EPURON
POWER FOR PORTFOLIOS

Environmental Assessment

PROPOSED YASS VALLEY WIND FARM:

COPPABELLA HILLS AND MARILBA HILLS PRECINCTS

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nghenvironmental

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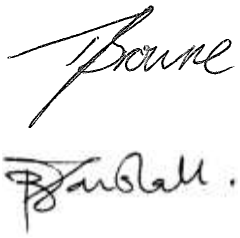
1		name		name		name	
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1 EXECUTIVE SUMMARY

1.1 INTRODUCTION

This Environmental Assessment has been prepared by **ngh**environmental on behalf of Epuron Pty Ltd (the Proponent) to assess the potential environmental impacts associated with development of the Coppabella Hills and Marilba Hills Precincts for the proposed Yass Valley Wind Farm.

The proposal is to be assessed as a Part 3A Major Project under the NSW *Environmental Planning and Assessment Act 1979*. Under this Act, the proposed development meets the criteria for Critical Infrastructure as it is a power generator with capacity to generate in excess of 250 MW.

This assessment report:

- Describes the Coppabella Hills and Marilba Hills Precincts of the proposed Yass Valley Wind Farm project
- Identifies the statutory assessment and approval requirements
- Identifies and assesses the environmental impacts, focussing on the key issues identified by stakeholders (including the Department of Planning, local and state government agencies and the local community)
- Identifies measures to manage risks and avoid or mitigate potential impacts

1.2 THE PROPONENT

Epuron Pty Ltd is the Australian subsidiary of Epuron GmBH, an international group of companies which develop and operate major renewable energy projects. Epuron is also currently working on number of wind farm projects at different stages of development as outlined in Table 1.1. Epuron was formerly known as Taurus Energy. Taurus Energy obtained approval for three wind farms in NSW, one of which is now in operation.

Table 1-1: Wind Farm Projects developed by Epuron

Project	Turbines / Size	Development Status	Region
Cullerin Range	15 WTG - 30 MW	Operating	Southern Tablelands
Conroy's Gap	15 WTG - 30 MW	Development Approval	Southern Tablelands
Snowy Plains	15 WTG - 30 MW	Development Approval	Monaro
Gullen Range	73 WTG ~ 240 MW	Project Approval	Southern Tablelands
Silverton	598 WTG ~ 1480 MW	Project Approval -stage one Concept Approval - stage two	Far Western NSW

Epuron is the most experienced wind farm company in NSW and currently operates and maintains one of the most extensive networks of monitoring masts in NSW.

1.3 THE PROPOSAL

Epuron Pty Ltd is proposing to build a wind farm with up to 182 turbines near Yass in southern New South Wales. The Yass Valley Wind Farm development would be comprised of three 'Precincts'; Coppabella Hills (up to 86 turbines), Marilba Hills (up to 66 turbines) and Carroll's Ridge (up to 30 turbines). Each precinct would be independently viable. This Environmental Assessment Report has been prepared in regards to the development of the Coppabella Hills and Marilba Hills Precincts. Henceforth, the 'proposed development' refers only to these two precincts. A separate application will be lodged for the proposed Carrolls Ridge Precinct along with further detailed biodiversity assessments. For the purpose of continuity and transparency, where appropriate, the impact of the three precincts have been assessed together, for example photomontages include all proposed turbines.

The proposed development would be sited on private farmland and involve around 23 properties. Wind turbines in these precincts would be located along the ridgelines and peaks of the South West Slopes, as shown on the indicative layout plans (Figures 3-10-3-12).

The wind turbine towers would stand at 78-100 metres high and the rotor diameter (total span of the blades) would be 80-112 metres. The maximum tip height for the turbine tower plus rotor would be 150 metres above ground level.

It is likely that construction of a substation, onsite control room and maintenance facility would be required in both precincts to connect the wind farm to the existing electricity network. Underground cabling would connect the turbines together into clusters, and overhead powerlines would connect the turbine clusters to the substation. Temporary construction facilities and upgrades to local roads would also be required.

The Coppabella Hills and Marilba Hills Precincts of the proposed wind farm would have a capacity of around 380 MW[1] and would generate approx. 1,200,000 MWh of electricity per year. The proposal would reduce our reliance on fossil fuels and avoid carbon dioxide emissions by 1, 160,000 tonnes per annum in a typical year. This is equivalent to taking 265,000 typical cars permanently off the road every year.

[1] Calculated using a typical 2.5 megawatt turbine, considered to be a representative size turbine for this project.

Table1-2: Summary of the proposed Coppabella Hills and Marilba Hills Precincts

ASPECT OF THE PROPOSAL	DESCRIPTION		
General features			
Project Summary	Construction and operation of a wind farm approx 30 kilometres west of Yass, NSW. The Coppabella Hills and Marilba Hills Precincts would have the ability to produce around 1,200,000 MWh of renewable energy every year.		
Infrastructure & Facilities	Both precincts are likely to require a 33kV to 132kV substation, onsite control room and maintenance facilities. Private access tracks would also connect all of the turbines internally.		
Electrical Connectivity	Underground and overhead cabling would connect the turbines internally. Through the onsite substations the wind farm would be connected to the existing transmission network.		
Employment	Development of the precincts would create approx 167 full time jobs during the construction phase and around 34 ongoing operation and maintenance jobs.		
Project Life	The wind turbines have a design lifetime of around 25 years, at which point they can either be replaced or decommissioned.		
Capital Cost	The project would have a capital cost of approx $670 million		
Environmental Benefits	CO_2 emissions reductions of 1,140,000 tonnes per year		
	Coppabella Hills	**Marilba Hills**	**Total**
Energy Potential (Based on a 2.5MW turbine)	86 turbines with a capacity of approx 215 MW	66 turbines – approx 165 MW	152 turbines – approx 380 MW
Development Envelope (ha)	2829.10	4140.00	6969.10
Woodland and forest to be removed (ha)	11.45	12.07	23.52

1.4 THE PROPOSAL SITE

The two precincts are located approximately 20 and 35 kilometres west of the township of Yass respectively, as shown in Figure 3-1. The Hume Highway runs predominantly along the southern boundary of the precincts between the towns of Bowning and Jugiong. The site is located in the Yass Valley and Harden Local Government Areas on land zoned for rural uses. Agriculture is a dominant industry in the region, particularly sheep and cattle grazing. This is reflected in the landscape which is characterised by open pasture on undulating to hilly terrain. The district is heavily cleared, with scattered paddock trees and small forest and woodland patches on watercourses and steeper slopes.

A strong transmission network passes through both precincts and connects into the Yass substation, one of the strongest nodes in the transmission network outside of Sydney.

1.5 PROJECT BENEFITS

The Proponent is committed to developing all precincts of the Yass Valley Wind Farm in a way which minimises adverse local impacts and maximizes the benefits of the project to the local and broader community.

Overall the project would reduce the current dependency on the consumption of fossil fuels for electricity and therefore reduce the impacts of climate change resulting from greenhouse gas emissions. Currently within the electricity sector in NSW, approximately 90% of electricity is generated by fossil fuel power stations, primarily coal fired power stations.

Based on the 152 indicative turbine layout proposed, the project offers the following benefits:

- Production of approximately 1,200,000 MWh of renewable energy per year, sufficient for the average consumption of around 140,000 homes in a typical year.
- Reduction in greenhouse gas emissions by around 1,140,000 tonnes per year, equivalent to taking around 265,000 cars of our roads permanently every year.
- Provision of local jobs and injection of up to $334 million into the Australian economy and approximately $75 into the local economy.
- Creation of up to 167 local jobs during the construction phase and up to 34 ongoing operations and maintenance jobs.
- Upgrades to local infrastructure such as roads and transmission lines.
- Improved security of electricity supply through diversification.

1.6 ENVIRONMENTAL IMPACT ASSESSMENT

Epuron commissioned a full environmental assessment of the Coppabella Hills and Marilba Hills Precincts of the wind farm to identify any potential impacts from the development and develop appropriate mitigation measures.

Epuron engaged **ngh**environmental to prepare the Environmental Assessment on their behalf. The main impacts of the proposal have been addressed with specialist studies which include detailed reports that can be found appended to this Environmental Assessment. Specialist assessments include:

- Landscape and Visual assessment conducted by Environmental Resource Management Australia (ERM)
- Noise impact assessments have been carried out by specialist acoustic consultants Heggies Australia and Marshall Day,
- Biodiversity Assessment conducted by **ngh**environmental
- Heritage and Archaeology impact assessment conducted by NSW Archaeology
- Traffic and Transport assessment conducted by Bega Duo designs

Other issues considered in the EA include:

- Communications and Aviation impact assessments
- Electromagnetic Interference assessment
- Hydrological impacts
- Fire and bushfire impacts
- Health and Safety impacts
- Economic impacts

The key potential impacts are summarised below.

1.6.1 Visual impacts

Epuron has assessed the potential visual impacts in the vicinity of the wind farm. The main concern with visual impact is the change to the existing environment that is likely for local residents, as well as road and recreational users.

The Visual Impact Assessment considered two elements; the potential impact to public view points, including road users and the potential impact to residences within 3km of a proposed turbine location.

The visual landscape in the study area has already been substantially modified by agriculture practices and contains many built elements, including several powerlines and farming structures. The assessment concluded that there were no areas where the wind farm would create unacceptable visual impacts. Visual impacts on the surrounding townships are expected to be low, and while there would be visibility from the main highways in the area, the overall impact has been found to be acceptable.

1.6.2 Noise impacts

The proponent commissioned an assessment on the potential for noise emissions from the construction and operation of the Coppabella Hills and Marilba Hills Precincts to have an impact on the local community. The primary concern of Epuron is to protect the amenity of the surrounding community from any adverse noise impacts.

To assess the impacts at local residences a consultant was engaged to model the predicted noise emissions at houses within 5 kilometres of all proposed turbine locations. In accordance with the relevant guidelines, background noise monitoring was conducted over two week periods to firstly determine existing noise conditions.

In total 100 houses were assessed for potential operational noise impacts. There are 21 houses located within 2 kilometres of proposed turbines, 16 of which are involved with the proposal. Results from this assessment showed that all residential locations were compliant with development guidelines under the worst case scenario. The results have been displayed graphically in Section 7.3.

Based on the proposed layouts for the Coppabella Hills and Marilba Hills Precincts, operational noise emissions would meet all relevant noise control criteria and World Health Organisation guidelines. If required after construction, a range of options remain available to mitigate noise at residences. These include, operating turbines with noise controls during specific weather conditions or fitting the turbine with acoustic insulation or the residence with mechanical ventilation or improved glazing.

1.6.3 Flora and fauna impacts

Epuron commissioned an assessment on the potential impacts to the local ecology from the proposed development with a particular focus on native flora and fauna including threatened species.

The primary concerns of the proponent in relation to fauna and flora impacts include the clearing of vegetation and habitat during the construction phase and potential blade strike impacts to birds and bats during the operational phase.

Field surveys were conducted by **ngh**environmental during spring and summer across both precincts within the development envelope – the area where wind farm infrastructure including turbines, transmission lines and road access, would be located.

Several plant and animal species which are listed as threatened were identified. These include one threatened plant (the Yass Daisy), four threatened birds (the Superb Parrot, Speckled Warbler, Diamond Firetail) and one threatened bat (Eastern Bent-wing Bat).

Microbats may be affected by bladestrike or changes in air pressure close to the rotating blades. High-flying and migrating bats are at most risk. Based on the survey results and available habitat, the turbines at the Coppabella Hills and Marilba Hills Precincts are not considered likely to significantly affect microbats.

As a result of the ecological assessment, Epuron modified the infrastructure layout to avoid areas that had high conservation significance and minimise the area of natural vegetation that would be impacted by the development, where possible. This has included removing and relocating turbines in sensitive areas as well as rerouting transmission easements and access roads.

Based on these modifications, the impacts of the proposal have been reduced to require around 23.33 hectares of box gum woodland to be permanently removed; the majority in poor condition. Habitat modification, for easement maintenance, and temporary impacts such as the construction of site compounds, have also been considered. Most of the affected woodland is in relatively poor condition. Better condition woodland and threatened plant habitats have generally been avoided by siting the infrastructure in cleared or disturbed areas. The proposal is not expected to significantly affect native flora at the proposal site.

The construction of the wind farm would result in the loss of a small area of marginal habitat for threatened woodland bird and reptile species. The habitat affected is generally degraded and woodland habitat in similar condition is relatively abundant in the study area.

Threatened woodland birds at the site are not likely to be affected by the turbines located on high ridgelines. High-flying raptors such as the Wedge-tailed Eagle and Little Eagle are present and may be vulnerable to bladestrike or loss of food resources. However, experience at other wind farms suggests that these impacts would not be significant or unacceptable.

1.6.4 Other impacts

Best practice erosion and sedimentation controls are sufficient to protect soils and watercourses at the proposal site. Several local and overseas studies suggest that the proposal would not have a significant impact on local land values and development potential. There would be no significant aviation impacts. Any interference to telecommunications should be readily able to be mitigated. The wind farm would not affect agricultural capacity at the site.

1.7 MITIGATION OF IMPACTS

A wide range of impact mitigation measures are identified in the Environmental Assessment, addressing the key impact areas of the proposal: visual, operational noise, biodiversity, communications, traffic and transport impacts as well as a range of issues relating to the benefits and impacts to local community, including wellbeing, lifestyle values and tourism. These would form part of the Proponent's Statement of Commitments; actions that would be undertaken by the Proponent, if the project is approved. These would be implemented as part of a Project Environmental Management Plan (including Construction and Operation Environmental Management Plans). The Proponent is committed to ensuring the measures developed in these plans are best practice and is committed to working to ensure the best possible result is achieved for the proposed Yass Valley Wind Farm.

1.8 ASSESSING THE PROPOSAL

The proposal would be assessed under Part 3A of the NSW *Environmental Planning and Assessment Act 1979,* under the 'Critical Infrastructure' provisions. The Minister for Planning is the consent authority responsible for determining whether or not the proposal would be approved.

Consultation with government agencies, neighbours and local residents has identified key issues and concerns associated with the proposal. The consultation process is important in the development of this project and has is described in more detail in Section 6 of this EA.

Consultation began with a planning focus meeting which was conducted on site and involved members from local and state government agencies. Following on from this meeting a list of Director General's Requirements was compiled and has subsequently been addressed in this EA.

An open house event was held in Binalong to present preliminary findings of the specialist studies to the local community, and seek feedback on the proposal. Results from a questionnaire indicate the top three issues in order of priority to be noise levels, impact to birds and potential impact to property value.

Studies in the region have shown that adult residents are concerned about global warming and are aware of the alternatives available. Respondents surveyed are generally supportive of wind farms in their immediate locality, and a majority would still approve of a wind farm within one kilometre of their home.

2 INTRODUCTION

2.1 ABOUT THIS REPORT

This Environmental Assessment has been prepared by **ngh**environmental on behalf of the Proponent to assess the potential environmental impacts associated with the development of the Coppabella Hills and Marilba Hills Precincts of the Yass Valley Wind Farm, located west of Yass, on the Southern Tablelands of New South Wales. The Proposal is to be assessed as a Part 3A Major Project, under the NSW *Environmental Planning and Assessment Act 1979*.

This Environmental Assessment (EA):

- Describes the Coppabella Hills and Marilba Hills Precincts
- Identifies statutory assessment and approval requirements in relation to the Proposal
- Identifies and assesses the environmental impacts of the Proposal, with a focus on key issues identified by stakeholders (including the Department of Planning, local and state government agencies and the community)
- Identifies measures to manage risks, and avoid or mitigate potential impacts

This EA meets the assessment requirements of the Part 3A provisions of the *Environmental Planning and Assessment Act 1979* and the Major Projects State Environmental Planning Policy 2005.

This EA draws together a number of specialist studies investigating potential impacts in detail. The findings of these studies have been incorporated into the EA and are included as stand alone documents appended to this report. This EA concludes with a *Statement of Commitments* to which the Proponent would commit, pending approval of the Proposal, in order to manage identified impacts.

A Project Application was submitted to the Department of Planning for this project on 1 December 2008. Director General's Requirements were received from the Minister on 15 January 2009. Refinements to the project design and staging have occurred as a result of the specialist environmental and engineering studies undertaken since the Project Application was submitted. The current EA assesses the Coppabella Hills and Marilba Hills Precincts using the same site boundaries and essentially the same turbine layouts as presented in the Project Application. A separate EA will be submitted for the Carrolls Ridge Precinct.

2.2 OVERVIEW OF THE PLANNING PROCESS

The *Environmental Planning and Assessment Act 1979* (*EP&A Act*) is the main statute for environmental planning and development control in NSW. The Act establishes three principal types of statutory planning instruments; State Environmental Planning Policies (SEPP), Regional Environmental Plans (REP) and Local Environmental Plans (LEP).

Part 3A of the *Environmental Planning and Assessment Act 1979* came into force on 1 August 2005. Part 3A integrates the assessment and approval regime for all Major Projects that need the approval of the Minister for Planning, previously dealt with by Parts 4 and 5 of the Act. The associated State Environmental Planning Policy (Major Projects) 2005 defines developments for the purpose of electricity generation including wind power, with a capital cost of in excess of $30 million dollars as Major Projects. The proposed Yass Valley Wind Farm would have a capital cost in excess of $30 million and is therefore considered a Major Project under Part 3A. A letter from the NSW Department of Planning dated

17/10/2008 confirmed it was the Ministers opinion that the proposed development was a Major Project under Part 3A.

A declaration by the Minster for Planning on 27 February 2008 stated that any project with the capacity to generate in excess of 250 megawatts would be considered *Critical Infrastructure* under the *Environmental Planning and Assessment Act 1979.* Consequently the Yass Valley Wind Farm would be considered Critical Infrastructure as it meets these requirements.

The assessment process for this Proposal is as follows:

- The Proponent of a major project first submits a Project Application for the approval of the Minister for Planning.
- For more complex projects, the Department of Planning (DoP) convenes a Planning Focus Meeting of state agency and local government representatives to consider the scope and level of assessment of key issues.
- The Director-General of DoP then issues the Proponent with requirements for the Environmental Assessment, indicating the issues to be addressed, the level of assessment required and consultation requirements.
- The Director-General's requirements may also require the Proponent to include in an Environmental Assessment a statement of the commitments the Proponent is prepared to make for environmental management and mitigation measures on the site.
- After an Environmental Assessment has been prepared and accepted by the Director-General, the report is placed on public exhibition for a minimum of 30 days during which time submissions from the community, local government and state agencies are accepted.
- Following the consultation period, the Director-General may require the Proponent to respond to the comments, revise the Proposal or revise the *Statement of Commitments*.

Consistent with the Part 3A reforms, this assessment was preceded by an issues scoping exercise to identify and prioritise issues related to the project. A Planning Focus Meeting was held at the proposed Coppabella and Marilba sites on 14th and 15th October 2008, involving representatives from the Yass Valley and Harden Shire Councils, Department of Planning (DoP), Department of Environment and Climate Change (DECC), Murrumbidgee Catchment Management Authority (CMA), Department of Primary Industries (Minerals), Country Energy, Department of Lands, the NSW Roads and Traffic Authority (RTA) as well as the staff from the Proponents and **ngh**environmental. A Project Application identifying and prioritising issues relating to the project was submitted to DoP on 1 December 2008. DoP responded on 14 January with the Director–General's Requirements for the Environmental Assessment (refer to Section 5.1.3).

2.3 THE PROPONENT

The Proponent for this Proposal is Epuron Pty. Ltd.

Epuron Pty. Ltd. is the Australian subsidiary of Conergy AG, a significant international group of companies which develop, finance, build and operate major projects in the field of renewable energy. Epuron and Conergy AG have many years of experience in the development of solar photovoltaic, wind power, bioenergy and solar thermal energy projects. In addition to the proposed Yass Valley Wind Farm, Epuron is concurrently working on additional wind farm projects, Gullen Range Wind Farm, near Goulburn and

Silverton Wind Farm, north-west of Broken Hill, which both just received planning approval. Epuron also have a significant pipeline of potential wind farm sites in NSW.

Prior to January 2007, Epuron was formally known as Taurus Energy, a NSW-based renewable energy company established in 2002 to explore wind energy projects primarily in NSW. Taurus Energy previously gained approval for three wind farm projects in NSW; one from the Snowy River Shire Council and two from the Department of Planning as Part 3A assessments, Cullerin Wind Farm and Conroy's Gap Wind Farm, in the Southern Tablelands of NSW. The Cullerin Wind Farm is now in operation.

2.4 REGIONAL CONTEXT OF THE PROPOSAL

2.4.1 Socio-economic context

The study area is located in the Yass Valley and Harden Local Government Areas (LGAs). The entire development envelope of the Marilba Hills is located within the Yass Valley LGA and the majority of the Coppabella Hills Precinct is located within the Harden Shire LGA. At this stage, 14 of 86 turbines proposed for the Coppabella Hills Precinct are located within the Yass Valley LGA and the remaining 72 turbines are within the Harden Shire LGA.

The Yass Valley LGA covers approximately 3,970 square kilometres, has a population of 13,135 and includes the town of Yass and villages of Binalong, Bookham, Bowning, Gundaroo, Murrumbateman, Sutton and Wee Jasper. Within its boundaries, there is one National Park, five Nature Reserves and one State Conservation Area (Yass Valley Council 2005). Refer to Figure 2-1 for LGA boundaries and the proximity of the precincts to major centres.

The region has a long history of agriculture, particularly wool production, with diversification now occurring into horticultural industries. Residential numbers in Yass Valley Shire have consistently risen over the 20 years between the 1981 and 2001 censuses (ACT Government 2004). There were 3,816 separate houses in Yass Valley Shire at the time of the 2001 census. Population is increasing by around 2.5% per year, along with an increase in the average age of the population (ABS 2002). Population density is around 0.03 persons per hectare (or one person for every 29.43 hectares). The average population density across all 17 NSW Local Government areas in the Australian Capital Region is one person for every 41.58 hectares (ACT Government 2004). Most people work in the agriculture/forestry/fisheries, retail trade, and property and business services sectors (ABS 2002).

The Harden Shire Council is known for it's rich agricultural base including cereal cropping, horticulture and grazing, Harden (2008). The Harden Shire LGA is approximately 1861 square kilometres, has a population of 3,582 with the major centre being Harden Murrumburrah. The shire also has four villages, Jugiong, Wombat, Kingsvale and Galong.

Harden Shire LGA has the highest dryland wheat production within NSW. The predominate industry within the Shire is agriculture, the second largest industry is transport. The Harden shire is strategically located at the junction of the major transport routes; the Hume and Olympic Highways as well as the Burley Griffin Way (Harden 2008).

