm operating in the NSW/ACT Border Region Renewable Energy Precinct - shows that the wind farm if established and operational by 2015 would:

- save approximately 3.7 million tonnes of greenhouse gas emissions by 2020 (**Figure 7**). If an average 0.6 million tonnes was adopted for the remaining project life then a further 11.4 million tonnes of greenhouse gas emissions would be saved;
- generate 723 gigawatt-hours (GWh) of electricity per annum for the life of the Proposal, giving a total of 18,000 GWh over 25 years; and
- produce enough electricity to power approximately 100,000 homes annually assuming an average household consumption of 7.3 megawatt-hours (MWh) annually.

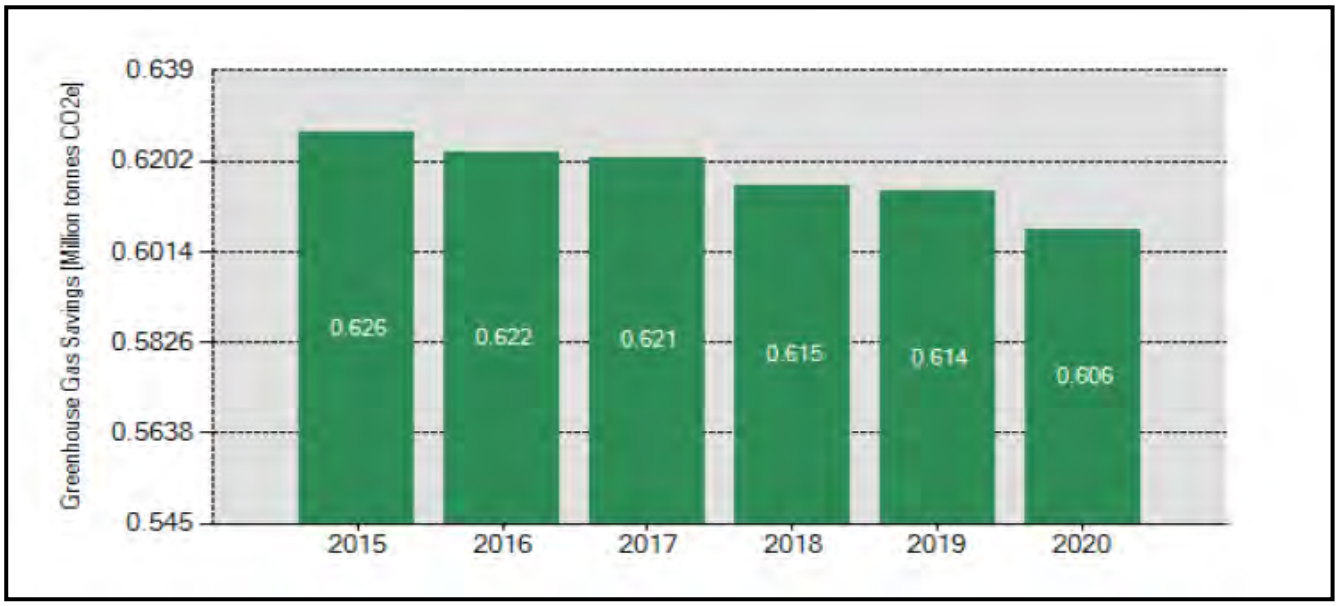

Figure 7 Greenhouse Gas Savings from a 230MW Wind Farm in NSW-ACT Border Region

Every megawatt-hour of electricity generated by the Proposal is expected to reduce the coal-fired generation of electricity by an equivalent megawatt-hour. SEWPaC has calculated that for every litre of petrol used in a

car, around 2.3kg of carbon dioxide is released. This equates to 3,600kg per year for a car with a fuel consumption of 10L/100km travelling a distance of 15,000km in one year. The greenhouse gas emission savings over the life of the project would equate to the removal of 122,222 cars off the road each year for 25 years.