Along with a strong agricultural base, the region benefits economically from the proximity to Canberra, the Hume Highway transport corridor, which bypasses all of the towns, and rail connections to Melbourne and Sydney.

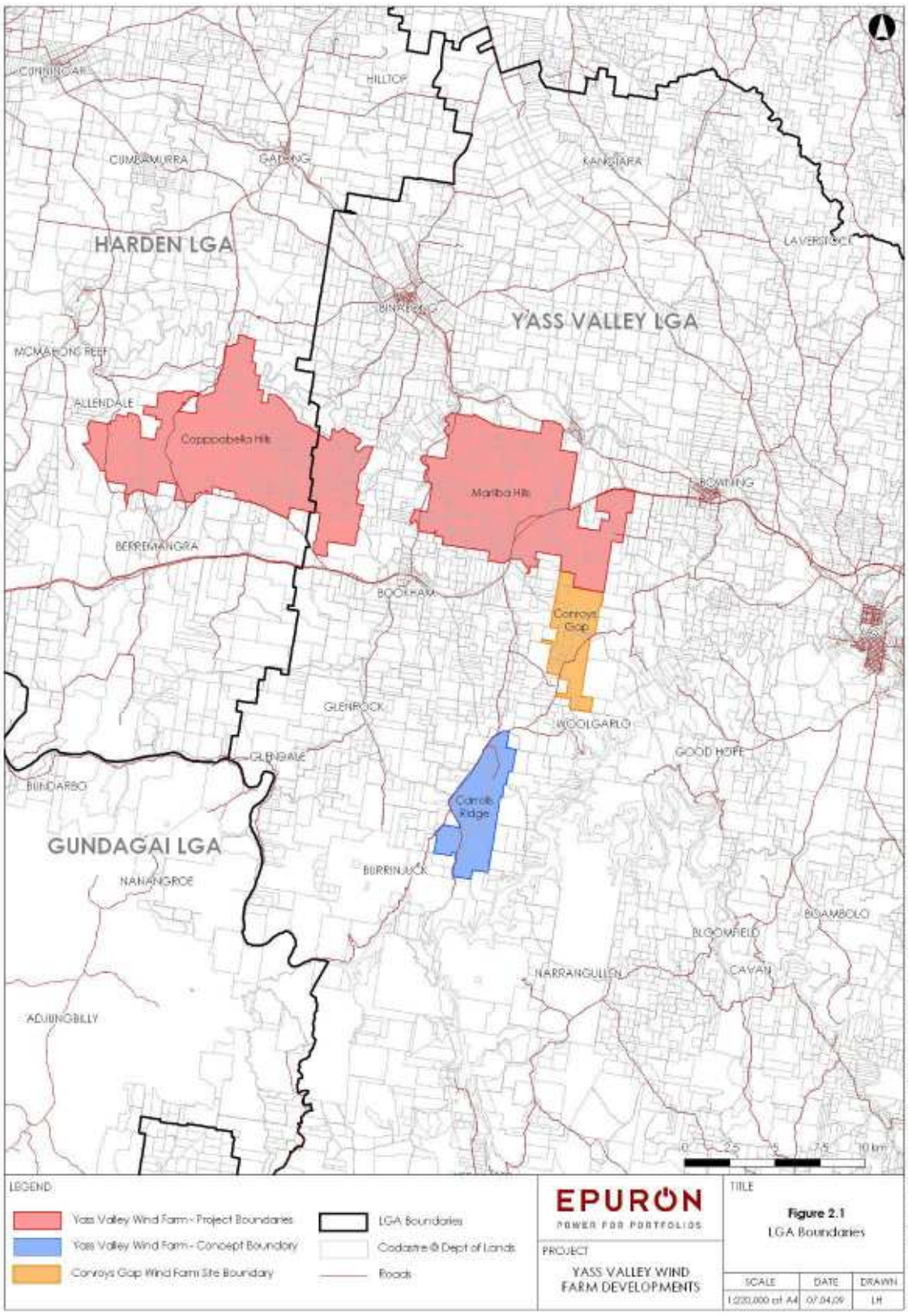


Figure 2-1: Location of proposed Yass Valley Wind Farm

The Coppabella Hills (top left) and Marilba Hills (top right) precincts are assessed in this EA. The Carrolls Ridge (bottom right) Precinct would be the subject of a separate EA. The approved Conroy's Gap wind farm is shown below the Marilba Hills Precinct.

3 DESCRIPTION OF THE PROPOSAL

3.1 GENERAL DESCRIPTION

The proposed development would involve the construction and operation of a wind farm spanning the Coppabella Hills and Marilba Hills Precinct areas along the boundary of the Southern Tablelands and Southwest Slopes in the Yass region of NSW.

The proposal includes:

- Up to 152 turbines across the two precincts;
- A substation and transmission connection at both precincts providing the electrical connectivity with the existing 132kV transmission network;
- Medium voltage electrical connections between the turbines and the substations, using multiple step-up transformers and a combination of overhead and underground power lines;
- Onsite control rooms and maintenance facilities;
- Internal site access tracks and minor upgrades to existing public roads to allow transport of equipment to the proposal; and
- Temporary construction facilities including batching plants and construction compounds during construction or refurbishment and decommissioning phases.

A range of turbines are being considered with a capacity between 1.5 and 3.6 megawatts. For ease of presentation the EA will refer to an indicative capacity of 380 MW based on a typical 2.5 MW turbine.

A number of turbines are under consideration for the proposal, each with varying physical dimensions, and a list of turbines is presented in Table 3-2. Section 3.3.2 discusses the range of physical dimensions of the turbines, including the largest (tip height, hub height and blade diameter) and the most likely or representative turbine. The turbines under consideration have a maximum hub height of 100m and a maximum of 112m blade diameter. The tallest tip height combination under consideration is 150m, while the likely tip height is expected to be between 125m – 135m.

Given the significance of turbine dimensions to the environmental assessment, further discussion on turbine sizes, their implications and the basis for the Environmental Assessment is provided in Section 3.3.2.

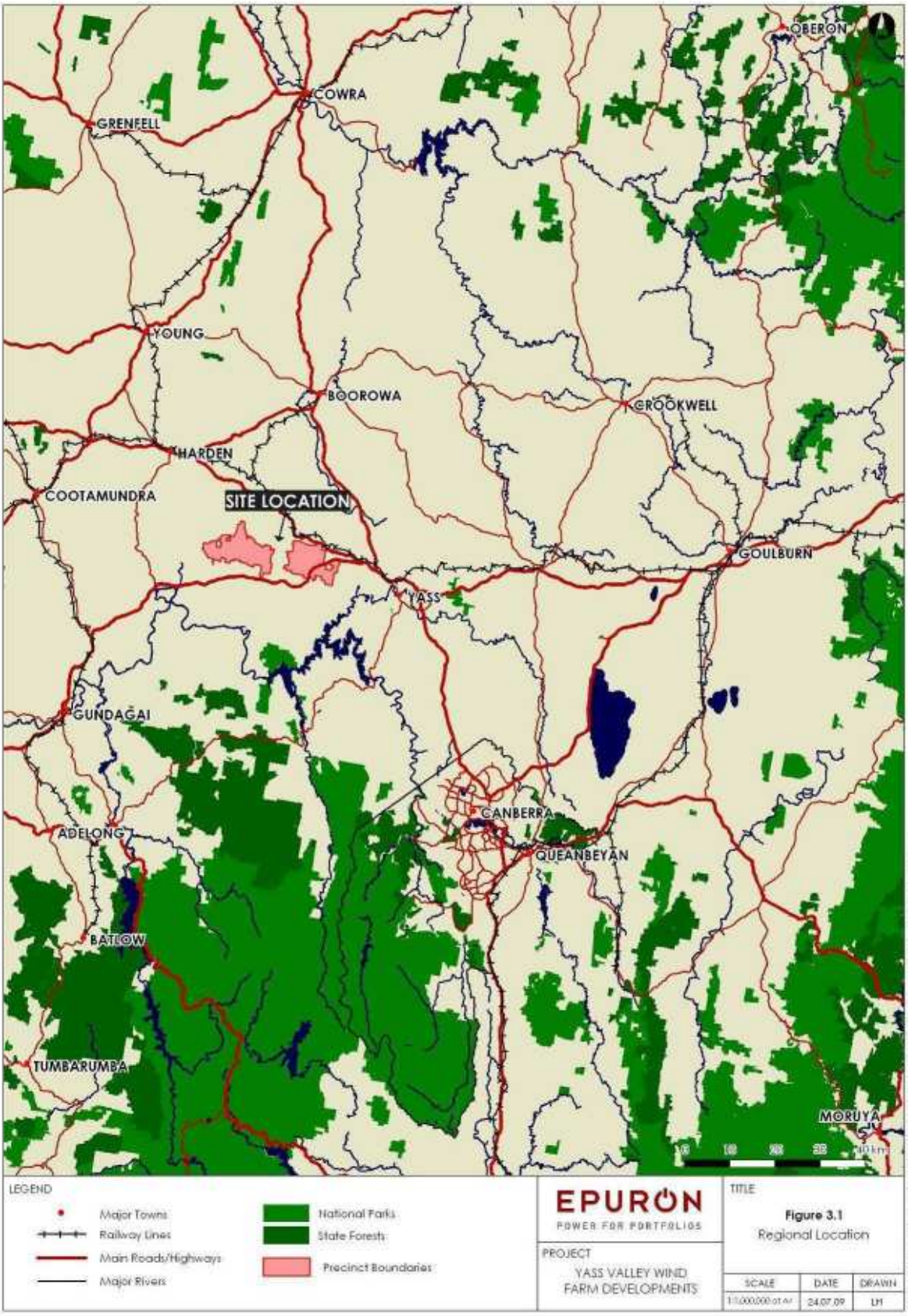


Figure 3-1 Regional locality of the Proposal

3.2 DESCRIPTION OF THE PRECINCTS

The Proposal is for construction and operation of a wind farm across two distinct geographical precincts within close proximity. Both precincts would be independently viable, that is, its development would not rely on the development of the other precinct. The precincts are described below and a list of the involved land parcels for each Precinct is presented in Attachment 1.

3.2.1 Coppabella Hills

The area known as the Coppabella Hills is located approximately 35 kilometres west of Yass and consists of one main ridge line with surrounding hillocks.

- This is the largest precinct of the Proposal and would contain up to 86 turbines with an approximate capacity of 215MW (based on a 2.5MW turbine)
- The Precinct is located approximately 10 kilometres southwest of the village of Binalong.
- A total of 15 landowners would be involved in the project for this Precinct.
- The Precinct could contain up to 86 wind turbines, each with three blades mounted on a tubular steel tower.
- Connection to TransGrids transmission network would be from the northern section of the Precinct where the existing Yass-Wagga Wagga 132kV transmission line passes through the site.
- The main access is proposed to be via the Hume Highway and Whitefields Road.

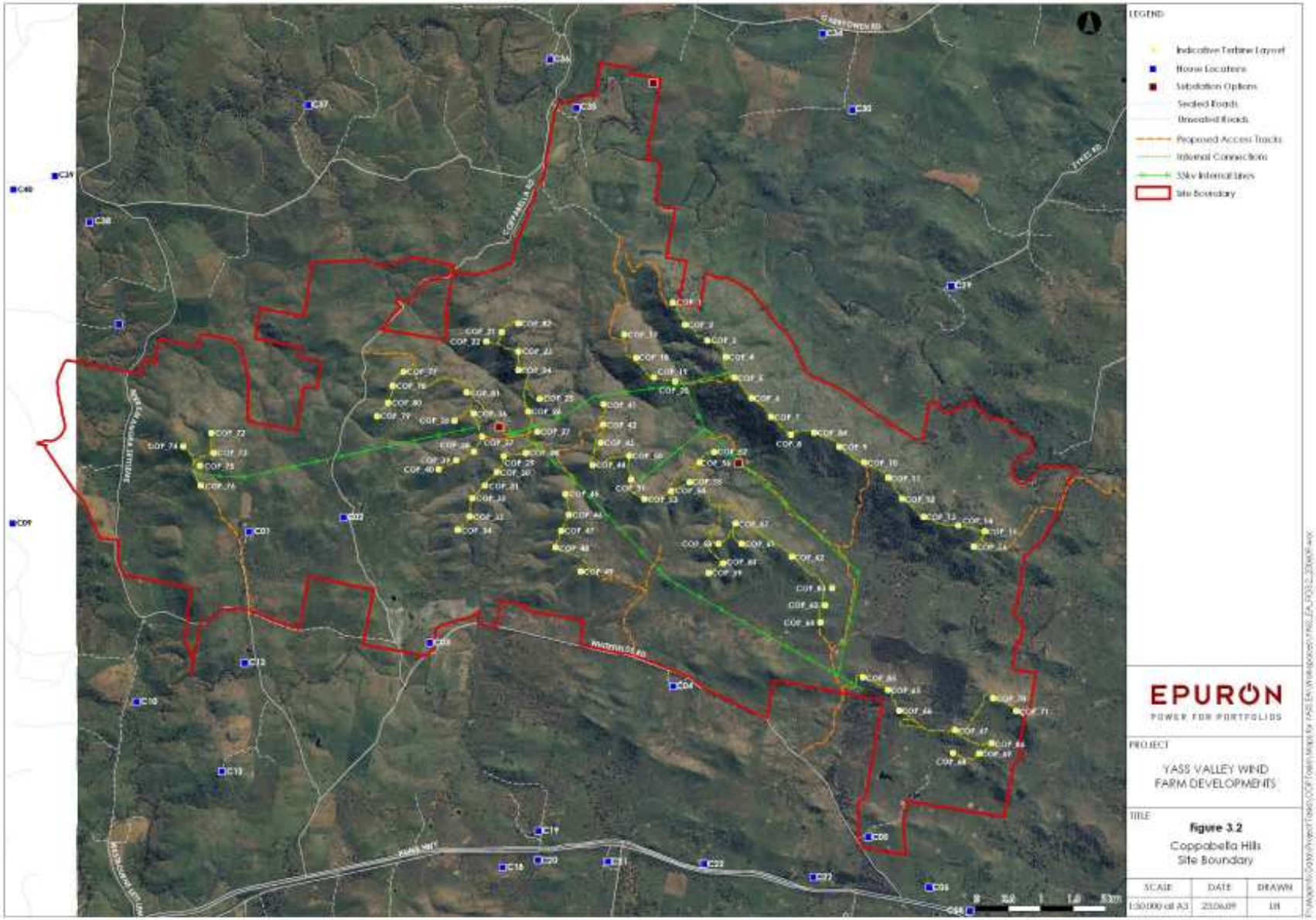


Figure 3-2: Site boundary – Coppabella Hills Precinct

Coppabella Hills consists of 86 turbines, is located 35 kilometres west of Yass and 10 kilometres southwest of Binalong.

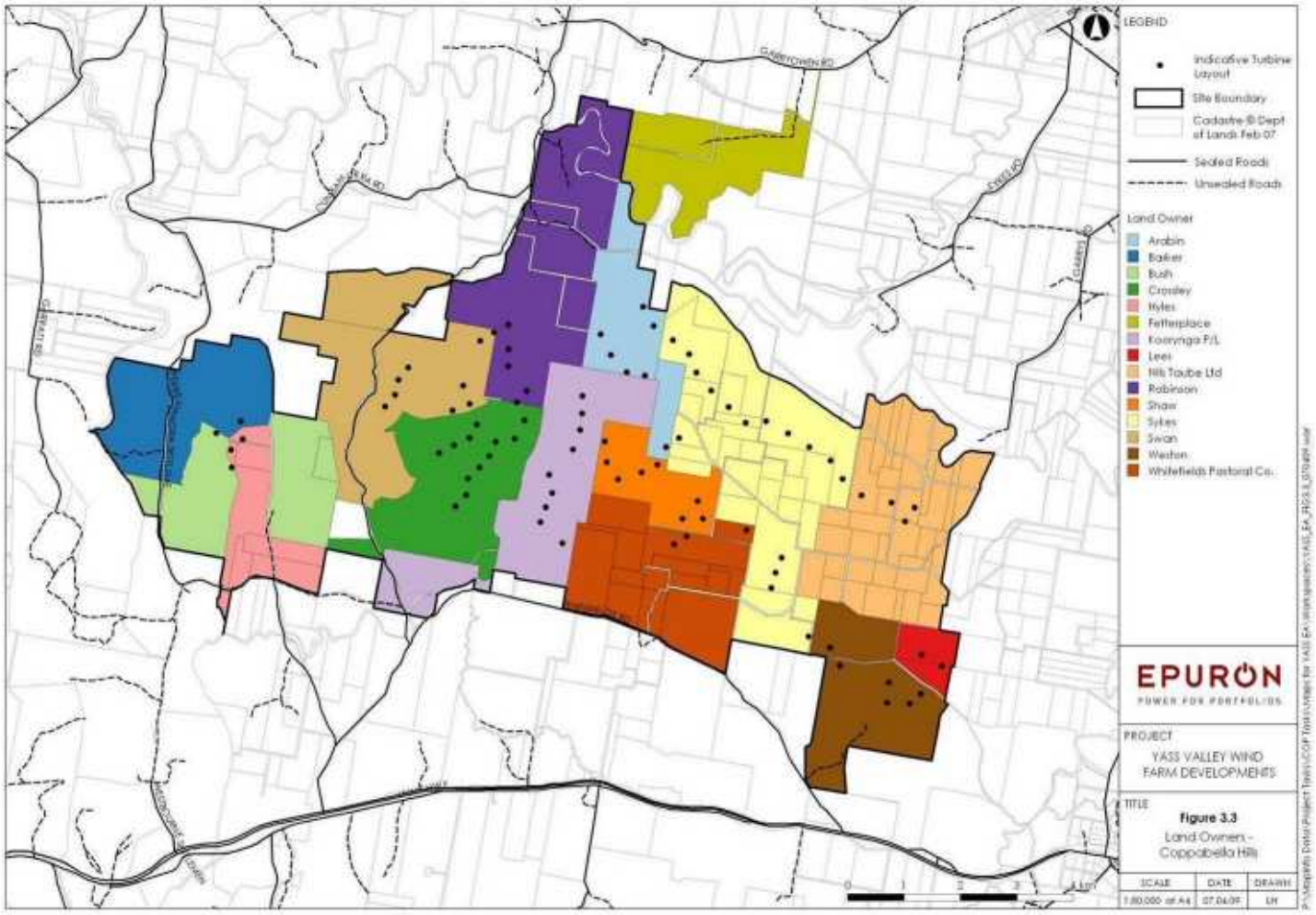


Figure 3-3: Landholdings – Coppabella Hills Precinct

Up to 13 landholders would potentially be involved in hosting turbines

3.2.2 Marilba Hills

The Marilba Hills Precinct would be located on ridges in the northern part of the Black Range and to the north of the previously approved Conroy's Gap Wind Farm Project. This precinct also includes a number of ridgelines to the west.

- There are up to 66 turbines proposed for the Marilba Hills Precinct with an approximate capacity of 165MW (based on a 2.5MW turbine)
- The Precinct is approximately 6 kilometres southeast of the village of Binalong.
- A total of 10 landowners would be involved with the project for this Precinct.
- The Precinct could contain up to 66 wind turbines, located on both sides of the Hume Highway.
- Connection to the existing transmission network would be via the northern section where the Yass – Wagga transmission line passes through the site or via a shared connection with the Conroy's Gap wind farm to the south.
- The main access for this Precinct is proposed to be via the truck rest stops on either side of the Hume Highway.

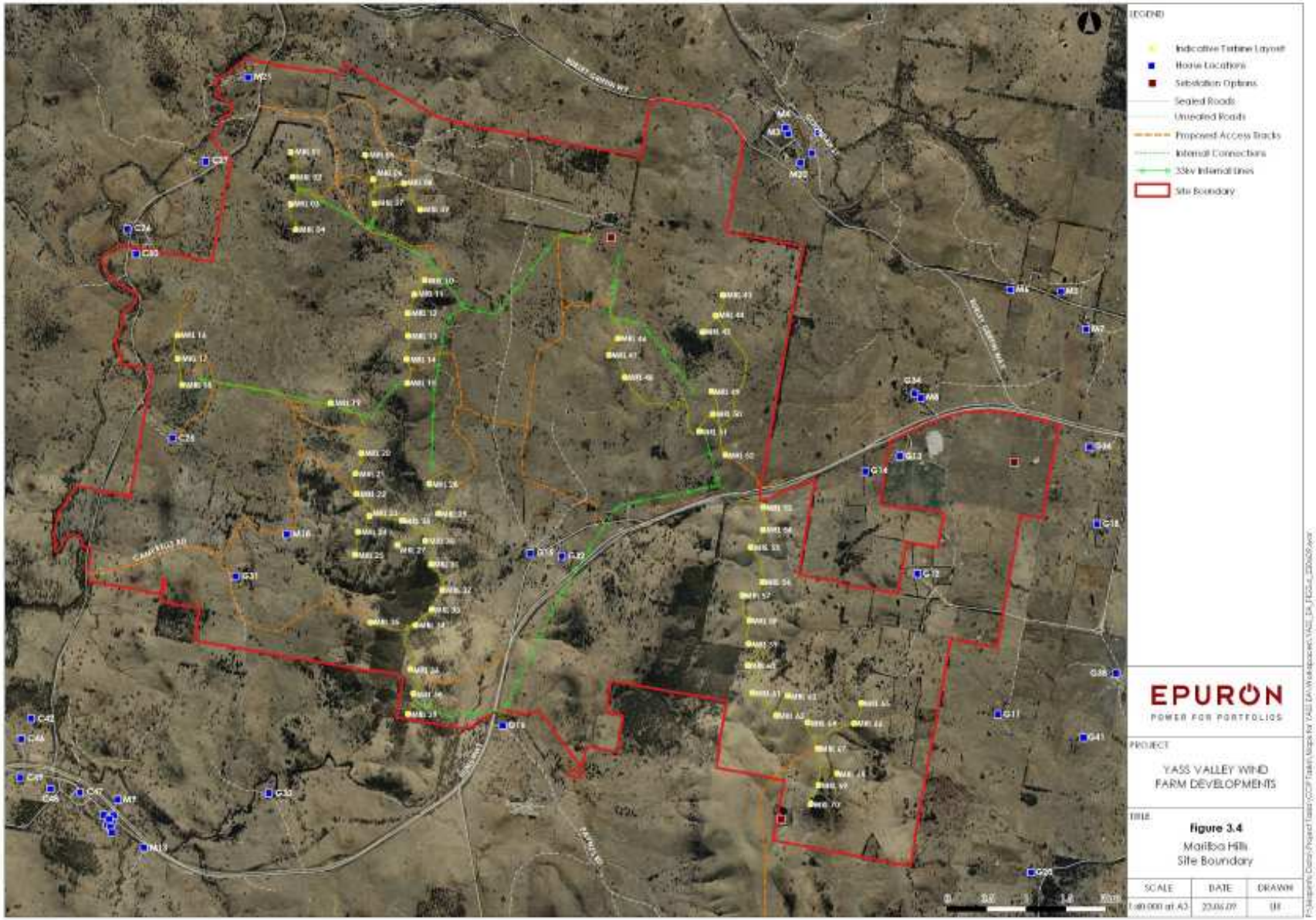


Figure 3-4: Site boundary – Marilba Hills Precinct

Marilba Hills consists of 66 turbines, and is located 20 kilometres west of Yass.

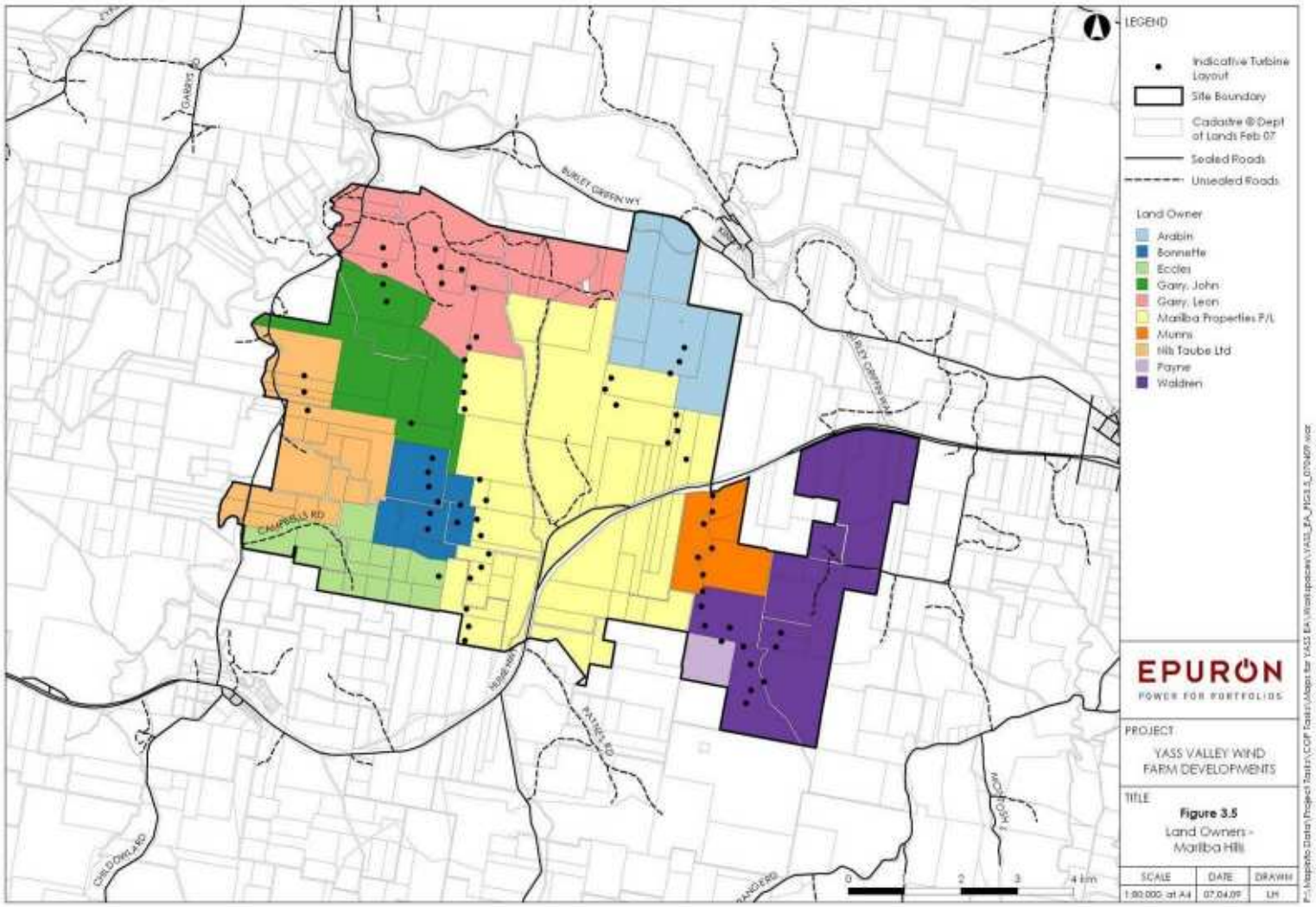


Figure 3-5: Landholdings Marilba Hills Precinct

Up to 10 landowners would potentially be involved in hosting turbines.

3.2.3 Nearby residences

The proposed site has a relatively small number of residences in close proximity to the wind turbine precincts. Table 3-1 presents a summary of the proximity of nearby residences in each precinct, measured from the nearest turbine.

Table 3-1 Residences within 5 kilometres from turbine locations

	Residences within 2km		Residences within 5km	
Precinct	**Involved[2]**	**Non-involved**	**Involved**	**Non-involved**
Coppabella Hills	5	0	10	31
Marilba Hills	11	4	0	59

[2] Involved landowners are those landowners hosting wind turbines on their property or who have agreements in place with the Proponent.

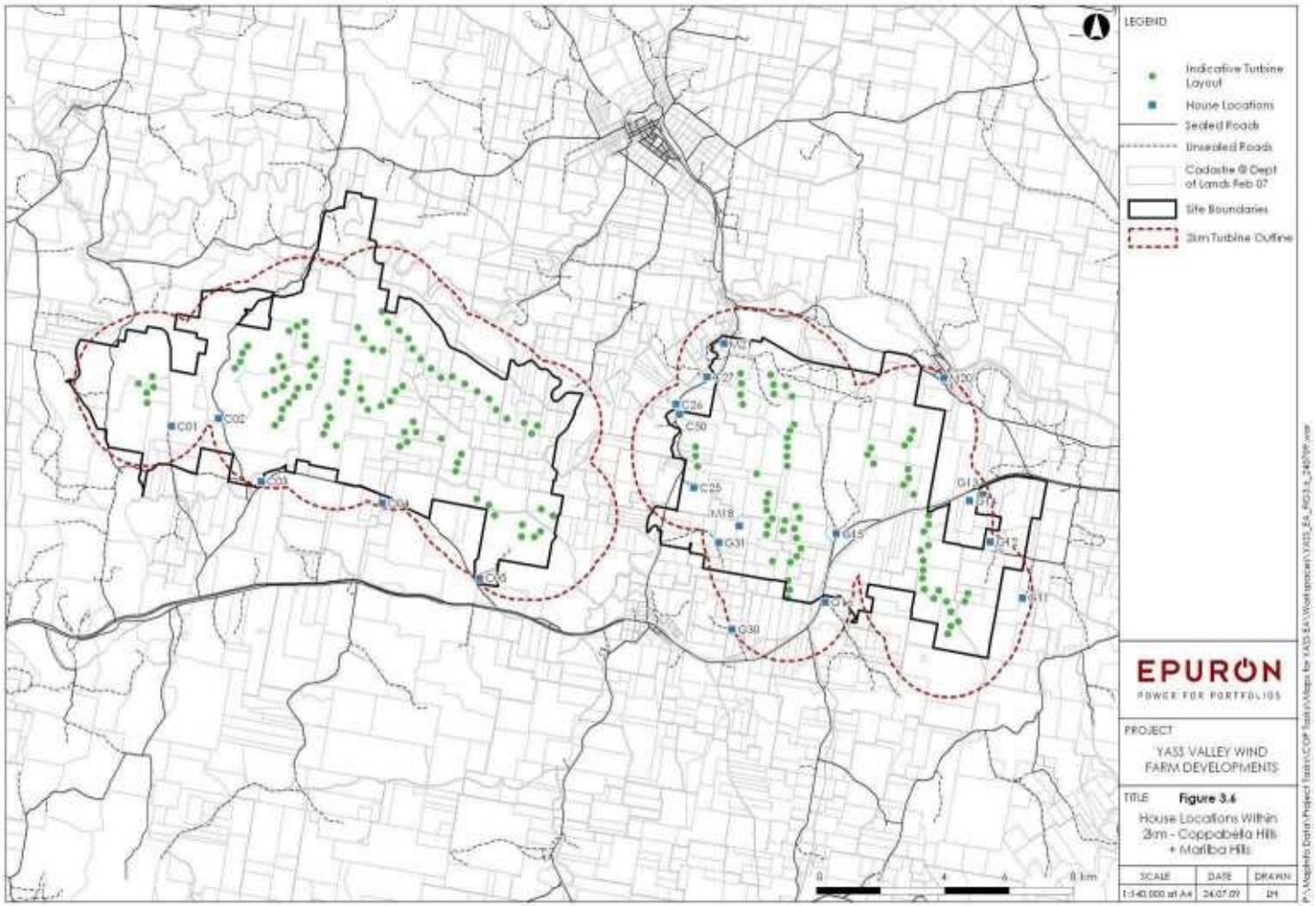


Figure 3-6: House locations (houses within 2km)

There are 17 houses located within 2 kilometres of proposed turbines on Coppabella Hills and Marilba Hills Precincts, 13 of which are landowners involved with the project.

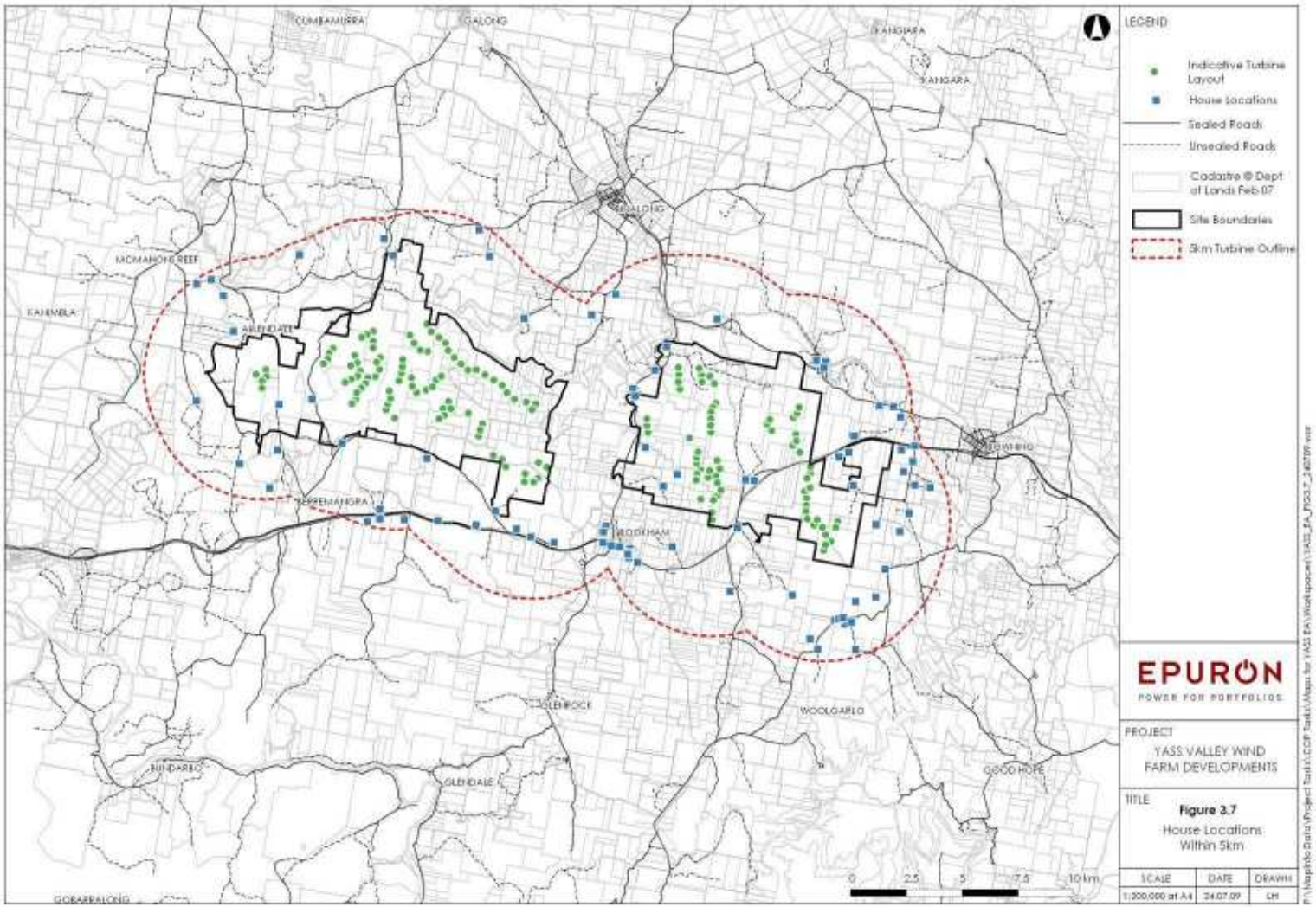


Figure 3-7: House locations (houses within 5km) – Both Precincts

Houses more distant from the site are generally located within the communities of Bookham and Goondah, and along the Hume Highway and Black Range Road.

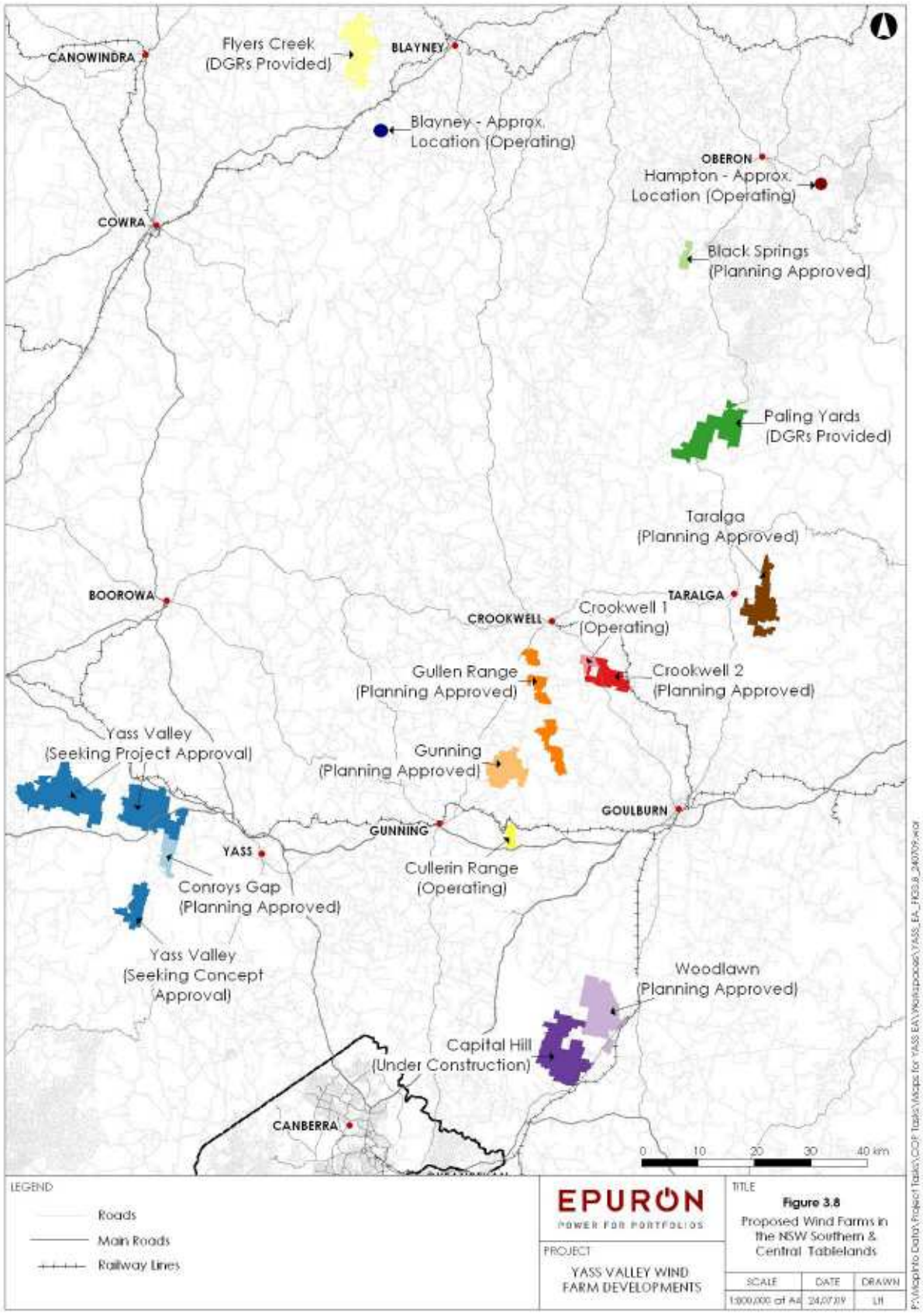


Figure 3-8: Proposed wind farms in NSW southern tablelands

One constructed and several approved wind farms occur in the region.

3.3 WIND FARM INFRASTRUCTURE

3.3.1 Wind turbines – general description

Wind Turbines

The wind turbines being considered for this Proposal have a rotor diameter of 80 to 112 metres and a hub height in the range of 78 to 100 metres. Examples of turbines currently under consideration are outlined in Table 3-2. This list is correct at the time of finalisation of this report, however wind turbine technology and design continues to evolve and new turbines are continually coming onto the market. Therefore, it is possible that minor variations to these typical dimensions could occur prior to final turbine selection.

The maximum tip height proposed for the site is 150 metres above ground level. Any turbine selected would meet this overall tip height limit.

Wind turbines can be fixed speed or variable speed machines, that is, the turbine blades would either rotate at a constant speed (when operating) or a variable speed depending on wind speeds. Variable speed machines have better performance over a wider range of wind speeds, provide higher quality power to the electricity grid, and help reduce wind turbine noise levels at low speeds. However, they are more expensive to install.

Each wind turbine would be a three bladed type of the "up-wind" design, i.e., facing up into the wind and in front of the tower. This design reduces noise levels generated during operation.

Wind turbine blades are typically made of glass fibre reinforced with epoxy or plastic (fibreglass) attached to a steel hub, and include lightning rods for the entire length of the blade. Blades are manufactured in one piece and are therefore the longest element transported to and around site.

Each wind turbine would have a rated power capacity of between 1.5 and 3.6 MW, subject to final turbine selection.

Nacelle

The nacelle is the housing at the top of the tower enclosing the generator, gearbox, and control gear including motors, pumps, brakes and electrical components. This control gear ensures that the wind turbine always faces into the wind, and adjusts blade angles to maximise power output and minimise blade noise. The nacelle also houses a winch or winches to assist in lifting maintenance equipment or smaller replacement parts to the nacelle.

The nacelle design takes into account acoustic considerations to minimise noise emissions from mechanical components.

Tower

The tower is a tubular steel or tubular steel and concrete tower up to 100 metres high, tapering from around 5 metres at the base to around 3 metres at the top. Exact dimensions would depend on the wind turbine design selected. The tower is constructed in up to five sections, each section bolted together via an internal flange. Within the tower are the power and control cables, and access ladder to the nacelle (with safety climb system).

Lattice towers would not be used as turbine towers in the project.

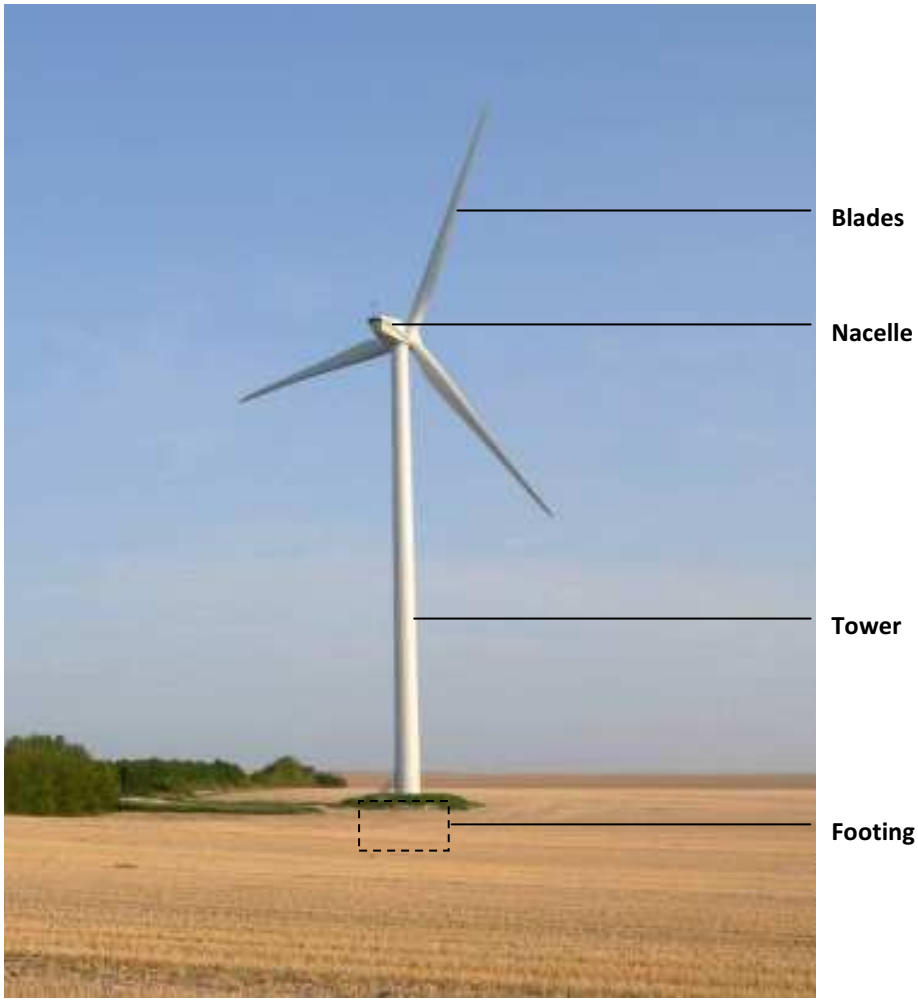


Figure 3-9: Typical wind turbine installed on an 80m tower

(Photo courtesy REPower Systems AG)

Access Tracks, Hardstands and Footings

The tower would be seated in a reinforced concrete footing and would require removal of rock and subsoil at the base of each turbine. Various designs of footing are under consideration, based around a gravity footing (where subsoil geology is less stable) and a rock-bolted footing (where subsoil geology provides good bedrock). A combination of these footing designs may be used on the site depending on the geology at each turbine location.

Each wind turbine would require track access and cabling access to allow construction and connection to each substation. Access tracks would typically be 6 metres wide (wider at bends) and be all weather graded tracks. Hardstand areas required beneath each turbine would be approximately 22m x 40m (900m^2) however are subject to final turbine selection and crane requirements.