The greenhouse gas abatement that will be achieved by the Proposal needs to be balanced against the emissions/energy that would be generated in the production of the components used in the construction of the wind farm. The wind farm operation itself would not generate any carbon dioxide emissions. It is noted that at the end of the economic life of the project the wind farm would be decommissioned and infrastructure removed, thereby minimising the potential for future pollution or degradation of the land.

The Danish Wind Turbine Manufacturers Association prepared a lifecycle analysis for wind turbine manufacture to identify the emissions that would be generated by manufacture of the component parts. The study found that an energy payback of four months would be required for a 150MW on-shore wind farm. The Proposal, which has an initial 20-25 year life, would generate approximately 60 to 75 times the energy used to construct the wind farm.

Martinez et al. (2009) undertook a life-cycle analysis (LCA) of a 2MW turbine in accordance with the ISO 14044 standard Environmental Management—Life Cycle Assessment. The application of LCA, according to the corresponding international standards, has made it possible to determine and quantify the environmental impact associated with a wind turbine. On the basis of this data, the final environmental effect of the wind turbine after a lifespan of 20 years and its subsequent decommissioning have been studied. The environmental advantages of the generation of electricity using wind energy, that is, the reduction in emissions and contamination due to the use of a clean energy source, have also been evaluated. The study concluded that the environmental pollution resulting from all the phases of the wind turbine (manufacture, start-up, use, and dismantling) during the whole of its lifetime is recovered in less than 1 year.

4.5. Electricity Market Modelling

OEH engaged McLennan Magasanik and Associates (2010) to prepare a report on the electricity market modelling to determine the emissions abatement impact of wind farms in New South Wales. The study examined four different scenarios. The study's second scenario related to a 150MW wind farm being an average large wind farm. This is the capacity closest to that of the Proposal. The study found the following:

- A 150MW wind farm would affect an abatement of greenhouse gases of between 150 kilo tonnes (kt) CO_{2e} to 450ktCO_{2e} per annum. The variability in the volume of gas abatement achieved was a result of whether the wind farm was replacing gas-fired or coal-fired electricity generation with a black coal plant having higher emissions intensity when compared to a gas plant.
- It was anticipated that following the commencement of the CPRS (assumed by the study to occur in 2015), wind capacity will displace a greater proportion of gas-fired generation than coal and so that the average abatement intensity achieved by wind generation will reduce over time. Less greenhouse gas emissions would be abated for the same level of electricity produced.

- There is variation in greenhouse abatement depending on the location of the wind farm. The most greenhouse abatement occurs in the Cooma-Monaro region; however, the NSW/ACT Border region in which the project site is located was placed second by a small margin.
- By 2020 the power generation market share held by coal would reduce to 91% with renewables holding a 7.25% share and gas the remaining 1.75%. In order to achieve the targeted 20% renewable electricity generation required by RET it is necessary to have a greater capacity of wind generation in NSW.

4.6. Need for Renewable Energy Generation in NSW

TransGrid is an electricity transmission network provider connecting generation to distribution networks and to large electricity consumers in NSW. In its *NSW Annual Planning Report 2010*, TransGrid advised that it anticipates that there will be an increase in interest for connections of new electricity generation into the grid. The report examines the future of renewable electricity generation and notes the following:

> *TransGrid has developed a negotiating framework approved by the AER (Australian Energy Regulator) to provide access to its network to the proponents of the alternative generation such as wind, gas and solar…*
>
> *An important part of TransGrid's planning and development function is to provide connections for proposed new generators. In recent years the vast majority of applications to connect to TransGrid's network have been from proponents of gas or wind powered generation.*
>
> *Since 2008, TransGrid has successfully directly connected to its network the following generation:*
>
> - *Uranquinty Gas Fired Power Station, capacity 664MW;*
> - *Capital Wind Farm, capacity 141MW; and*
> - *Colongra Gas Fired Power Station, capacity 667MW.*
>
> *In addition to these new direct connections, TransGrid has also worked with the NSW Distributors to coordinate and assist with the connection of new generating systems of various technologies and scale. This includes the 400MW Tallawarra gas fired power station embedded into Integral Energy's 132kV network and the Cullerin Range Wind Farm embedded into Country Energy's 132kV network.*
>
> *The status of the supply demand balance in the NSW region, the scope for peaking generators to assist in managing trading risk and the Mandatory Renewable Energy Target scheme are among the factors contributing to the above mentioned new generation connections.*
>
> *There is a material amount of good quality wind generation resource in NSW that is also proximate to existing transmission lines. Generation developments that do not require the construction of new transmission links can be developed relatively quickly. To date this has been the focus of wind generation development in NSW.*

The Proposal seeks to provide additional and new electricity generating capacity in NSW. The wind farm is located in the strategic Sydney-Canberra growth corridor and is proximate to the South Coast industrial/employment centre of Wollongong and Port Kembla. The electricity generated from the Proposal is

easily fed into the grid through a connection into the 330kV lines that cross the northern edge of the project site.

4.7. Suitability of the Project Site

4.7.1. Wind Energy Potential

The project site's wide open space and location along a line of hills across the direction of prevailing winds makes it very suitable in harnessing the region's excellent wind resource which has been proven consistent and suitable for the operation of wind turbines. Wind energy yield and layout studies have confirmed the site's potential for wind energy generation.

4.7.2. Co-existence and Compatibility with Current Land Uses

The wide separation between WTGs allows the Proposal to co-exist with the predominantly pastoral land use of the project site, with only the very minor portions of land to be occupied by infrastructure and access roads taken out of agricultural production. In simple terms, wind turbines typically need to be separated widely across and along the prevailing wind direction to allow the turbines to turn and follow the wind, and to allow wind speed to recover sufficiently to power the succeeding row of turbines downwind.

The Proposal is not expected to alienate land for residential purposes. Residences in and around the project site are relatively sparse. Except for a development approval for the subdivision (but not including residential development) of one property to the south of the project site, information from the local Council showed there are no other approved subdivisions in the immediate area.

The Proposal's siting of WTGs has taken into consideration potential environmental impacts. In particular, areas of ecological and heritage sensitivity have been avoided. The layout of WTG has also been designed to minimise the potential noise and amenity impacts on the local community.

The NSW Land and Property Management Authority (LPMA) defines the following reserves located within the project site:

- Reserve 17318 (Lot 7003 DP94490) for trigonometric purposes, located at the central north east section of the project site, east of Lerida Road South;
- Reserve 198 (Lot 7002 DP94461) for water supply, located in the central section of the project site near the upper reaches of Sandy Creek west of Lerida Road South; and
- Reserve 530137 (Lot 66 DP754127) as a dedication for public school site, located at the south west section of the project site adjacent to Lerida Road South.

No works are planned within or in the immediate vicinity of any of these reserves and the Proposal will not impede access to these reserves.

There are two conservation reserves in the vicinity of the project site at the junction of Lerida Road South and Collector Road and at the junction of Marked Tree Road and Collector Road. Neither of these reserves will be

impacted by the proposal. There are no significant water, mineral or forestry resources that will be sterilised or alienated by the Proposal.

4.7.3. Existing Access and Transmission Infrastructure

The Proposal intends to take advantage of the proximity of existing infrastructure, including Hume Highway, Lerida Road South and various Crown roads, which provide traffic access, and the 330kV transmission lines along the northern end of the project site which reduces the required length of the connection to the electricity grid.

The 330kV single circuit transmission line that passes along the north of the project site forms part of the four 330kV lines that connect the southern transmission grid at Yass and Canberra to the remainder of the NSW main system. Power sources in the south-west of NSW include the Snowy scheme, Uranquinty gas turbine, minor hydro power stations, and new wind farm developments. There is also significant power transfer between NSW and Victoria through this part of the grid.