Hardstands would be left in situ after construction to provide for ongoing maintenance and repairs if necessary. Access tracks would also be left in situ, however their width would be reduced to approximately 3 metres after construction is completed by covering with topsoil and revegetating.

Transformer

Each wind turbine generator would produce power at typically 690V, and up to 1,000V. This is then transformed at each wind turbine to either 22,000V or 33,000V for reticulation around the site. The transformer for each wind turbine would be located either within the base of the tower, in the nacelle, or adjacent to the tower as a small pad-mount transformer, depending on the specific wind turbine model selected. The transformer would be either a dry-type transformer, or would be suitably bunded.

Lightning protection

Each wind turbine would have a lightning protection system installed. This system includes lightning rods through each wind turbine blade, an earth mat built into the foundations of the wind turbine, and lightning protection around the various electronic components within the wind turbine.

Obstacle lighting

Civil Aviation Safety Authority (CASA) guidelines for aviation warning lighting for a group of wind turbines are currently being reviewed and Advisory Circular 1390-18(0) has been withdrawn by CASA. However, the issue of safety risks to aviation operations must be considered and therefore it is proposed that sufficient wind turbines should have red obstacle beacons to indicate the extent of a group of wind turbines. The (withdrawn) advisory circular defined that interval between turbines and obstacle beacons should not exceed 900m. Accordingly, if it is considered by CASA or an independent consultant that the project is likely to be a hazard to aircraft, it is expected that approximately 50 turbines in the proposed project may require aircraft warning lights. Requirements would be discussed with CASA once the final turbine layout is selected however it is assumed that aviation warning lighting would be required in accordance with CASA guidelines and the therefore the impacts are assessed in this EA.

Wind turbine controls and operation

Each wind turbine would have its own individual control system, and would be fully automated. Start-up and shutdown (including safety shutdowns) are fully automated, with manual interruption available via onsite control systems and remote computer.

Generally, wind turbines would commence operation at wind speeds around 3 – 5 metres per second (11 – 18 kilometres per hour) and gradually increase in production to their maximum capacity, usually at wind speeds around 12 – 15 metres per second (44 – 54 kilometres per hour). Once at this maximum capacity, the wind turbine would control its output by altering the pitch of the wind turbine blades. Under high wind conditions in excess of 25 metres per second (90 kilometres per hour) the wind turbine would automatically shut down to prevent damage. It would continue measuring the wind speeds during this state via an anemometer mounted on the nacelle, and would restart once wind speeds drop to a suitable level.

Various operating constraints can be programmed into the control system to prevent operation under certain conditions. For example, if operational issues are identified such as excess noise or shadow flicker under certain conditions, these conditions can be pre-programmed into the control system and individual wind turbines automatically controlled or shut down whenever these conditions are present.

It should be noted that shadow flicker is not expected to be an issue for this Proposal As shown in the detailed reports the indicative layout proposed complies with all existing guidelines. Furthermore, the Proposal can address these issues within the control system, allowing the adjustment of wind turbine operation modes for unforeseen outcomes.

3.3.2 Wind turbine selection

Background to turbine selection

Wind farms are highly capital-intensive, with around 90% of the long term costs of a wind farm being related to the up-front capital construction and financing costs. Likewise, revenues are directly linked to energy production, which is fixed by the turbine selection and siting carried out in the design phase. For this reason, to keep generation costs down and to ensure the project's financial viability, it is essential that the appropriate wind turbine is selected for a site, and that a competitive tender approach is used to select the final turbine model, thereby minimising the capital costs of the project.

At this stage, the specific wind turbine model and manufacturer has not been selected for this Proposal. Various international wind turbine manufacturers have products suitable for the Australian market and for this Proposal. These include Clipper Wind (US), Vestas (Denmark), RE Power (Germany), Mitsubishi (Japan), Nordex (Germany), Suzlon Energy (India), GE Wind (US), and Siemens (Germany). Improved turbines are progressively coming onto the market; superior models may be available by the time the project receives Project Approval.

While all of the turbines under consideration meet the general description in Section 3.3.1, each wind turbine model is different in its design parameters, and each manufacturer also offers a number of similar wind turbine models which are optimised for different wind speed conditions. Even small changes in wind speeds or minor modifications to turbine locations can impact a turbine's suitability for a site and energy production at a site. Accordingly, the final turbine selection is preferentially carried out under a competitive tendering process, once the conditions of approval are known.

Wind turbines under consideration

Every turbine has slightly different characteristics in terms of site suitability, physical size, energy production, and noise emissions. Further, some manufacturers provide different blade diameters for what is essentially the same machine. For example, REPower provides a nearly identical wind turbine with either 82m or 92m blades (MM82 or MM92 respectively). It is therefore possible to locate a combination of similar machines on the same site to provide the best overall outcome, such as Cullerin Range Wind Farm where both MM82 and MM92 machines are installed.

Table 3-2 shows the wind turbines currently under consideration for the Proposal, together with key parameters of these turbines. In general, different characteristics of turbine models require different turbine layouts, however to simplify the environmental assessment of the Proposal, an indicative layout has been developed that reflects the characteristics of a large range of turbine models.

Final wind turbine selection would be carried out based on commercial considerations within the consent conditions stipulated by the Department of Planning. In particular, a final assessment of potential noise impacts would be undertaken prior to construction based on the final turbine selection and layout. The Proponent would ensure that noise predictions for the final turbine selection and layout meets the SA EPA Guidelines for non-involved houses or the WHO Guidelines for involved houses, as appropriate (refer to Section 7.3).

Table 3-2 Wind turbines under consideration for the Yass Valley Wind Farm Proposal

Turbine supplier	Turbine model	Turbine capacity	Blade diameter	Hub heights	Maximum tip heights[3]
Clipper Wind	C89	2.5 MW	89m	80m	125m
Clipper Wind	C93	2.5 MW	93m	80m	127m
Clipper Wind	C96	2.5 MW	96m	80m	128m
Clipper Wind	C99	2.5 MW	99m	80m	130m
GE Wind	2.5xl	2.5 MW	100m	75m, 85m, 100m	125m – 150m
GE Wind	1.5sl/sle	1.5 MW	77m	80m, 85m, 100m	119m – 139m
GE Wind	1.5xle	1.5 MW	82.5m	80m, 100m	121m – 141m
Mitsubishi	MWT92	2.4 MW	92m	70m	116m
Mitsubishi	MWT95	2.4 MW	95m	80m	126m
Nordex	N90	2.5 MW	90m	80m, 100m	125m – 145m
Nordex	N100	2.5MW	100m	100m	150m
RE Power	MM82	2.0 MW	82m	80m	122m
RE Power	MM92	2.0 MW	92m	80m	127m
RE Power	MM104	3.3 MW	104m	80m	132m
Siemens	SWT83	2.3 MW	82.4m	80m	121m
Siemens	SWT93	2.3 MW	93m	80m	127m
Siemens	SWT101	2.3MW	101m	80m, 100m	130.5m, 150.5m[4]
Siemens	SWT107	3.6MW	107m	80m, 100m	133.5m, 153.5m
Suzlon	S88	2.1 MW	88m	80m	124m
Vestas	V80	2.0 MW	80m	78m	118m

[3] *Because of varying hub diameters for some turbines, the sum of the blade length plus tower height does not exactly equal maximum tip height.*

[4] *The SWT101 and SWT107 if built on a 100m tower would exceed the maximum tip height proposed (150m). Therefore should this turbine be selected it would be configured to achieve the maximum tip height of 150m.*

Turbine supplier	Turbine model	Turbine capacity	Blade diameter	Hub heights	Maximum tip heights[3]
Vestas	V82	1.65 MW	82m	78m	119m
Vestas	V90	1.8 MW	90m	80m	125m
Vestas	V90	3.0 MW	90m	80m	119m – 129m
Vestas	V112	3.0 MW	112m	84m, 94m	140m - 150m

Selection of 'representative' versus 'worst case impact' wind turbines

The majority of issues identified with respect to this proposed development are not impacted by specific turbine selection. For example, the assessment of biodiversity and archaeology constraints is based on a development envelope, that is, the entire geographic area where infrastructure may be located. This approach allows ecological and archaeological constraints to be defined within the development envelope and as a consequence allows for design responsiveness including minor relocation of infrastructure within the development envelope, without further assessment. However, the final turbine selection could have a material impact on some issues, and in these cases the decision as to whether to present a representative or worst case turbine must be considered.

The wind turbine layout design is based on a REPower MM92 turbine.

The REPower MM92 is a mid range turbine, known to be suitable for the site. If a larger physical turbine is selected, fewer turbines are likely to be installed in each precinct, a consequence of the requirement for larger separation distances between turbines. In this scenario, some associated impacts may be reduced (such as visual impacts). Conversely, a layout using the smallest turbine option would represent the worst-case scenario in terms of the number of turbines able to be developed but may overstate other impacts. Use of the REPower MM92 is therefore considered a likely and representative turbine for the purposes of assessment.

The energy production and greenhouse calculations are based on an indicative 2.5MW turbine,

A turbine with a name plate rating of 2.5MW sits in the middle of the range of turbines under consideration and is a likely turbine size to be ultimately selected. It is therefore considered representative of the energy production and greenhouse abatement benefits from the Proposal.

Impact area calculations, visual and noise propagation modelling

This Environmental Assessment and the related specialist studies consider impacts based on turbines that provide the worst case impacts and in some cases representative impacts as well.

The approach taken is to present the worst case impact assessment for specialist studies where physical dimensions and technical characteristics of turbines are related to the extent of the potential impact.

Examples of this are visual impacts and noise propagation. However, the most likely turbines to be ultimately selected for the project are not the largest and sit in the middle of the turbine size range (physical size and generation capacity). Therefore in this context, the Environmental Assessment also considers and presents the indicative or likely impacts.

Turbines providing the worst case impacts have been used for preparation of Photomontages, Zone of Visual Influence, and Shadow Flicker analysis for the Visual Impact analysis.

The photomontages, Zone of Visual Influence, and Shadow Flicker analysis are prepared using the GE 2.5xl, which is a turbine with a 100m blade diameter on a 100m hub height. This is the largest physical turbine with the highest hub height and maximum tip height proposed.

In some cases, the worst case presents an unrealistic portrayal of impacts when compared to the most likely turbines to be selected for the project. Therefore, in some areas, the Environmental Assessment also considers and presents the indicative or likely impacts for comparison. Noting that the layout would require review and likely removal of a number of turbines to accommodate the physically largest turbine, this assessment would overstate the visual impacts. One photomontage was prepared using the likely and indicative turbine sizing of an 85m hub height with a 100m blade diameter (tip height of 135m) to present the likely and representative scenario.

The noise assessment was conducted using the Vestas V90 3.0MW (the worst case scenario) and the REpower MM92 evolution (the representative scenario). The assessment considers an 80m hub height and a 100m hub height to reflect the worst case physical dimensions of turbines under consideration

The noise assessment presents the modelling of the REPower MM92 turbine as a likely and representative impact from the proposal, and the Vestas V90 as the worst case impact for the proposal. The MM92 presents the representative impacts as it has noise characteristics typical of modern wind turbines and therefore offers a good approximation of the likely noise impacts of the proposal. The physical and noise characteristics of these turbines are considered to be indicative of the wind turbines available. The V90 presents worst case impacts as it has noise characteristics higher than any other turbine considered for this proposal. The analysis demonstrates that it is possible to achieve the noise limits set by the SA EPA guidelines and WHO guidelines using the MM92 as the likely and representative turbine.

The indicative layout, as presented in this EA, has been formulated to allow design responsiveness to achieve the noise criteria in relation to the final selected turbines specific noise characteristics. Accordingly by contemplating that turbines can be relocated within a reasonable distance of their proposed location or removed to achieve the SA EPA Guidelines, a single flexible indicative layout can be presented and assessed. Additional analysis of the sensitivity of the physical dimensions (hub height and maximum tip height) on noise propagation and a worst case scenario, requiring mitigation, is presented in the noise assessment.

The approach undertaken simplifies the noise assessment process by avoiding a different layout for each proposed turbine. The Statement of Commitments affirms that modelling of the final turbine on the final layout would be undertaken and measures would be taken to ensure compliance with the SA guidelines.

3.3.3 Wind turbine layouts

Preparation of wind turbine layouts

The Proponent has prepared an indicative wind farm layout for both of the precincts, Coppabella Hills, and Marilba Hills, which identify 86 and 66 indicative wind turbine locations respectively (refer to grid co-ordinates, Attachment 2). These layouts reflect the typical spacing required for wind turbines under consideration.

To prepare this layout, key parameters and constraints were considered for each precinct, including:

- A Precinct boundary.
- Aerial photography of the precinct (for production of vegetation and roughness maps).
- High resolution topography of the precinct (5m contours).
- Wind speed data collected at each precinct (2 separate monitoring masts).
- Location of residences in the vicinity.
- Results of background noise assessment including proposed noise limits at residences.
- Information on general constraints within each precinct (including biodiversity and heritage constraints, boundary and residence proximity constraints).
- Information on communications constraints caused by the location of the communication tower in the Marilba Hills Precinct and related microwave/UHF links
- Operating parameters of selected representative wind turbines

An optimised wind turbine layout was then prepared that could accommodate the turbines under consideration using a variety of specialised software packages including WaSP and Windfarmer™, as follows:

- Preparation of wind speed correlation at the 2 monitoring mast locations (comparison of measure period with long term Bureau of Meteorology wind monitoring sites) to determine likely long-term wind speed characteristics at the monitoring locations
- Preparation of a wind speed profile across the precincts based on this long term wind speed and the site physical parameters (topography, vegetation)
- Optimisation of wind turbine location based on this wind speed profile to maximise wind energy production while meeting all constraints (including biodiversity, heritage, noise limits on neighbouring residences, EMF interference, and proximity constraints)
- Calculation of likely long term average wind energy production at each turbine

Turbine layout optimisation was carried out using the REPower MM92 turbine which is representative of turbines under consideration as discussed in Section 3.3.2. Adjustments to the optimised layout were then carried out to take into consideration site constraints, access and related issues.

The indicative turbine layout has undergone a preliminary review to determine if the layout is reasonably suitable for construction and would comply with expected consent conditions. However, minor relocation of specific turbines may be required prior to construction to take into account a number of factors including:

- Final turbine selection.

- Final wind speed and energy yield analysis.
- Additional site constraints identified through ongoing investigations.
- Constraints identified in relation to constructability or construction cost minimisation.
- Constraints identified in relation to turbine suitability assessment of the site.
- Constraints identified after the results of final geotechnical investigations at each turbine location are completed.

Depending on final turbine selection, it is possible that not all turbines proposed would be installed to ensure that the project continues to meet all consent conditions (e.g. noise constraints).

To that end, a final layout would be prepared after final turbine selection has taken place and prior to construction. This final layout would be adjusted to ensure all criteria (including noise criteria) are achieved.

Figure 3-10 Indicative turbine layout Coppabella Hills Precinct, western section

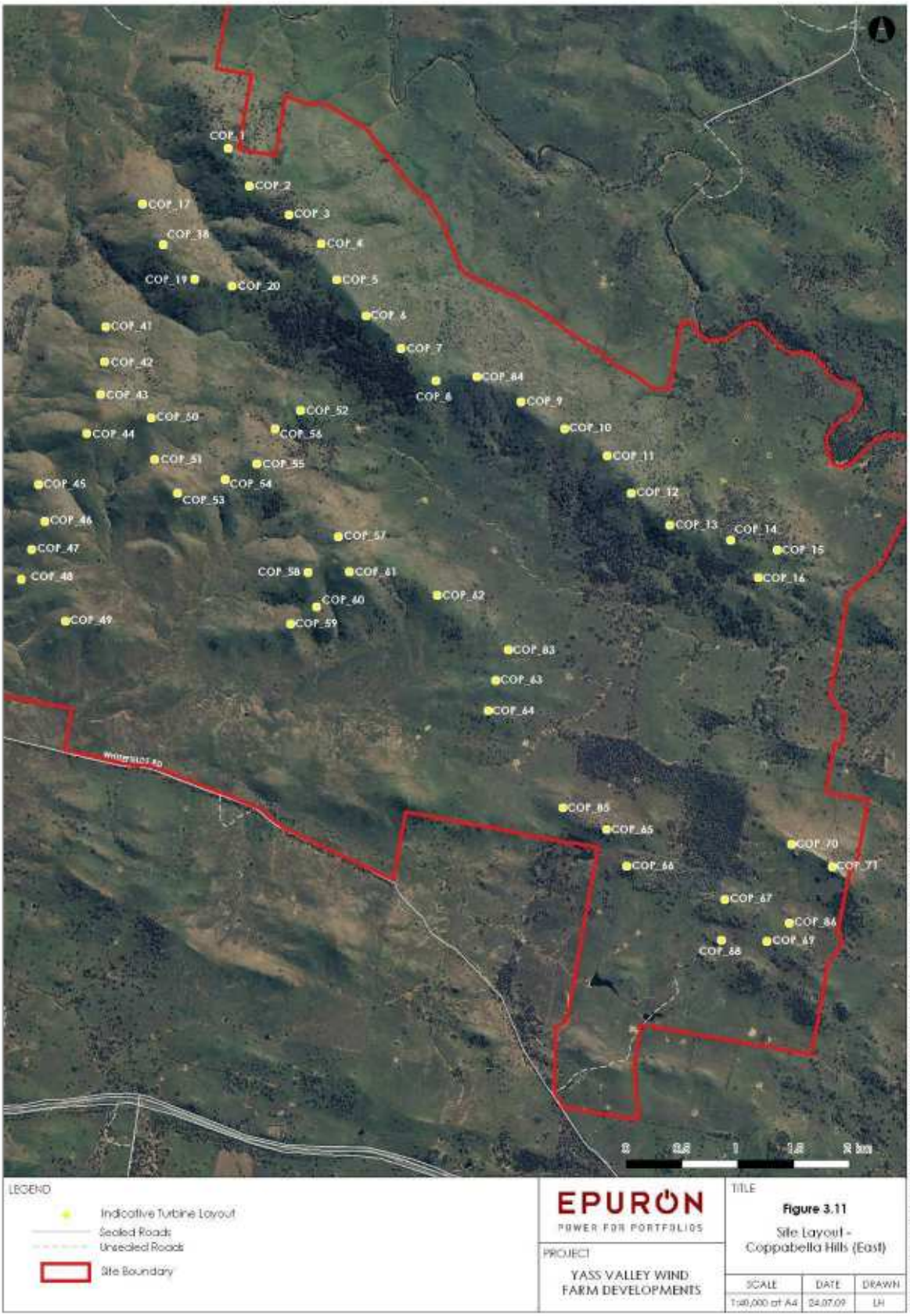


Figure 3-10: Indicative turbine layout Coppabella Hills Precinct, eastern section

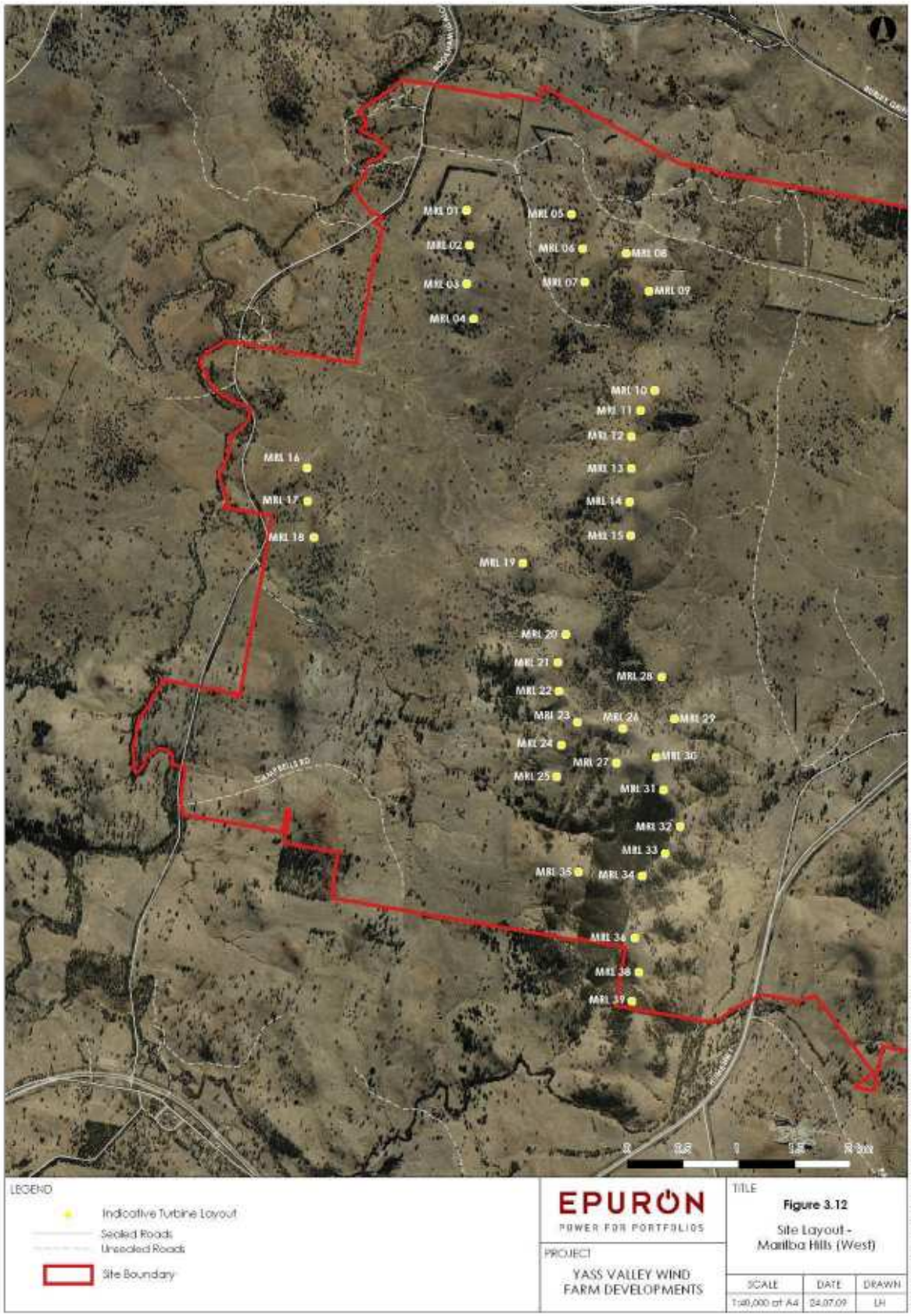


Figure 3-11: Indicative turbine layout Marilba Hills Precinct, western section

Figure 3-12: Indicative turbine layout Marilba Hills Precinct, western section

3.3.4 Electrical connections and substation

Introduction

To export power from the wind farm, it is necessary to electrically connect each wind turbine to the NSW electricity grid. Both precincts would require individual connection to the transmission network, and as a result the two precincts would be individually viable projects if necessary. The onsite electrical works at each precinct would include:

- A substation to step the voltage up from reticulation voltage to transmission voltage of 132kV, suitable for connection to the existing TransGrid's 132kV transmission network connecting Wagga and Yass. This network consists of two separate transmission lines, which pass through different sections of the two precincts.
- Onsite power reticulation cabling (underground and overhead) at either 22,000V (22kV) or 33,000V (33kV) to connect wind turbines to the control room and site substation
- Onsite control and communications cabling
- An onsite control building housing control and communications equipment

Onsite electrical reticulation

Within each wind turbine, or in the adjacent pad-mount transformer, the power voltage is stepped up from generation voltage to either 22kV or 33kV for reticulation around the precincts.

Each wind turbine must be connected together at reticulation voltage, and then connected to the precinct substation. These connections are to be made using a combination of underground and overhead cabling.

In general, overhead cabling offers benefits as it minimises ground disturbance and is lower cost, however, there are practical limitations installing overhead cabling on ridges where turbines are present. Therefore it is typical to use underground cabling to connect turbines on ridgelines, and use overhead cabling to transport power from clusters of turbines back to the substation.

Cable trenches would, where reasonable, be dug within or adjacent to the onsite roads to minimise any related ground disturbance. Short spur connections would come off a main cable run which would approximately follow the main road access route at each precinct. Underground cables would require a trench of approximately 1 – 1.5 metres deep and 0.5 – 1 metre wide.

All of the potential options for power reticulation have been assessed. Statements of Commitment accompany this proposal to ensure that micro-siting to minimise environmental impacts (particularly biodiversity impacts) would be undertaken with the assistance of an ecologist, where routes are located near sensitive environmental features.

Site substation and transmission connection

A number of substations are required at each precinct to convert power from on-site reticulation voltage of 22kV or 33kV to a transmission voltage of 132kV suitable to connect into TransGrid's transmission network. The exact number and configuration would depend on the results of detailed electrical connection studies and network connection agreements. It would also include all necessary ancillary equipment such as control room and amenities, control cubicles, voltage and current transformers, and circuit breakers for control and protection of the substation.

It is likely that each of the three precincts would require separate substations and control room buildings.

At each precinct, the substation area would be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. The ground would be covered partly by crushed rock and partly by concrete pads for equipment, walkways and cable covers, and would have an earth grid extending outside of the boundary of the security fence. The substation would be built to a specification suitable to TransGrid.

Figure 3-13: Cullerin Range Wind Farm 132/33kV substation

The proposed locations for the substations would be within each precinct and generally adjacent to the existing TransGrid transmission line. Typically a 132kV substation would take up an area of up to 100m x 100m surrounded by a security fence.

Substations could be located in the areas indicated in Figure 3-14. These locations have been selected based on the indicative wind turbine layout. Final locations would be selected to minimise environmental disturbance, reduce cabling lengths and therefore reduce costs and environmental impacts, reduce visual impacts and ground disturbance of the Proposal. In general, substations are located in flatter areas.

The potential to establish a bushfire Asset Protection Zone (APZ) that complies with the RFS *Planning for Bushfire Protection* guidelines has been evaluated based on the vegetation type and slope. The site parameters (predominantly flat land with limited continuous canopy cover) indicate that a compliant inner protection area (which can be maintained under continued grazing practices) and outer protection area would be achievable.

Each substation would include up to two large power transformers. The transformers are likely to be of the oil-cooled variety, and therefore may contain considerable quantities of oil. Provision would be made

in the design of each substation for containment of any oil which may leak or spill. Other equipment in the substation includes circuit breakers and a 132kV busbar.

It is likely that alterations would be required to the existing transmission line to allow connection of the new cabling. This may include the construction of new power poles at the connection point to direct the conductors to the proposed substation. A separate lower voltage supply would also be required to provide backup power to the substation.

3.3.5 Control and maintenance facilities

A control building would be built next to each substation to house instrumentation, control equipment and communications equipment. This building would also house routine maintenance stores, equipment, a small work area, and amenities for staff.

The control building is expected to be of concrete slab on ground construction with steel frame, metal or brick walls, a non-reflective sheet steel (colourbond) roof, and would include rainwater collection and storage for domestic use. A composting or septic toilet system would be installed for staff use. It is likely that the control building would be air-conditioned. The internal layout of the control building would be finalised after the Grid Connection Agreement has been completed with TransGrid. Parking would be provided adjacent to the building. Figure 3-25 presents an indicative control building.

Communications to the control building would be required to allow remote monitoring and control of the wind farm. This connection could consist of multiple buried telephone lines, broadband cable, microwave or a satellite connection. It is possible that a microwave link may be required by TransGrid for substation control, in this event this would be subject to a license application to the Australian Communications and Media Authority.

Standard 240 Volt / 415 Volt power would be installed at the control building.

The control building would be located adjacent to the substation, and is expected to be a joint facility for control of the substation as well as the wind farm (refer to Figure 3-14 to Figure 3-15) and would also encompass storage of maintenance components.

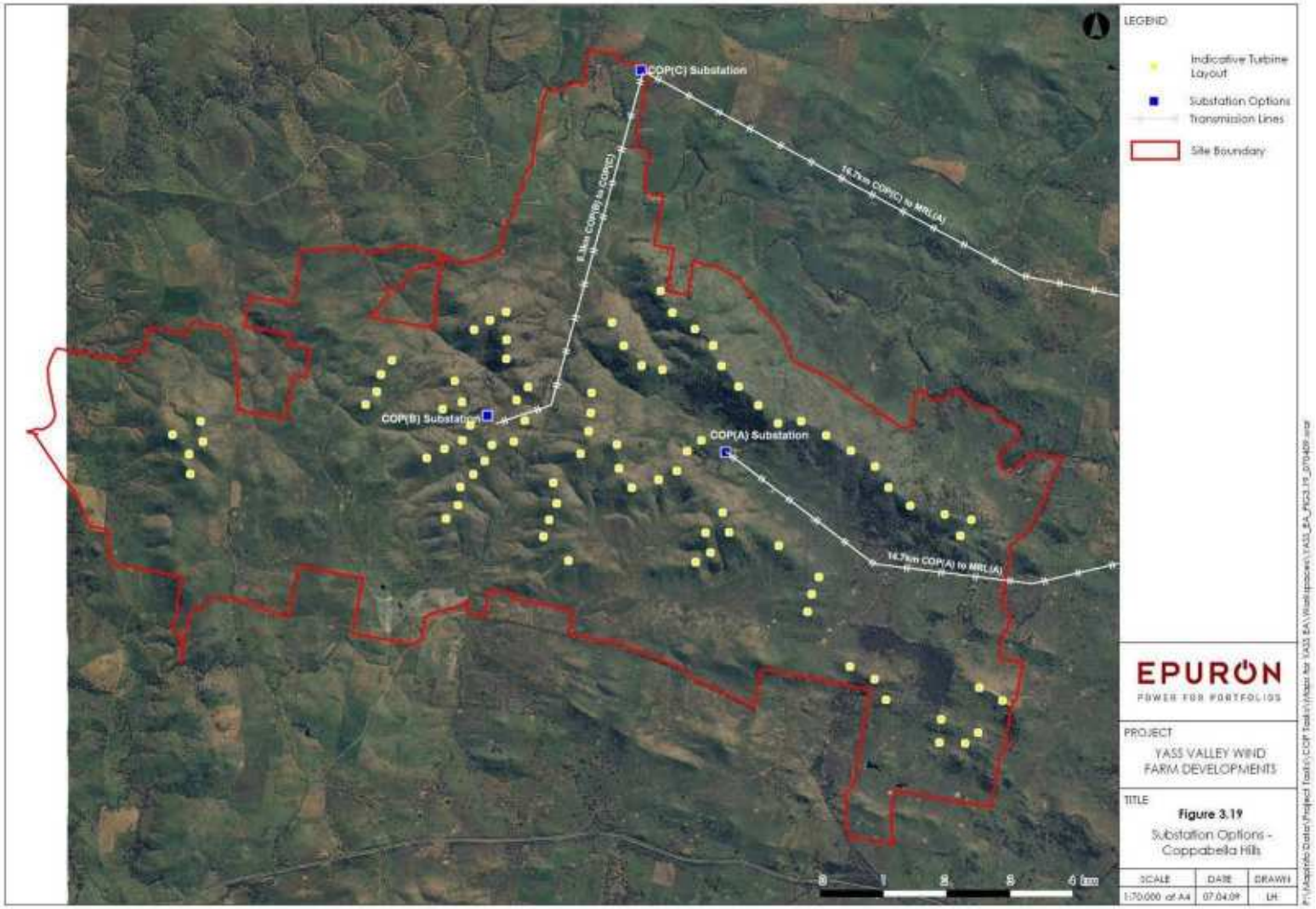


Figure 3-14: Substation and control building locations - Coppabella Hills Precinct

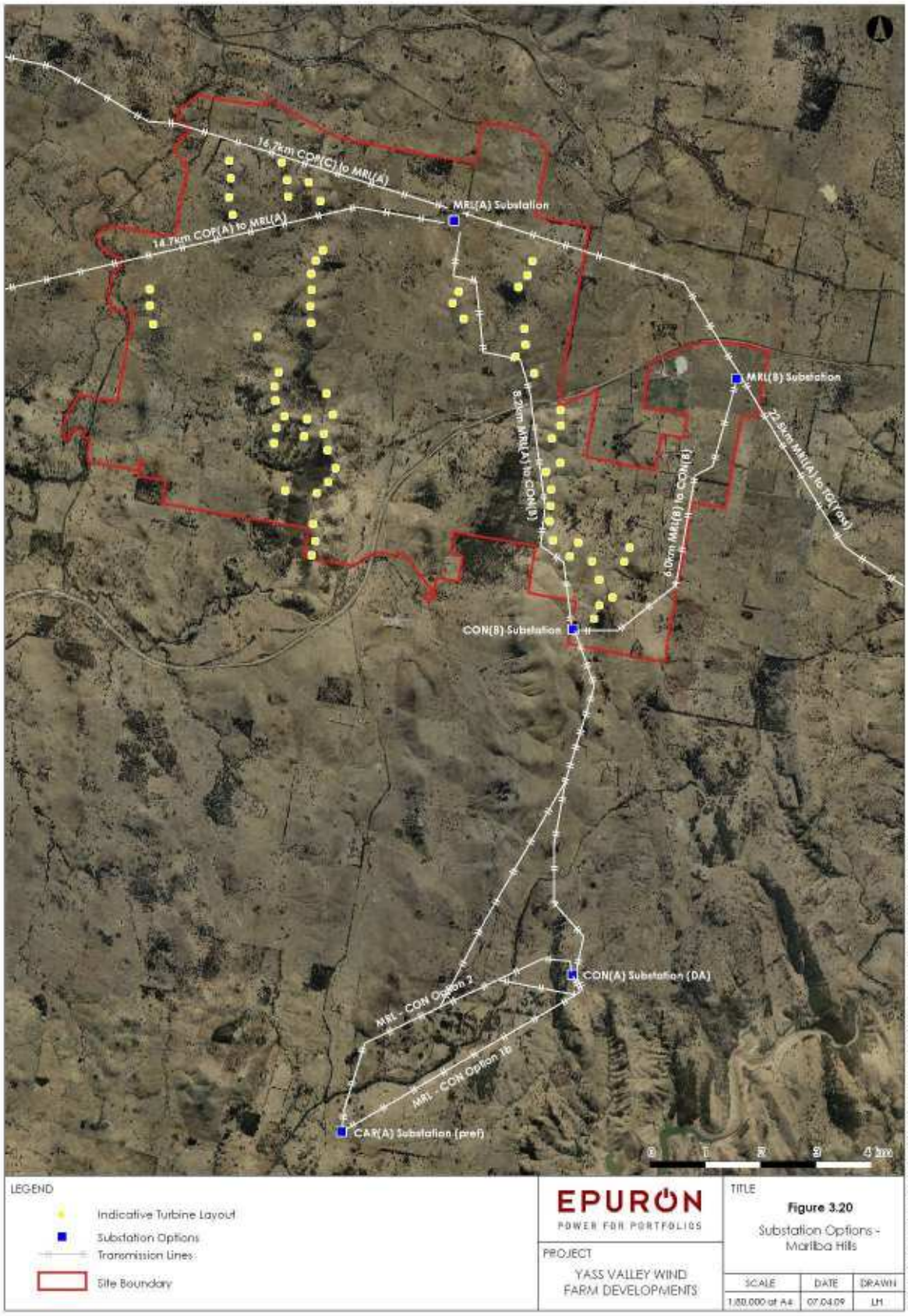


Figure 3-15: Substation and control building locations - Marilba Hills Precinct

Control cabling

In addition to the power reticulation cabling, control and communications cabling is required from the control building to each wind turbine, and to the substation. This control cabling would be installed using the same method and route as the power cabling described above, that is, strung from the same poles as overhead lines, or dug in the same cable trench as underground cables.

Control cables would consist of twisted pair cables, multi-core cables or optical fibres and would be used for central and remote control of individual wind turbines, substation controls, monitoring of weather data and equipment, and communications to offsite control centres where required.

Interaction with TransGrid

The Proponent has submitted a Grid Connection Application, and seeks to finalise a Grid Connection Agreement with TransGrid on the basis of the proposed connection arrangements and in accordance with the National Electricity Code. This Grid Connection Agreement would include all technical requirements for safe connection of the wind farm to the NSW electricity grid.

Relevant stakeholders including TransGrid and NEMMCO would be consulted in preparation of the related Grid Connection Application.

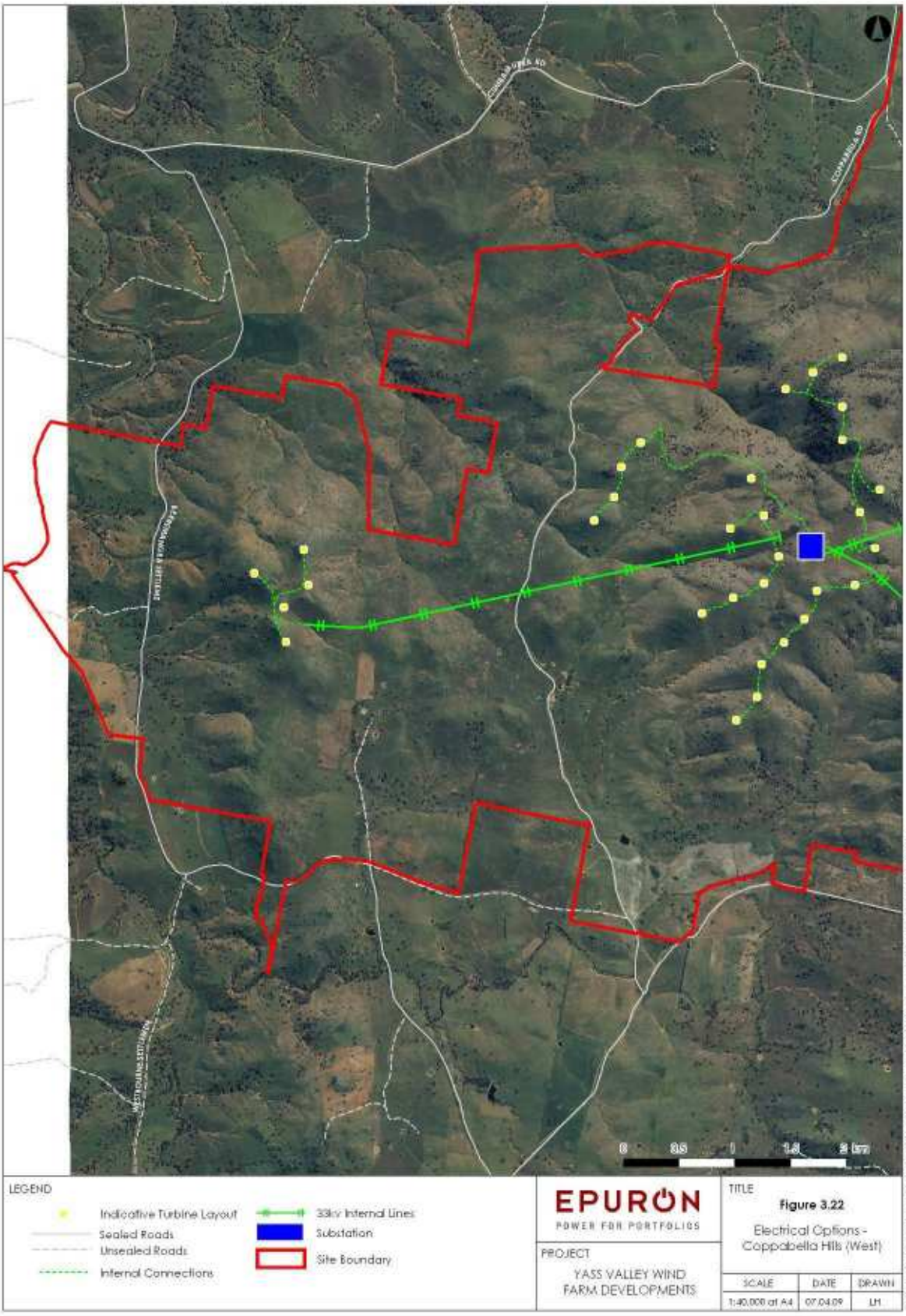


Figure 3-16: Indicative Electrical reticulation layout – Coppabella Hills Precinct western section

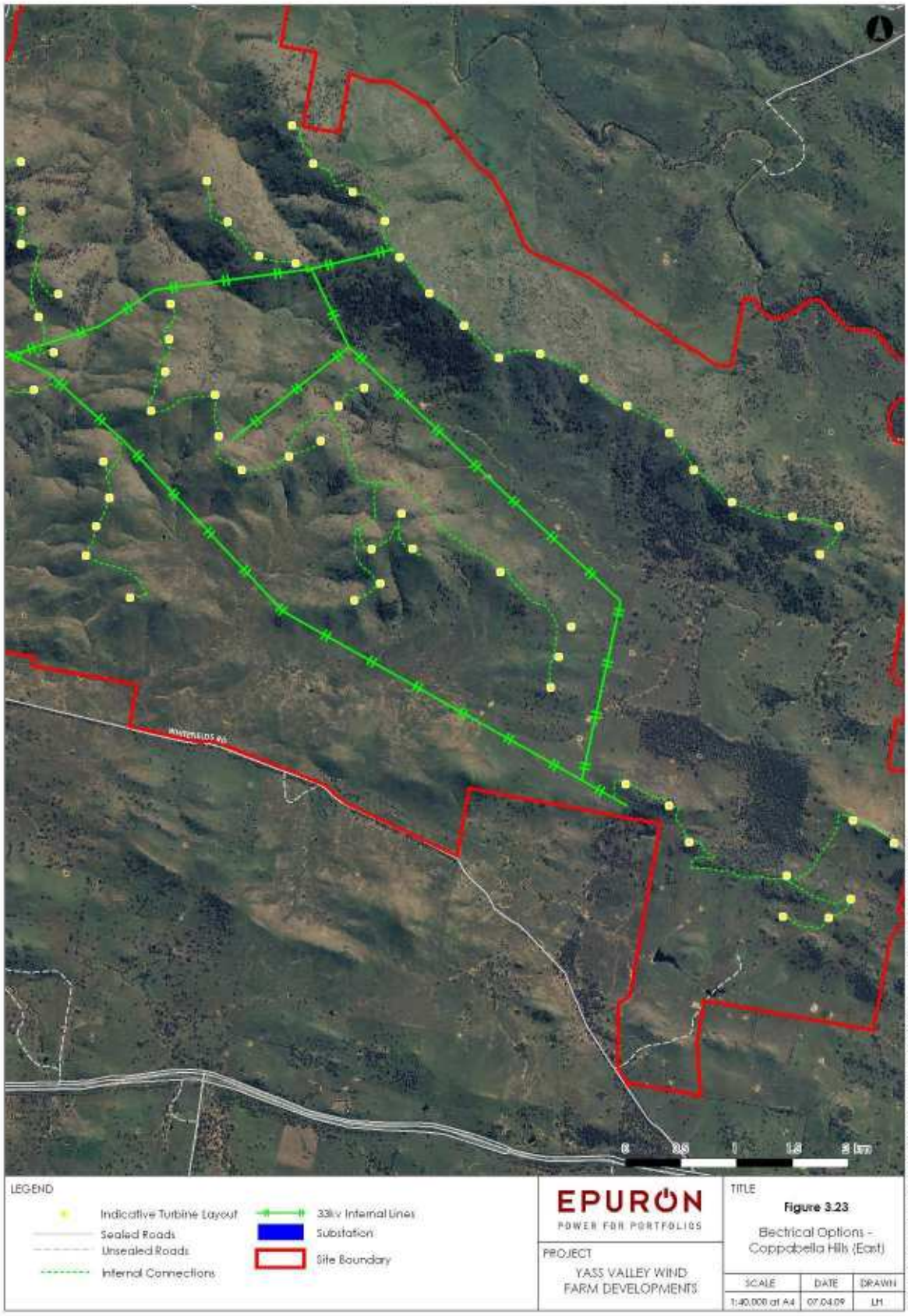


Figure 3-17: Indicative electrical reticulation layout – Coppabella Hills Precinct eastern section