TransGrid (2010) notes that supply to the NSW south-west will increasingly rely on southern generation or import from Victoria. By virtue of its location, the Proposal is expected to contribute in supplying this load. This increased load is expected to require an upgrade of the 330kV system in this section of the transmission grid within the next decade. These upgrades will reduce transmission constraints and allow the electricity generation of the Proposal and of other wind farms proposed or approved for development in the region, to be absorbed more efficiently into the NSW transmission grid.

4.8. Alternatives Considered

4.8.1. Location

The Proposal was originally being developed by another electricity generation company which had commissioned detailed wind energy yield and layout studies for the general area of Collector to confirm the site's suitability for wind farm development. The Proponent took over the Collector wind farm project as part of its acquisition of a renewable energy development portfolio from the original proponent.

The Proponent has since carried out further wind turbine layout studies which considered access to turbine sites (landowner agreement) and environmental constraints such as ecologically sensitive areas and potential adverse impacts on the local community, especially noise and visual impacts. These have been the main considerations in assessing options with respect to the number and location of wind turbines across the project site. The proposed number (maximum of 68 WTGs) and layout of wind turbines is described in **Section 2.3.2**. After the selection of the WTG model and the determination of the final number of WTGs that would comply with applicable operational noise criteria, the proposed WTG locations will be subject to further minor adjustments or micro-siting to optimise generation capacity and address environmental and other constraints.

4.8.2. Design

The WTG models being considered for the Proposal are shown in **Section 2.3.1**. These models are generally similar in that all are upwind pointing horizontal axis wind turbines. They vary in generation capacity (from 2.1 to 3.4MW), blade diameters (from 44 to 54.5m) and hub heights (from 80 to 100m), but all these models belong to the utility-scale category in terms of size.

While, the Proponent still has to select the model of the WTGs to be installed for the Proposal, the following are considered preferred design and construction parameters:

- installed capacity will be up to 228MW;
- step-up transformers will be two units 130MVA;
- connection to the electricity transmission grid will be through the existing 330kV transmission line traversing the northern section of the project site;
- cabling from WTGs to the site substation will be generally underground; and
- construction and equipment delivery access to the project site will be through Hume Highway and Lerida Road South.

The final number and location of WTGs will be determined by compliance with noise criteria, as discussed in more detail in **Chapter 7**. Detailed geotechnical investigations will be carried out during the pre-construction phase to select the type of foundation for each WTG location (either gravity or rock anchor footing), and to scope the extent of construction and/or upgrade of access roads.

4.9. Community Support for Renewable Energy

Surveys show that there is generally broad community support for renewable energy developments in NSW and the surrounding region. These surveys are described in more detail in the following sections.

4.9.1. National Telephone Survey 2003

The Australian Research Group (2003) on behalf of the Australian Wind Farm Association undertook a survey telephone survey of 1027 people in August 2003. The survey was focussed on the use of renewable energy and in particular sought opinions on wind farms. The results in summary revealed that:

- 94% of the respondents thought that a target to increase the contribution of clean energy from renewable resources was a good or very good idea (32% and 62% respectively). Less than 3% of respondents considered the current target to be too high or much too high;
- 76% of respondents stated they were prepared to pay 5% more on electricity bills for 10% more clean energy. They were prepared to pay more even when given the option of having cheaper electricity at any cost;
- 88% of respondents stated they wanted the Government to increase support to the renewable energy sector. In contrast 26% stated they wanted to see an increase in support for the fossil fuel sector;
- 95% of respondents supported or strongly supported (27% and 68% respectively) the building of wind farms to meet Australia's rapidly increasing demand for electricity; and

- 91% stated it was more important to build wind farms for electricity than avoid building them in rural Australia.

It is interesting to note that a majority of respondents were prepared to pay more for electricity to facilitate alternate renewable energy sources being used. Significantly greater support was shown for the reduction of greenhouse gas through the use of renewable energy sources such as wind power than the protection of fossil fuel based industry.