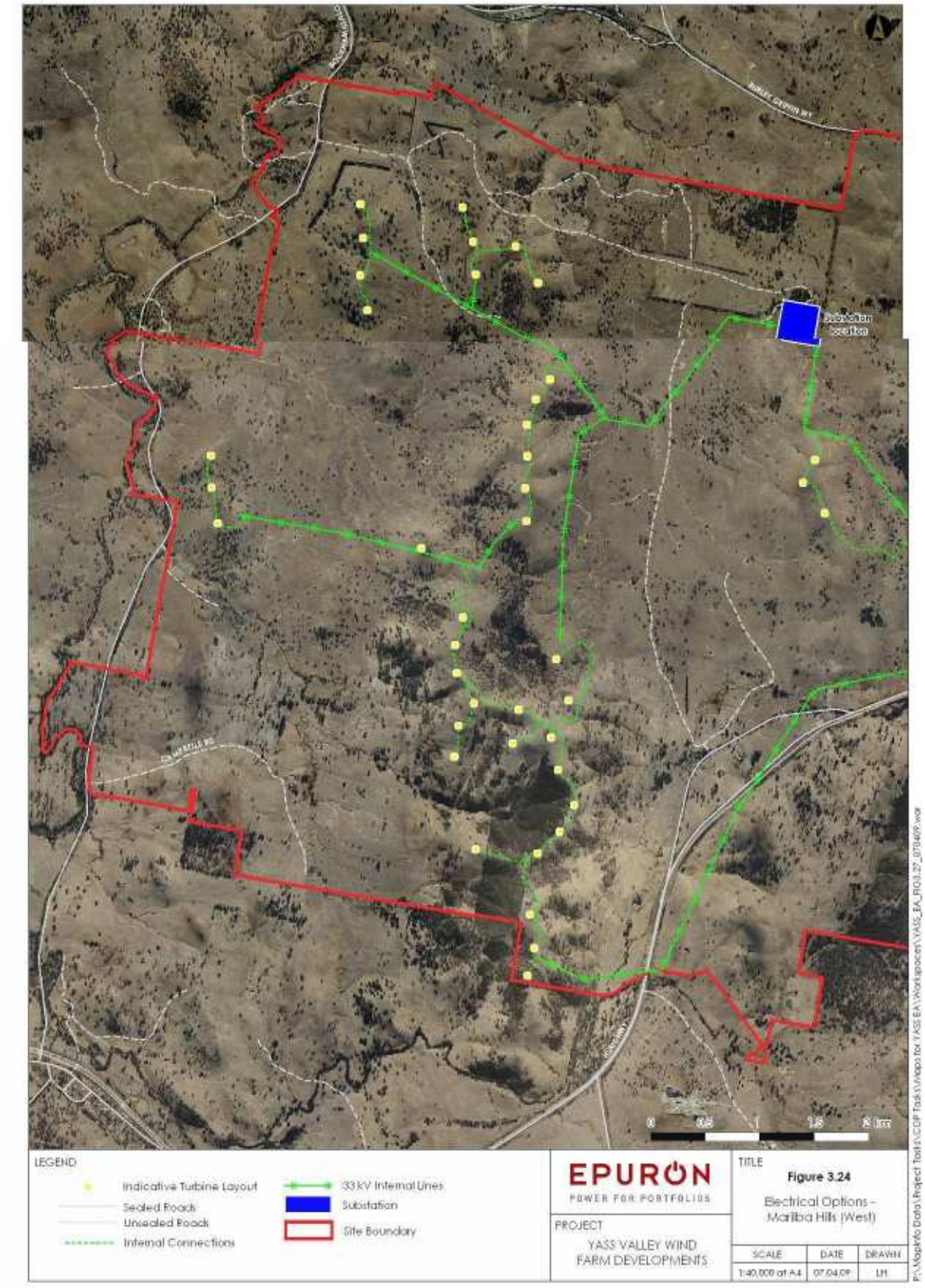


Figure 3-18: Indicative electrical reticulation layout – Marilba Hills Precinct western section

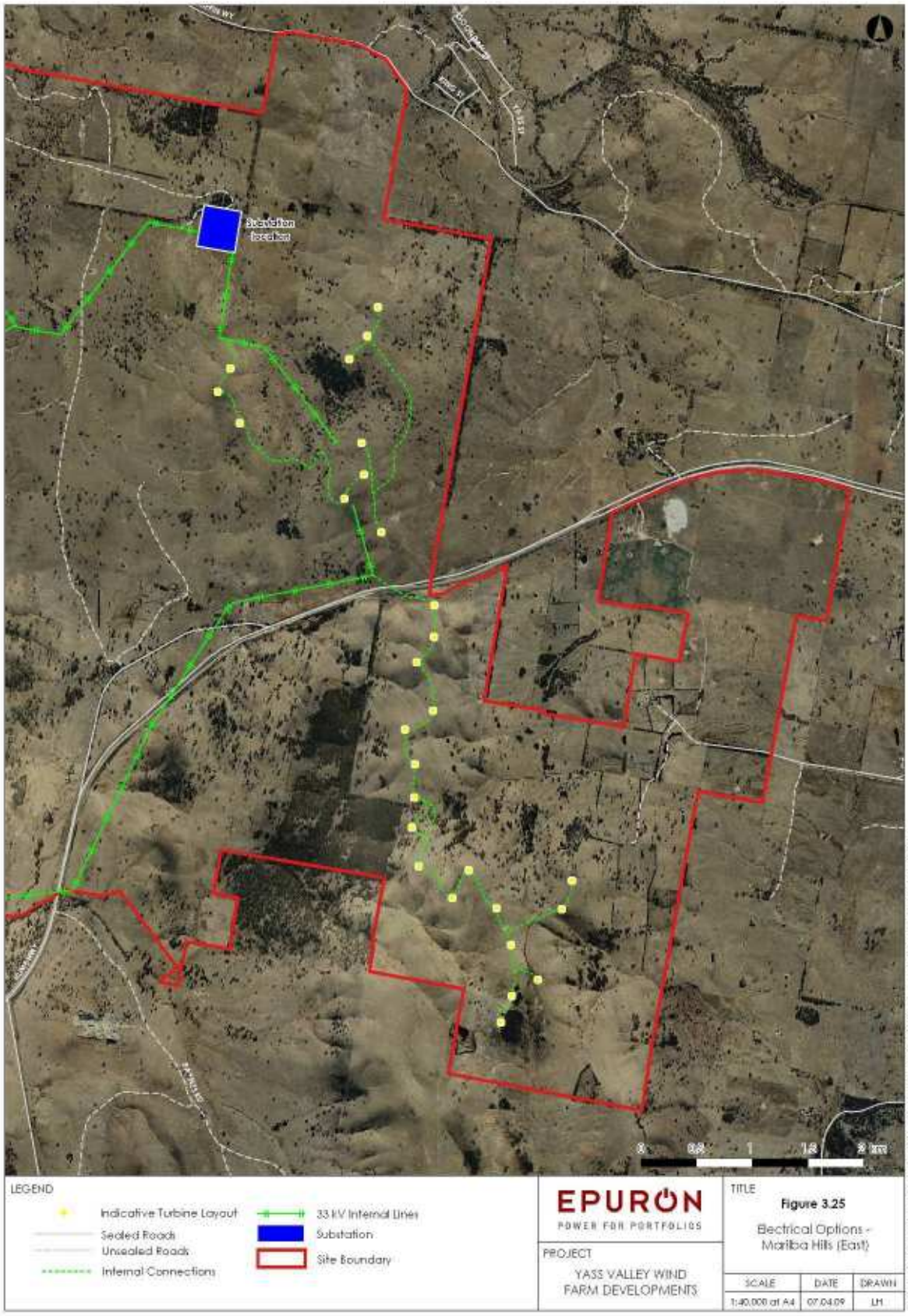


Figure 3-19: Indicative electrical reticulation layout – Marilba Hills Precinct eastern section

3.3.6 Site civil works, roads, and access

Access route

Access to both of the precincts would generally be via the Hume Highway, a high speed four lane dual carriageway road with a high standard of access at all of the major junctions. The Hume Highway provides access to within 10 kilometres of each precinct. Regional and locally maintained roads would be used to connect the Hume Highway to the sites.

The main access points being considered for the Coppabella Hills Precinct are from Whitefields Road to the south and Berramangra Road to the west. Both of these roads are under local control. These roads carry very small traffic numbers as they serve as access for residents.

Access points under consideration for the eastern section of Marilba Hills are from the Hume Highway, via the truck rest areas on either side of Conroy's Gap. Access to the western section would mainly be from the Marilba Station property access road, along with access from the northern section of Illalong Road off Burley Griffin Way.

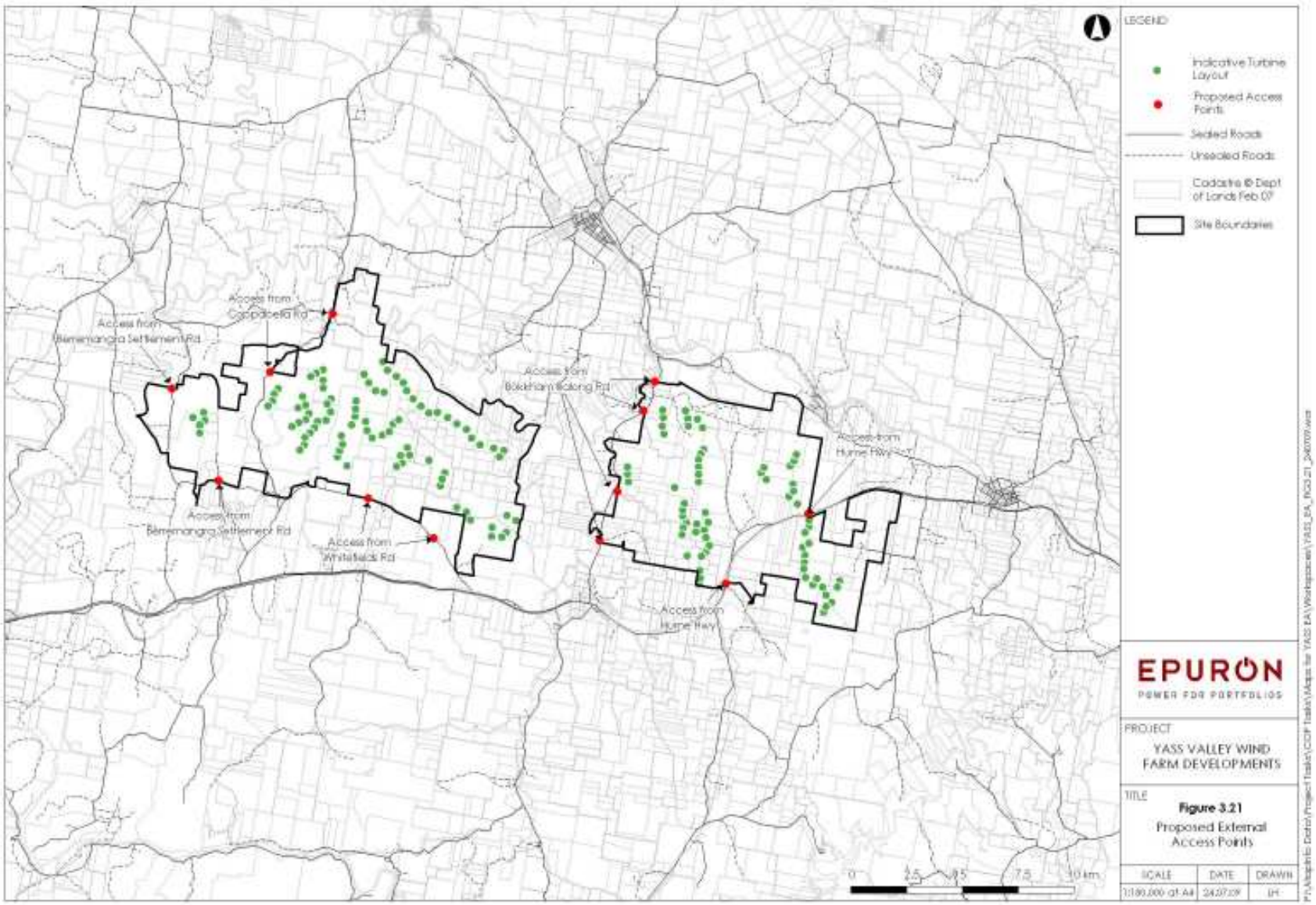


Figure 3-20: Proposed external access

Proposed external access points shown in red

Vehicle management

Every effort would be made to ensure vehicles:

- Are minimised in size, length, and number.
- Travel with appropriate regard to other road users.
- Travel at times which minimise traffic noise impacts to surrounding residents.

During construction, light vehicles would generally operate within 1 hour of the normal construction hours. However, the delivery of turbines via oversize vehicles may occur at night, outside normal construction hours, in order to ensure safe passage during low traffic conditions.

Traffic management is discussed in more detail in Section 7.10. A Traffic Management Plan (TMP) would be prepared to properly manage traffic impacts in accordance with Section 7.10. It would be developed in consultation with the roads authorities to ensure that the measures are adequate to address potential safety and asset degradation impacts.

Access tracks

On site access tracks required for construction and operation would be unsealed formations up to 8m in width or up to 12m in width where passing lanes are required. Tracks are required to the base of each wind turbine location and the location of each site substation and control building.

At each wind turbine base, a firm hardstand area would be required to provide a level and stable base for cranes necessary for construction (approximately 22m x 40m; 900m^2 in area). New gates and possibly new or realigned fences may also be required to protect stock during the construction phase.

Once the construction phase has finished, any tracks not used for normal farming practice or turbine maintenance would be rehabilitated to a width of 3 metres, suitable for use by standard 4WD vehicles. Both hardstand and access tracks would be maintained to allow maintenance and repairs to the wind turbines.

In locating access tracks on site, every effort would be made to:

- Minimise the number and length of necessary access tracks
- Locate access tracks along the route of existing farm tracks
- Locate access tracks to minimise clearing of native vegetation
- Locate access tracks to minimise impact on sensitive biodiversity or heritage areas
- Construct access tracks with due regard to erosion, sediment control and drainage

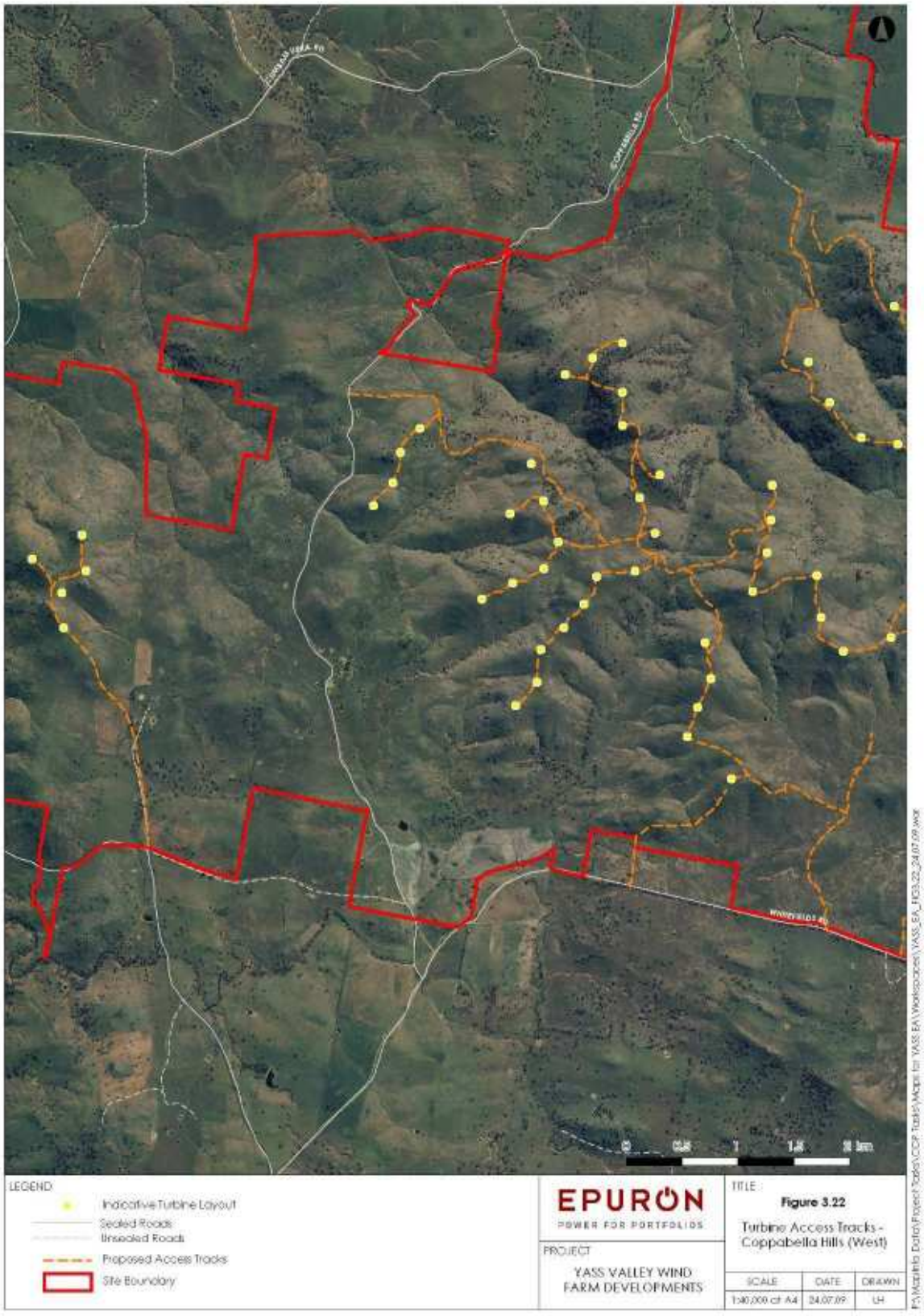


Figure 3-21: Shows an indicative track layout based on the current turbine layout and preliminary design principles.

This figure shows proposed existing tracks (some requiring upgrade) in white and proposed access tracks in orange.

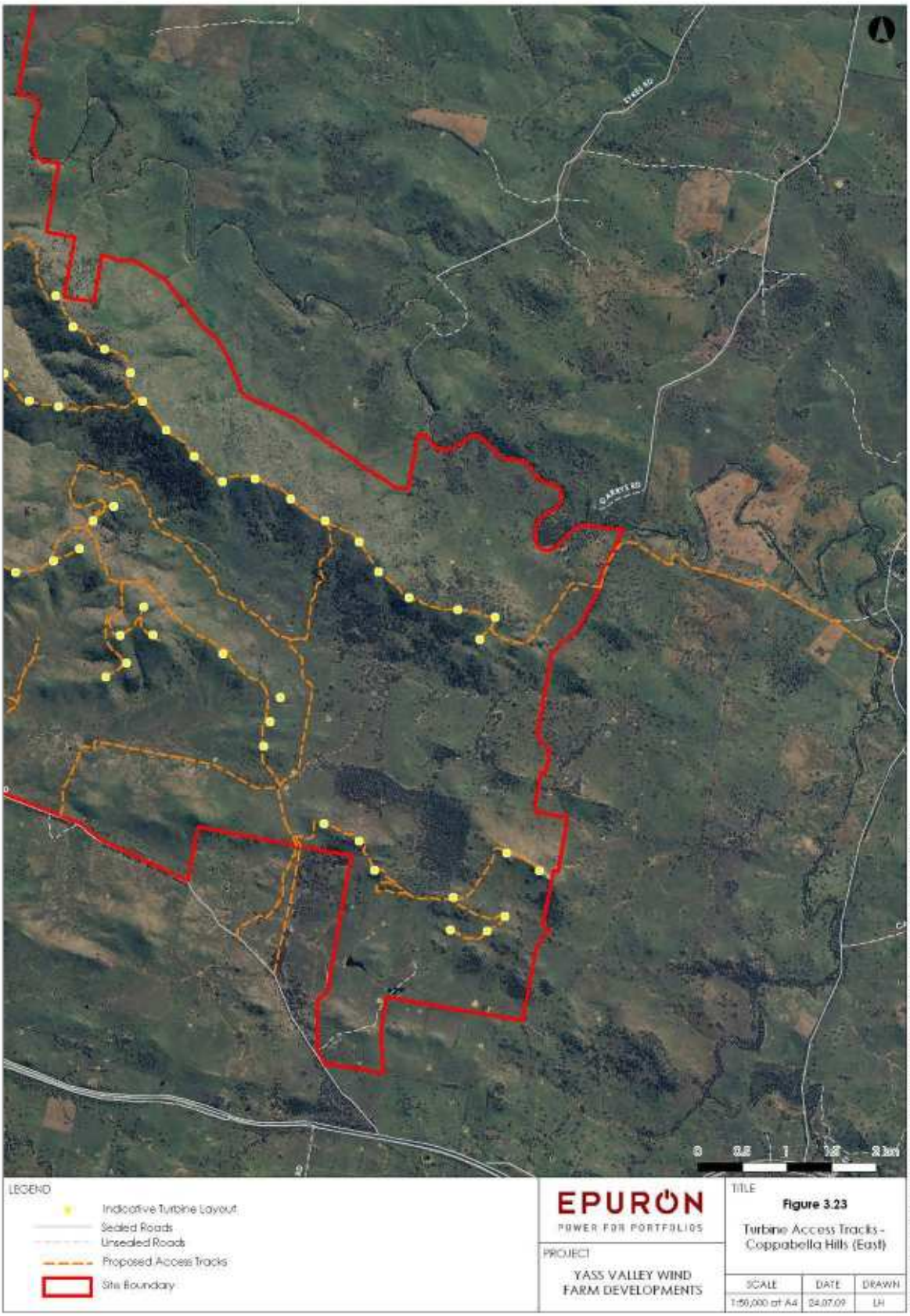


Figure 3-22: Indicative site access tracks, Coppabella Hills Precinct eastern section

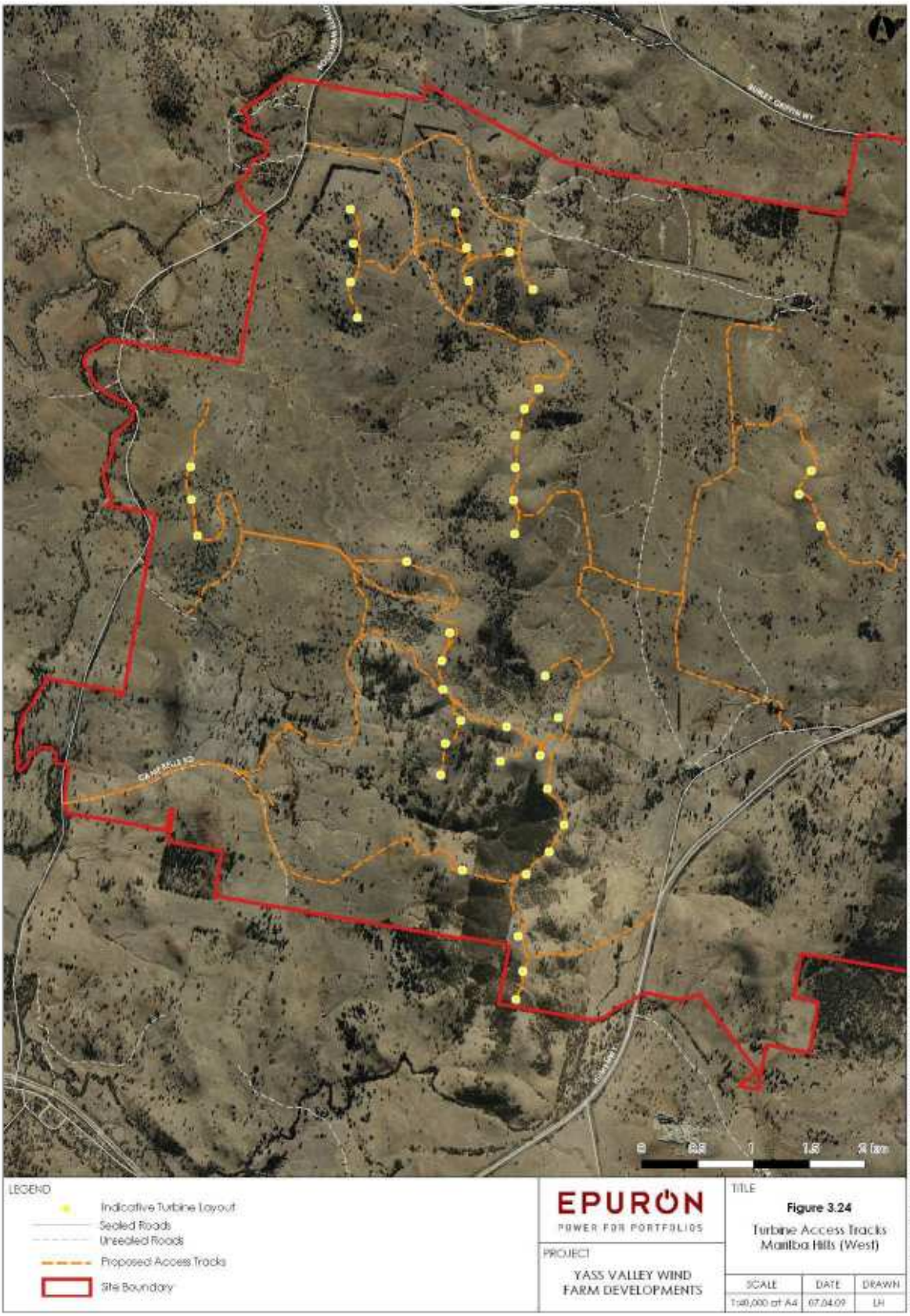


Figure 3-23: Indicative site access tracks, Marilba Hills Precinct western section

Figure 3-24: Indicative site access tracks, Marilba Hills Precinct eastern section

3.3.7 Wind monitoring equipment

The Proponent is currently maintaining a number of wind monitoring masts across each precinct to assess wind speeds at proposed turbine locations. Following construction, permanent wind monitoring masts would be required to assist the control and operation of the wind farm. These would be static guyed towers with remotely operated wind monitoring equipment installed at multiple heights on each mast.