4.9.2. NSW Southern Tablelands Survey 2007

REARK Research (2007) on behalf of Epuron carried out a random telephone survey in July 2007 of 300 residents of the Goulburn-Crookwell-Yass region. The purpose of the survey was to determine the community perception of wind farm developments in the NSW Southern Tablelands. Outcomes of the survey can be summarised as follows:

- 80% of respondents were concerned, at the time of the survey, with the threat of global warming and its impact on the environment, Sixteen per cent were unconcerned with the threat of global warming;
- awareness of wind farms was very high with more than 8 in 10 respondents having seen the Crookwell wind farm and associated infrastructure.
- 89% of respondents were in favour of wind farms being developed in the Southern Tablelands, with only 5% of respondents opposed; and
- when asked about the acceptability of a wind farm being located near where they lived 87% of respondents supported a wind farm within 25km of where they lived while 71% of respondents favoured a wind farm within one kilometre of their home.

The survey revealed that the majority of respondents were concerned about global warming and the impact on the environment. The respondents were aware of, had viewed and understood what a wind farm and the component turbines were and how they looked and were supportive of wind farms generally and within close proximity (one kilometre) to their homes.

4.9.3. Upper Lachlan Shire Council Poll 2008

As part of the 2008 Local Government Elections, Upper Lachlan Shire Council conducted a community poll which posed the question: *Do you support the continuing development and construction of wind farm turbines in the Upper Lachlan Council area?* The poll results (with 88.2% voter participation) showed that 70% of electors supported continuing development of wind farms in the Shire, with 30% opposed (NSW Electoral Commission, 2009).

4.9.4. Auspoll Community Opinion Survey

The Proponent engaged Auspoll to undertake a Community Opinion Survey. The responses are summarised in **Chapter 14**. It is relevant to note that 68% of the 400 persons surveyed stated their support for the Proposal, with 14% opposed.

4.9.5. Department of Environment, Climate Change and Water 2010

The NSW Department of Environment, Climate Change and Water (DECCW) commissioned a survey of community attitudes toward wind farms, which was undertaken in May and June 2010 by AMR Interactive (2010). The survey was of 2,022 residents across the six NSW Renewable Energy Precincts (see **Figure 1**), with a control sample from elsewhere in regional NSW. The key findings of the survey were:

- wind power was regarded as acceptable for power generation by 81% of the surveyed residents;
- 85% of residents supported wind farms being established in NSW, with 80% supporting wind farms in their local region; and
- 79% of residents supported wind farms being established within 10km of their residence, with 60% supporting developments within 1 to 2km of their residence.

Results for the NSW/ACT Border Region - which included the largest installed wind farm capacity (145.8 MW) of all Precincts at the time of the survey – showed the highest levels of support for wind farms in NSW at 89%. This indicates ongoing high levels of support for wind farm developments post-establishment.

4.9.6. CSIRO Report 2012

The CSIRO report *Exploring Community Acceptance of Rural Wind Farms in Australia: a Snapshot* (CSIRO, 2012), noted:

> *There is strong community support for the development of wind farms, including support from rural residents who do not seek media attention or political engagement to express their views. This finding contrasts with the level of opposition that may be assumed from the typically 'conflict-oriented' portrayal of wind farm proposals in the popular media. This media coverage frequently gives significant attention to legal challenges, political protests, and vocal opponents including 'Landscape Guardians' and high profile individuals, but fails to balance this with coverage of middle ground views, or with equivalent attention to the potential benefits of with wind farms.*

This finding is consistent with the results of the surveys outlined above, which show majority community support for development of wind farm projects.

4.9.7. Qdos Research 2012

Qdos Research (2012) undertook community research in April 2012 on behalf of Infigen Pty Ltd. The objective was "…*to explore and test local attitudes towards wind farms in the communities surrounding the Capital Wind Farm in New South Wales amongst residents and local business operators*." This research specifically targeted a community hosting an established wind farm development.

The telephone survey - which sampled approximately 30% of the local population - made the following findings:

- 75% of respondents believed that wind farms benefit the environment;
- Approximately 50% of respondents considered the wind farms were good for the local community and local business (approximately 35% thought there was no difference);

- 68% of respondents supported future wind farm developments in the local area, with 15% in opposition;

In addition to the resident survey, 34 local businesses were surveyed with 64% believing that the wind farm was good for local business.

4.10. Summary

The project site is considered to be suitable for the development of a wind farm due to the following factors:

- the region's excellent wind resource which has been proven consistent and suitable for the development and long term operation of a wind energy facility;
- the relatively sparse density of residences within the vicinity of the project site;
- immediate proximity to a suitable electricity grid connection;
- low environmental impacts, as demonstrated by technical studies and environmental investigations; and
- broad community support for renewable energy developments in the region from the community, local and State government.

5

APP Corporation

Key Assessment Requirements

5. Key Assessment Requirements

This Environmental Assessment (EA) was prepared in accordance with the Director-General's Requirements (DGRs) issued under section 75F of the EP&A Act. The DGRs (issued on 15 October 2010 in response to a Major Project Application made by the Proponent on 17 September 2010) identify the key issues that must be assessed in this EA. The DGRs were supplemented on 2 February 2011 (following a revised Major Project Application made on 17 January 2011), requiring additional ecological assessment, and on 16 August 2011 in relation to community consultation. The supplementary DGRs, included in **Appendix A**, are also addressed in this document.

Table 8 summarises the assessment method for each of the issues identified in the DGRs, together with the supplementary requirements and the relevant section of this document containing the assessment. The respective chapters provide a description of the existing environment, assessment methodologies and relevant criteria, identification and assessment of potential impacts, and detailed mitigation measures to minimise any residual environmental impacts.

In addition to the DGRs, this EA was prepared with regard to the *Draft NSW Planning Guidelines: Wind Farms* (December 2011). As the Guidelines were in draft form at the time of preparation of this EA, and the environmental assessment process was well-advanced, the Proponent met with DoPI officers on 19 January 2012 to discuss the applicability of the Guidelines to the Proposal. Formal advice from DoPI (dated 18 April 2012; see **Appendix A**) listed the key aspects of the Guidelines relevant to the Proposal. These matters are summarised in **Section 3.4.2**.

Table 8 Key Assessment Requirements

Key Issue	Chapter in this EA	Assessment Method
Director-General's Requirements – 15 October 2010		
Visual Impacts	Chapter 6	Assessment by Green Bean Design
Noise Impacts	Chapter 7	Assessment by Marshall Day Acoustics
Flora and Fauna	Chapter 8	Assessment by NGH Environmental
Indigenous Heritage	Chapter 9	Assessment by NSW Archaeology
Traffic and Transport	Chapter 10	Assessment by AECOM
Hazards and Risks	Chapter 11	
• Aviation	• Section 11.1	• Assessment by Rehbein Consulting
• Telecommunications	• Section 11.2	• Assessment by PB
• Bushfire Risk	• Section 11.3	• Desktop Review
• Health and Safety	• Section 11.4	• Desktop Review
• Electromagnetic Fields	• Section 11.4.2	• Desktop Review
• Shadow Flicker	• Section 11.4.3	• Assessment by RATCH-Australia
Water Quality	Chapter 12	Desktop Review & Authority Consultation
General Environmental Issues	Chapter 13	
• Air Quality	• Section 13.1	• Desktop Review
• Soils	• Section 13.2	• Desktop Review
• Non-indigenous Heritage	• Section 13.3	• Assessment by NSW Archaeology
• Waste Management	• Section 13.4	• Desktop Review
• Property Values	• Section 13.5	• Desktop Review
• Mineral Resources	• Section 13.6	• Desktop Review
• Socio-economic	• Section 13.7	• Desktop Review
• Land Use	• Section 13.8	• Desktop Review
Supplementary Director-General's Requirements – 2 February 2011		
Flora and Fauna	Chapter 8	Assessment by NGH Environmental
Supplementary Director-General's Requirements – 16 August 2011		
Community Consultation	Chapter 14	Consultation by Proponent

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