Pending final wind turbine placements, it may be necessary to maintain the existing wind monitoring masts, move the existing wind monitoring masts to different locations within each precinct, replace the wind monitoring mast with a shorter or taller wind monitoring masts, or install additional wind monitoring masts to assist with control and operation of the proposed development.

These masts would be located within the development envelope assessed in the various studies reported in this document. Approvals for the construction of these masts are not required. The proponent would inform CASA and the Department of Defence of the location of any monitoring masts constructed.

Figure 3-25: Indicative control building

3.3.8 Other site services

Temporary power (11kV) would be required for the construction phase. In addition, a permanent power supply (11kV) would be required for each substation to allow backup supplies to each substation in the event of an outage on the main 132kV transmission line. The 11kV lines are typically the same sized distribution lines that provide domestic power supply to houses in the area of the site.

Operating staff would be responsible for removal of all other wastes generated from the wind farm; no waste management services would be required.

Site Office

During the construction phase up to 100 staff would be working on site at any time. A suitable location for the site office would be selected at each of the precincts, avoiding areas that are regarded as having environmental constraints. The site office may include several demountable buildings, and an amenities block located on site for the duration of construction. Sufficient parking would be provided for the expected usage.

3.4 MODIFICATIONS TO INFRASTRUCTURE LAYOUT

The infrastructure layout presented in this Proposal has undergone assessment to determine that the layout is reasonably suitable for construction and would comply with likely environmental constraints and consent conditions. Minor relocation of equipment may be required prior to construction however, as a result of a number of factors including:

- Final turbine selection.
- Final wind speed and energy yield analysis.

- Additional environmental constraints identified through any ongoing investigations.
- Constraints identified in relation to constructability or cost minimisation.
- Constraints identified in relation to turbine suitability assessment.
- Constraints identified after the results of final engineering and geotechnical investigations are completed.

It is recognized that in accordance with Section 75W the *Environmental Planning and Assessment Act 1979* equipment relocation is permissible if such relocation is broadly consistent with the Proposal as outlined and approved, otherwise an application for modification of the Development Consent would be required.

In a recent NSW Land and Environment Court ruling (Taralga Landscape Guardians v. Minister for Planning NSWLEC 2007) the Court found in relation to relocation of wind turbines in that circumstance:

"… that a 250 m relocation of any of the elements is not unreasonable."

While this finding could be perceived to be site specific, it accepts the principle in relation to equipment relocation and provides some guidance as to acceptable relocation distances.

The Proponent considers that in relation to this Proposal, acceptable minor equipment relocation of wind turbines and other equipment of up to 250m would have negligible effect on visual impacts of the Proposal and is broadly consistent with the Proposal. In relation to noise impacts, relocation of wind turbines and other equipment is broadly consistent with the Proposal where the principle acceptability limit criteria outlined in the South Australia EPA Noise Guidelines for Wind Farms (February 2003) is achieved at neighbouring (non-involved) residences as outlined in Section 7.3.

Relocation of any equipment in a way which does not notably increase impacts to native vegetation, biodiversity, indigenous heritage or non-indigenous heritage (considered as a whole) is broadly consistent with the Proposal and this would be managed in accordance with the Statements of Commitment.

Any relocation required during the construction phase would be only undertaken within the defined development envelope and in consideration of any constraints identified within each of the specialist studies.

3.5 STAGING OF WORKS

The works establishment of the wind farm can be considered as occurring in four phases. These include construction, operation, refurbishment and decommissioning of the wind farm. A description of activities under these headings follows.

3.5.1 Phase 1: Wind farm construction

Before project approval has been received, it is not possible to define the timeline for the construction of the project. It would be expected that from the time project approval is received, it would take a further year to finalise the additional agreements required before construction could commence. This includes finalising the grid connection agreement and ordering long lead-time items such as transformers and turbines.

The construction phase of the wind farm would then occur over a 24-36 month period and would include such activities as:

- Transportation of people, materials and equipment to each precinct.

- Civil works for access track construction, footings and trenching for cables.
- Establishment, operation and removal of up to two concrete batching plants (as discussed below).
- Potential use of rock crushing equipment if required.
- Potential use of blasting in foundation excavation, if required.
- Installation of wind turbines using large mobile cranes.
- Construction of substation and onsite power reticulation lines and cables.
- Construction of temporary offices and facilities.
- Temporary storage.
- Restoration and revegetation of disturbed onsite areas on completion of construction works.

This Proposal may be constructed in phased or staged approach, with separate precincts or groups of infrastructure considered discrete work packages and commenced at different times.

In general for each precinct, construction would commence with the upgrading of roads and all other site civil works, including preparation of hardstand areas, and laying of cables. This would be followed by preparation of concrete footings, which must be cured for many weeks prior to construction of wind turbines.

Wind turbine construction can be relatively fast once the footings are prepared, with wind turbines installed at a rate of approximately 2 per week. The towers are erected in sections, the nacelles lifted to the top of the towers, and finally blades lifted and bolted to the hub.

The necessary substation construction and grid connection works would be carried out in parallel.

The commissioning phase would include pre-commissioning checks on all high-voltage equipment prior to connection to the TransGrid transmission system. Once the wind farm electrical connections have been commissioned and energised, each wind turbine is then separately commissioned, connected and put into service.

On completion of construction, disturbed areas would be revegetated and all waste materials removed and disposed of appropriately.

Wind turbine construction and installation

Installation of the wind turbine blades would require establishment of a level (<1% gradient) and stable hardstand area at the base of each wind turbine. This hardstand area would support cranes used for the major component lifts. It is also necessary to have a delivery area for the various components adjacent to the hardstand area.

Installation of the wind turbine blades would also require largely cleared areas at the base of each wind turbine to manoeuvre the wind turbine blades. Generally, the three blades are connected to the hub on-ground, and the hub and blades lifted as one piece by a crane located on a hard stand platform. There is some scope to avoid damage to or removal of native vegetation during this stage by careful positioning of the blades to avoid trees and shrub;, this would be carried out wherever possible[5].

[5] The calculation of estimated impact area assumes the entire 'crane operation area' would be entirely disturbed, in order to calculate a 'worst case' scenario.

The wind turbines would be anchored using large concrete gravity footings or smaller concrete footings bolted to rock, as determined by geological parameters. Some blasting of rock may be required to excavate footings, dependent on the geological properties of the rock and design of the footing. Should controlled blasting be required, it would be carried out in accordance with all relevant statutory requirements.

Rock crusher

Materials excavated during the construction of wind turbine footings may be able to be reused as road base for the road surface upgrades. For this purpose, it is possible that a mobile rock crusher would be used during construction.

Concrete batch plants

There are several quarries or batch plants within the vicinity of the project that are likely to have the ability to supply pre-mix concrete to both precincts from either Bookham, Jugiong or Yass. However, four locations have been identified as suitable for portable concrete batch plants should they be required to supply concrete during the construction phase and therefore are included in this Proposal. Batching plant equipment may be relocated within each precinct as the works progress to different areas of each precinct.

The Bogo Quarry on Paynes Road is currently preparing an Environmental Assessment for the expansion of the Quarry which would include a mobile concrete batch plant and a mobile asphalt plant (Department of Planning 2008). Access to this batch plant for the supply of concrete to all precincts has been considered as a desirable planning option.

In the event that pre-mix concrete is unable to be supplied to all precincts, up to four portable concrete batching plant locations would be required. The concrete batch plants would involve a level area of approximately 100 metres by 75 metres to locate the loading bays, hoppers, cement and admixture silos, concrete truck loading hardstand, water tank and stockpiles for aggregate and sands. The batching plant would include an in-ground water recycling / first flush pit to prevent dirty water escaping onto the surrounding area, and would be fully remediated after the construction phase.

Figure 3-26 indicates likely batching plant locations. These are proposed to be located either adjacent to substations or in cleared open paddocks. Final batching plant locations would be confirmed prior to construction. A concrete batching plant would produce up to 340m^3 of concrete per day when a turbine foundation is being poured. The maximum operational period would be 12 months and each plant would produce a maximum of 850 tonnes per day. This is equivalent to 114,750 tonnes during the construction phase assuming that 75% of the concrete is produced from onsite batching plants. The batch plant operations would therefore require a license to be issued by DECC (under the Protection of the Environment Operations Act 1997), given the amount exceeds the license threshold of 150 tonnes per day. License conditions specified by DECC are likely to include operational protocols and monitoring.

Sands and aggregate would be sourced from excavation of footings, where possible, or from existing sand and gravel pits within the local area. Every effort would be made to source clean sands and aggregates to prevent transport of weeds to site. Where possible, sands and aggregates used would be similar in colour to materials already found on site.

Water required for onsite concrete batching would be sourced from one or more of several options outlined in Section 8.1. These options include acquiring water from either Lake Burrinjuck, new or existing ground bores, the pipeline connecting Harden and Jugiong or trucking water from local town centres. In all of these scenarios an allocation of water would need to be purchased by the Proponent as an embargo

exists in the area preventing the acquisition of new water allocation. Where possible and where there is available water, water from on-site dams may be utilised.

There are several quarries or batch plants within the vicinity of the project that are likely to have the ability to supply pre-mix concrete to all precincts from either Bookham, Jugiong or Yass. However, up to two portable concrete batch plants may be required to supply concrete onsite and therefore two concrete batch plant locations are included in this Proposal.

The Bogo Quarry on Paynes Road is currently preparing an environmental assessment for the expansion of the Quarry which would include a mobile concrete batch plant and a mobile asphalt plant (Department of Planning 2008). Access to this batch plant for the supply of concrete to all precincts has been considered as a desirable planning option.

In the event that pre-mix concrete is unable to supplied to all precincts, up to four portable concrete batching plants would be required on site. The concrete batch plants would involve a level area of approximately 100 metres by 75 metres to locate the loading bays, hoppers, cement and admixture silos, concrete truck loading hardstand, water tank and stockpiles for aggregate and sands. The batching plant would include an in-ground water recycling / first flush pit to prevent dirty water escaping onto the surrounding area, and would be fully remediated after the construction phase.

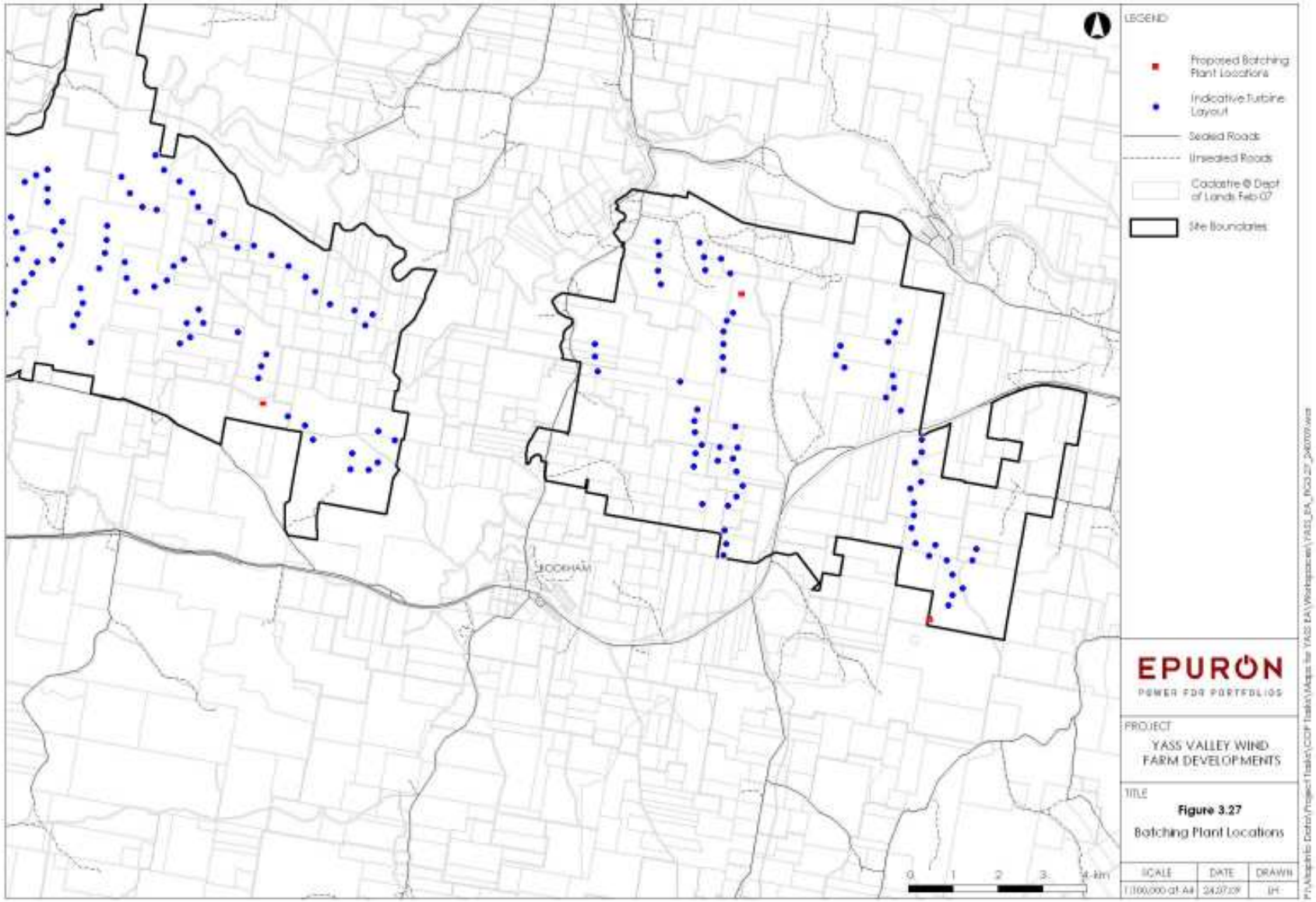


Figure 3-26: Proposed concrete batch plant locations

3.5.2 Phase 2: Wind farm operation

While the wind farm operates largely unattended, the wind turbines and other equipment would require regular maintenance. It is possible that some equipment may require major repair or replacement. In addition, during the initial operating years, operator attendance may be more regular while wind farm operation is being fine-tuned and optimised.

Once installed, the turbines would operate for an economic life of twenty to thirty years. After this time the turbines may be refurbished to improve their performance or decommissioned and removed from the site (refer to Sections 3.5.3 and 3.5.4).

Routine maintenance

To ensure the wind farm operates in a safe and reliable manner, it would require regular inspection and operation on an 'as needs' basis. This would generally be carried out using standard light vehicles.

In addition, regular maintenance is required, generally at 3, 6 and 12 monthly intervals. As a guide, each turbine requires approximately 7 days of maintenance per year. This does not require the use of major equipment, and could be carried out in a normal utility or small truck and would not require any additional works or infrastructure.

Major repairs

It is possible that major unexpected equipment failures could take place during the life of the wind farm. While wind turbines and electricity connections are designed for a 20 - 30 year life, failures can occur due to a number of factors including lightning strike (either directly to the wind turbines or offsite on the transmission line) and damage to key components (such as transformers or gearboxes). Failure can also occur on other equipment including that located in substations.

Most repairs can be carried out in a similar manner to routine maintenance, with some exceptions:

- Replacement of wind turbine blades, if necessary, would require bringing new blades to the affected turbine and installation of these blades using large cranes. The requirements are similar to the construction phase, and the access tracks established for construction may need to be brought into operation again.
- Replacement of wind turbine generators or gearboxes may require a crane and low loader truck to access the wind farm.
- Replacement of substation transformers would require a low loader truck to access the site.

Site monitoring program

A post-construction monitoring program would be established to determine any additional impacts resulting from the operation of the wind farm. The Operational Environmental Management Plan would contain specific monitoring programs required and would assess key issues such as biodiversity, noise compliance and visitation numbers.

Further details of the monitoring and adaptive management mechanisms are included in Section 10.

3.5.3 Phase 3: Wind turbine refurbishment

The life of a modern wind turbine is typically 20 - 30 years, at which point individual wind turbines would be refurbished, replaced, overhauled or removed. Individual turbines may also fail at shorter lives for various reasons as discussed above.

Replacement, refurbishment and recommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the existing turbines and to install replacement turbines.

Existing substations and cabling would be largely reused. It is also possible that the existing footings and towers could also be reused, subject to the designs of turbine available at the time of replacement / recommissioning. This would allow a significant cost saving for the wind farm.

Any refurbishment or turbine replacement would comply with the requirements of the project approval under this application.

3.5.4 Phase 4: Wind turbine decommissioning

Should a turbine fail and it is not commercially viable to replace the turbine, the turbine would be decommissioned in accordance with the Statement of Commitments; any turbine remaining non-operational for a continuous 12 month period would be decommissioned and removed from the site.

Decommissioning would involve similar road access arrangements to construction, and would require access for large cranes and transport vehicles to dismantle and remove the turbines. All underground footings and cable trenches would remain in situ; all above ground infrastructure would be removed. The decommissioning period is likely to be significantly shorter and with significantly less truck movements than the construction phase.

It should be noted that the scrap value of turbines and other equipment is expected to be sufficient to cover the majority of the costs of their dismantling and site restoration.

3.5.5 Construction hours

Construction activities associated with the project that would generate audible noise at any residence would be undertaken during the hours of:

Monday – Friday	7am – 6pm
Saturday	7am – 1pm
Sunday and public holidays	Not proposed

These working hours have been proposed to allow reasonable efficiencies of effort to achieve maximum productivity to minimise the overall construction duration. However, some work (e.g. delivery or erection of turbines) may occur overnight due to logistic reasons. Turbine lifts, for example, can only be carried out during periods of lower wind speeds because of operational limitations with the tall cranes and it is possible that night-time work would be required in this instance. This scenario has occurred at other wind farms (for example Cape Bridgewater, Victoria) where night crane operations have been required because of strong winds during the day.

3.6 SITE DISTURBANCE AND IMPACT AREA

The proposed wind farm requires the construction of a number of elements including turbines, turbine foundations, underground and overhead powerlines, a substation, control building and access roads on the site.

During the construction phase, additional areas of the site would be impacted to provide construction compounds, concrete batching plants and storage areas. These areas can be rehabilitated and restored following the completion of the construction program.

The table below estimates the uppermost areas that would be impacted within the development envelope. The development envelope is the entire area that was assessed and in which infrastructure may be located. The table then breaks down these areas into those that would require permanent habitat loss (footings that would remain in place after decommissioning), habitat modification (transmission easements that will require slashing) and areas that could be rehabilitated post construction (the crane operation area, construction compounds etc).

Table 3-3 Impact area estimations

The development footprint is expected to create the following areas of disturbance. Some of these areas would be able to be rehabilitated after the construction phase.

Coppabella Hills Precinct				
Infrastructure	**Quantity**	**Width (m)**	**Length (m)**	**Area (ha)**
Turbine footing [a]	86.00	25.00	25.00	**5.38**
Crane hardstand [c]	86.00	22.00	40.00	**7.57**
Crane operation area (includes footing and hardstand) [c]	86.00	50.00	50.00	**21.50**
Tracks [a]	1.00	8.00	67063.65	**53.65**
Underground powerlines onsite [c]	1.00	2.00	21905.29	**4.38**
Overhead powerline cabling / easement [b]	1.00	20.00	14517.82	**29.04**
Overhead power pole footings [a]	145.18	1.00	1.00	**0.01**
Substation and control bldg [a]	3.00	2.00	18330.43	**11.00**
Concrete batch plant [c]	1.00	75.00	100.00	**0.75**
Construction compound, staging and storage [c]	1.00	300.00	100.00	**3.00**
Development envelope (DE)				**2829.10**
Percentage of DE permanently removed				**2.48**
Breakdown by impact type:				
a Permanent total habitat loss (includes all footings and tracks)				**70.04**
b Habitat modification (transmission easement maintenance)				**29.04**
c Temporary habitat loss (areas that can be rehabilitated post construction)				**24.26**

Marilba Hills Precinct				
Infrastructure	**Quantity**	**Width (m)**	**Length (m)**	**Area (ha)**
Turbine footing [a]	66.00	25.00	25.00	**4.13**
Crane hardstand [c]	66.00	22.00	40.00	**5.81**
Crane operation area (includes footing and hardstand) [c]	66.00	50.00	50.00	**16.50**
Tracks [a]	1.00	8.00	63834.46	**51.15**
Underground powerlines onsite [c]	1.00	2.00	18330.43	**3.67**
Overhead powerline cabling / easement [b]	1.00	20.00	40031.00	**80.06**
Overhead power pole footings [a]	400.31	1.00	1.00	**0.04**
Substation and control bldg [a]	5.00	150.00	85.00	**6.38**
Concrete batch plant [c]	1.00	75.00	100.00	**0.75**
Construction compound, staging and storage [c]	1.00	300.00	100.00	**3.00**
Development envelope (DE)				**4140.00**
Percentage of DE permanently removed				**1.49**
Breakdown by impact type:				
a Permanent total habitat loss (includes all footings and tracks)				**61.70**
b Habitat modification (transmission easement maintenance)				**80.06**
c Temporary habitat loss (areas that can be rehabilitated post construction)				**19.79**

4 THE ENERGY CONTEXT OF THE PROPOSAL

This section provides a strategic overview of the need for the project in regards to the requirement for additional electricity supply in NSW and the need for more renewable energy projects. It also outlines Government policy objectives and targets for renewable energy and greenhouse gas reductions.

The Yass Valley Wind Farm would:

- Help secure reliable energy in a market where demand will soon exceed supply
- Assist in the reduction of Green House Gas (GHG) emissions contributing to climate change
- Help meet Federal and State policy objectives

4.1 THE NATIONAL ELECTRICITY MARKET

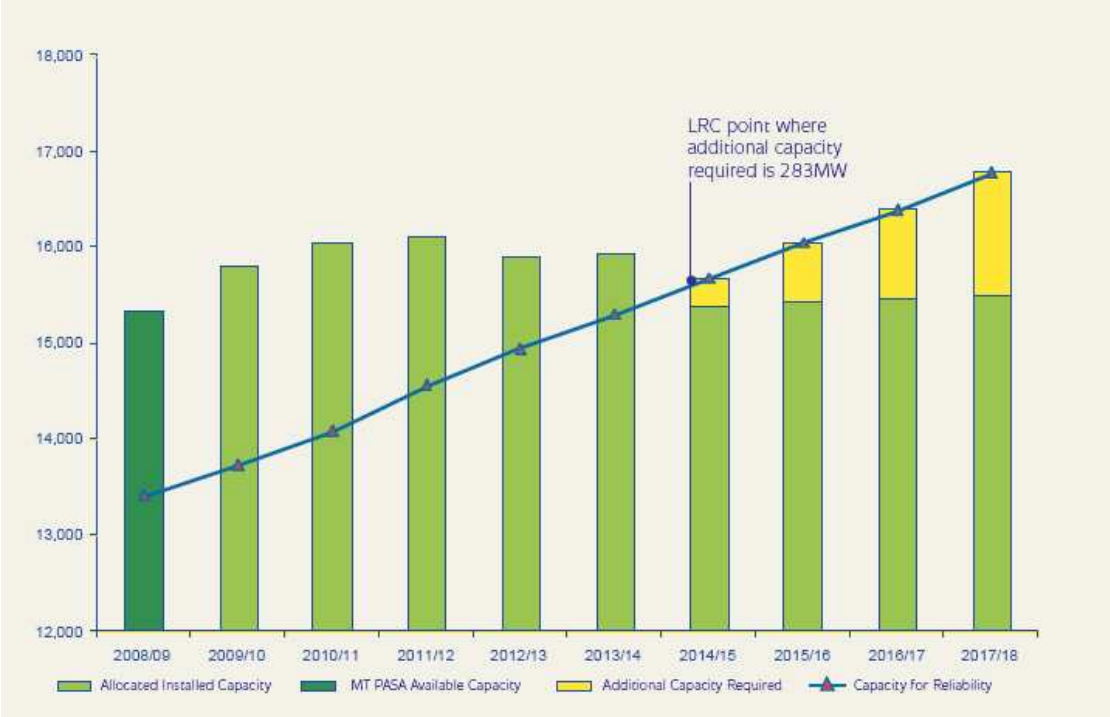
The National Electricity Market (NEM) is an all-inclusive market which facilitates the supply of electricity to retailers and consumers in Queensland, New South Wales, the Australian Capital Territory, Victoria, South Australia and Tasmania (NEMCO 2008). The NEM is a public-private partnership (PPP) where energy generated by various enterprises is aggregated into a pool made available to consumers. The NEM currently supplies to eight million end-use consumers which commands up to $10.2 billion of electricity to be traded annually (NEMCO 2008).

4.2 ELECTRICITY DEMAND IN NSW

TransGrid's Annual Planning Report (2008) confirms that growth in electricity demand will soon exceed supply during peak times. Scheduled demand projections indicate that additional generation will be required to manage peak periods by summer 2014/15. New South Wales currently has the capacity to supply 15,500 MW of reliable electricity (TransGrid 2008), however forecasts show demand will surpass this amount in the next 5 years. Consequently, the State will need to build additional electricity generators to meet this demand, as well as to evade power outages and blackouts.

This is reproduced in the NEMCO Statement of Opportunities 2008 report which analyses the supply and demand of electricity for each region of the market. The NSW average annual growth rate of scheduled energy is 0.8% and the summer supply-demand outlook graph (Figure 4-1) shows that additional capacity will be required to meet this forecast demand.

As depicted in the graph there is currently enough installed or planned energy infrastructure to meet the reliable capacity up until the summer of 2014/15, from which a minimum additional capacity of 283 MW will be required.



Source: NEMCO, 2008

Figure 4-1: NEMCO NSW Summer Outlook

4.3 THE ROLE OF RENEWABLE ENERGY

4.3.1 Climate change

There is scientific evidence that the Earth's climate is changing. Observations have shown global increases in air and ocean temperatures, the widespread melting of snow and ice and rising sea levels (IPCC, 2008). It has further been observed that many of the world's natural systems are already being affected by the change of regional climates, in particular temperature increases (IPCC, 2008). Other indicators include altered rainfall patterns and more frequent or intense weather patterns such as heatwaves, drought, and storms (DCC, 2009). In Australia, this change in the climate is anticipated to have an impact on water supply and quality, ecosystems and conservation, agriculture and forestry, fisheries, settlements and industry and human health. Australian trade and commodity prices may also be impacted on by the global impacts of climate change (DCC, 2009).

The drivers for climate change have been identified as being from both natural and anthropogenic forces, however a main contributor is the release of Green House Gases into the atmosphere (IPCC 2008).

4.3.2 Green House Gas (GHG) emissions

The International Panel for climate change (IPCC) has acknowledged that it is very likely that human GHG emissions have directly influenced global temperatures to increase, as well as lead to other climate impacts. As GHG emissions stay in the atmosphere for decades, a predicted warming of around 0.2°C per decade is already expected regardless of future emission levels (IPCC 2008). However, if GHG emissions continue to be emitted at their current rate then further and more extreme changes to the global climate

system will be experienced (IPCC 2008). Therefore, a reduction in GHG emissions is able to reduce the rate and magnitude of climate change. The IPPC recognises that GHG mitigation efforts over the next 20-30 years will be crucial to stabilising the amount of change (IPCC 2008).

The GHG contributing the most to climate change is Carbon dioxide (CO2). Between 1970 and 2004 the amount of CO2 being emitted from human-based activities increased by 80% and the current level of CO2 in the atmosphere is now higher than ever measured (IPCC, 2008). This large increase is predominantly due to the burning of fossil fuels, such as coal, for energy generation. Therefore the IPPC (2008) recommends a vital step to reducing CO2 emissions is by employing renewable energy technologies.

4.3.3 GHG emissions in Australia and NSW

Department of Climate Change reports (2008c) show that emissions from the stationary energy sector, which include those from electricity generation and the manufacturing, construction and commercial sectors, is the largest and fastest growing area in terms of greenhouse gas emissions in Australia. The stationary energy sector accounted for 50 per cent of total emissions in 2006 (DCC, 2008c) and within this sector, emissions from electricity generation contributed nearly 70 per cent. Between 1990 and 2005 emissions from electricity increased by 65 Mt CO2-e, an average of 3.3% per year (DCC, 2008c). Currently in Australia, 198.1 (Gg) CO2-e, or 54.1% of total greenhouse gas emissions, are produced during the generation of electricity (DCC, 2008a).

In 2006, 35% of the total GHG emissions in NSW were from the generation of electricity. Between 1990 and 2006 emissions from electricity generation grew by 35% to a total amount of 59.3 MtCO2-e (DCC, 2008b). This made up 10% of the total GHG emissions in Australia.

4.3.4 The need for renewable energy technology

The NSW Department of Environment and Climate Change (DECC) has forecast that emissions from the Stationary Energy sector[6] will reach a total of 79 MtCO2-e by 2020 (DECC 2006) under a 'business as usual' approach.

An indicator used to determine the amount of greenhouse gases emitted per MWh of electricity supplied to the NSW grid in a particular year is the NSW Annual Pool Value (GGAS 2008). Table 4-1 shows that the Annual Pool Value is calculated by dividing the total energy supplied to the NSW grid by the total NSW emissions in that year.

To account for one-off highs or lows that may be experienced in a particular year the Pool Coefficient is determined. This value is calculated by averaging the five Annual Pool Values from previous years, with a lag of two years (GGAS, 2008). So the NSW Pool Coefficient for 2009 is the average of the Annual Pool Values from 2003 to 2007.

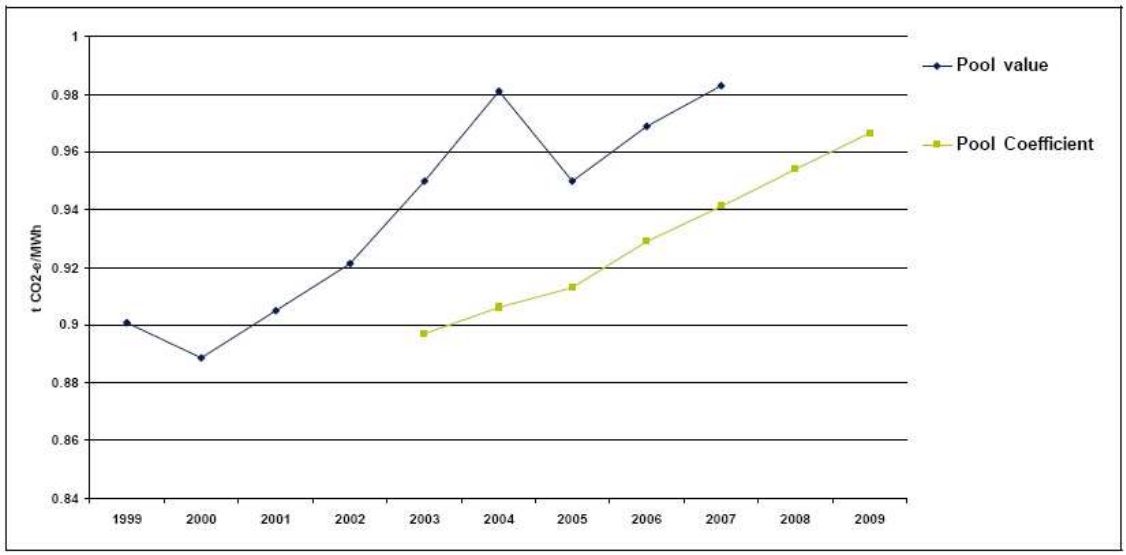
Table 4-1: NSW Annual Pool Values and Pool Coefficients (2003-2009)

Year	Total NSW emissions (tco2-e)	Total NSW sent out generation (MWH)	Annual pool value tco2- e/MWH	Pool coefficient tco2- e/MWH
2003	63,431,793	66,800,866	0.950	0.897
2004	65,979,036	67,276,401	0.981	0.906

[6] The stationary energy sector includes all sources of energy production and consumption excluding transportation. Electricity generation makes up a large proportion of this sector.

Year	Total NSW emissions (tco2-e)	Total NSW sent out generation (MWH)	Annual pool value tco2- e/MWH	Pool coefficient tco2- e/MWH
2005	65,896,606	69,341,455	0.950	0.913
2006	70,010,515	72,222,646	0.969	0.929
2007	69,810,669	71,015,242	0.983	0.941
2008	TBA	TBA	TBA	0.954
2009	TBA	TBA	TBA	0.967

Source: GGAS, 2008



Source: GGAS, 2008

Figure 4-2: Historical NSW Pool Value and Pool Coefficient (1999-2009)

The 2009 Pool Coefficient value indicates that presently for every megawatt-hour of electricity supplied to the NSW electricity pool, 967 kg of green house gases are emitted. At this point in time, approximately 90% of electricity in NSW is generated by fossil fuel power stations, primarily coal fired. Therefore it can be assumed that for every megawatt-hour of electricity generated at a coal power station 967kg of green house gases are emitted.

The Annual Pool Value is calculated using the total sent out electricity from all technologies, including that from renewable energy. It is expected that the more electricity supplied to the pool from renewable sources, reducing the amount required from coal power stations, the lower the Annual Pool Value and the lower the Pool Coefficient.

4.4 RENEWABLE ENERGY TARGETS

The Australian Government's Mandatory Renewable Energy Target (MRET) scheme was established in 2001 to expand the renewable energy market and increase the amount being utilised in Australia's

electricity supply. The MRET advocates that an additional 2 percent, or 9,500 GWh, of renewable energy by sourced by 2010 (DCC, 2009a).

In 2007, the NSW State Government introduced new legislation called the Renewable Energy (NSW) Bill as part of their Greenhouse Policy to encourage additional generation of renewable energy. The NSW Renewable Target (NRET) requires 10% of electricity to be sourced from renewable energy by 2010 and 15% by 2020 (DEUS, 2006). The NRET will be incorporated in the new Federal RET.

The Renewable Energy Target (RET) is an expansion of the MRET and requires an additional 20 percent of Australia's total electricity supply to be sourced from renewable projects by 2020 (DCC, 2009a). This means a total of 45,000 GWh of electricity will need to be sourced from renewables, requiring an additional 8,000 - 10,000 MW of new renewable energy generators to be built across Australia in the next decade. The RET also assures that national greenhouse gas emissions are reduced to meet Federal Government targets. Currently the legislation is in draft form and has been introduced to parliament but has yet to be finalised.

4.5 ENERGY RELIABILITY

In the State Plan, the Government has identified energy reliability as "critical to our quality of life and State's business competitiveness' (NSW Government 2006). The Plan also identifies low cost energy as crucial to attracting business investments and socio-economic equality. To ensure this, along with the issue of controlling GHG emissions, the Government aims to increase the State's energy efficiency while at the same time reducing the environmental impacts of energy generation (NSW Government 2006). Additional stable and reliable renewable energy projects in NSW are required to help meet this aim.

5 PLANNING CONTEXT

5.1 STATE GOVERNMENT LEGISLATION AND POLICY

5.1.1 Critical infrastructure

This Proposal is to be assessed as a Part 3A Major Project, under the NSW *Environmental Planning and Assessment Act 1979.* On 26 February 2008, then NSW Premier Morris Iemma announced that proposals to build new power stations with a capacity to generate at least 250 MW would be declared Critical Infrastructure under the *Environmental Planning and Assessment Act 1979*. The declaration is intended to secure the energy future of the state and to allow for sustainable economic development. Therefore this proposal is considered critical Infrastructure under the EP&A Act as it is a power generator with capacity to generate in excess of 250 megawatts and is the subject of an application lodged under Section 75E of the EP&A Act.

On 27 February 2009, it was announced by the NSW Premier that the criteria for wind farm projects considered as Critical Infrastructure under the Environmental Planning and Assessment Act 1979 is being amended. Wind farm projects that fall within the specified renewable energy precincts that generate 30 MW or more of electricity would be considered critical, replacing the existing criteria of 250 MW.

The renewable energy precincts were listed as;

- The NSW/ACT Cross Border Region;
- The Central Tableland;
- The New England Tableland;
- The Upper Hunter; and
- The South Coast.

The Government considers this to be a strategic move to advance renewable energy projects by giving them planning priority. The proposed wind farm is nearby to the NSW/ACT border and is designed to generate approximately 455 MW of electricity across the three precincts. Therefore the project is recognised by the State as being Critical Infrastructure.

5.1.2 Part 3A approval process

The Proposal is a Major Project which will be assessed under Part 3A of the *Environmental Planning and Assessment Act 1979* (*EP&A Act*). The project has a capital investment of more than $30 million and was confirmed to be a project to which Part 3A of the EP&A Act applies by the Director-General of the Department of Planning on 17 October 2008, refer to Attachment 3.

Part 3A integrates the assessment and approval regime for all Major Projects that require the approval of the Minister for Planning, previously dealt with by Parts 4 and 5 of the Act. Projects approved under Part 3A of the *EP&A Act* do not require authorisations under the:

- *Fisheries Management Act 1994* (sections 201, 205 or 219, stop work orders)
- *Heritage Act 1977* (Part 4 or Section 139)

- *National Parks and Wildlife Act 1974* (section 87, consent under Section 90, interim protection and stop work orders)
- *Native Vegetation Act 2003* (section 12)
- *Rivers and Foreshores Improvement Act 1948* (Part 3A)
- *Rural Fires Act 1997 (*section 100B)
- *Water Management Act 2000* (sections 89, 91)
- *Threatened Species Conservation Act 1995* (interim protection and stop work orders)
- *Protection of the Environment Operations Act 1997* (environment protection notices)
- *Local Government Act 1993* (orders under Section 124)

5.1.3 Director General's Requirements

Under the EP&A Act, Determining Authorities are to *consider 'to the fullest extent possible all matters affecting or likely to affect the environment* by reason of that activity'. The Director General's Requirements that outline the form and content of the Environmental Assessment are attached to this document (Attachment 4). The following table summarises the requirements and where they are addressed in this report.

Table 5-1 Director General's Requirements

This table outlines the DGRs, issued by the DoP on 12 January 2009 and where each item is addressed in this EA. The full DGRs are provided in Attachment 4.

Director-General Requirement's	Addressed in:
General requirements	
• Executive summary	Section 1
• Detailed description of Proposal including construction, operation and decommissioning details, grid coordinates of turbines and details of all infrastructure	Section 3
• Timeline indicating staging (including decommissioning)Proposal	Section 3.5
• Consideration of relevant statutory provisions (including consistency of the project with the objects of the *Environmental Planning and Assessment Act 1979*)	Section 5
• Assessment of key issues (outlined below) during construction, operation and decommissioning	Section 7
• Draft *Statement of Commitments*	Section 10.2
• Conclusion justifying the project taking into consideration environmental, Social and economic impacts of the project; suitability of the site and the public interest	Section 11
• Certification by the authors of the EA	Section 13

Director-General Requirement's	Addressed in:
Key issues	
• Strategic justification	Section 9
• Visual amenity impacts	Section 7.2
• Noise impacts	Section 7.3
• Flora and fauna (biodiversity)	Sections 7.4 and 7.5
• Indigenous heritage (archaeological and cultural)	Section 7.6
• Hazards and Risks (aviation / communications / EMFs / bushfires)	Sections 7.7, 7.8, 7.9, and 7.11
• Traffic and transport	Section 7.10
• General environmental risk analysis	Section 8
Consultation requirements	
• Appropriate and justified level of consultation with agencies and community	Section 6

Resources considered in this EA include:
• DoP Draft NSW Wind Energy Environmental Impact Assessment Guidelines 2002
• Auswinds's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia 2006
• Auswea and National Heritage Trust Wind Farms and Landscape Values March 2005
• South Australian EPA Wind Farms – Environmental Noise Guidelines 2003
• EPA – Environmental Noise Control Manual 2004
• Section 5A *Environmental Planning and Assessment Act 1979*: Impact on critical habitats, threatened species, populations and ecological communities
• DEC and DPI Draft Guidelines for Threatened Species Assessment 2005
• DEH Cumulative Risk for Threatened and Migratory Species, 2006
• Auswind's Wind Farms and Birds: Interim Standards for Risk Assessment 2005
• Auswea's Assessing the Impacts on Birds – Protocols and Data Set Standards

Resources considered in this EA include:
• DEC's Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation 2005
• CASA Advisory Circular AC 139-18(0) Obstacle marking and Lighting of Wind Farms 2005 (withdrawn)[7]
• ARPANSA Guidelines on Radiation Protection Standard for Exposure Limits to EMFs
• RFS Planning for Bushfire Protection

5.1.4 Protection of the Environment Operations Act 1997

This Act is administered by the Department of Environment and Climate Change (DECC), Environmental Protection Authority (EPA). Projects approved under Part 3A of the *EP&A Act* do not generally require authorisations under this Act. Matters relevant to this Act have been taken into consideration in the preparation of this EA.

Until recently, general electricity works with the capacity to generate more than 30 megawatts of power required a licence under this Act. Recent amendments to this Act describe "general electricity works" as:

> *the generation of electricity by means of electricity plant that, wherever situated, is based on, or uses, any energy source other than wind power or solar power.*

Therefore, the proposed development of the Coppabella Hills and Marilba Hills Precincts does not require a licence under this act.

Concrete batch plants exceeding production of 150 tonnes per day or 30,000 tonnes per year require a license under this Act. In the event that concrete cannot be sourced from local batching plants or quarries, temporary batching plants would need to be installed on site. It is anticipated that up to two temporary concrete batch plants would exceed this amount and in this case, would require a license to be issued by DECC.

5.1.5 DoP draft NSW Wind Energy Environmental Impact Assessment Guidelines 2002

This guideline identifies some important factors to be considered when undertaking environmental assessment of wind farm projects. Key recommendations relate to consultation, site selection, project justification as well as specific impact areas such as noise, visual amenity and aerial fauna.

The DoP guideline has been considered in the preparation of this EA.

5.1.6 Auswinds's Best Practice Guidelines for the Implementation of Wind Energy Projects in Australia 2006

The guidelines were developed to establish the process for identifying, developing and implementing wind energy projects, recognising that each project would require assessment on its individual merits. They are focused primarily on technical and planning issues.

These guidelines have been considered in the preparation of this EA, particularly with respect to the chronological flow of the project phases.

[7] CASA have recently withdrawn their advisory circular and are currently reviewing their guidelines for obstacle lighting on turbines. As it has not yet been replaced, the criterion in the withdrawn advisory circular has been considered in this Environmental Assessment.

5.1.7 DEH Supplementary Significant Impact Guidelines 2.1.1: Wind Farm Industry Sector 2005

The purpose of these guidelines is to assist operators in the wind farm industry to decide whether or not actions which they propose to take require assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*).

These guidelines have been considered in the preparation of this EA, particularly with reference to Section 7.4, biodiversity impacts.

5.1.8 Planning Framework for Natural Ecosystems of the ACT and NSW Southern Tablelands

The Planning Framework for Natural Ecosystems of the ACT and NSW Southern Tablelands (Fallding 2002) provides regional principles and planning settings to be considered in planning and development control decision-making. The Framework identifies key planning issues and conservation values relevant for 18 landscape units within the Southern Tablelands region. The Framework also provides recommended actions and impact assessment guidelines for threatened species and communities occurring in the region. The Framework has no statutory force, but is to be considered by decision-makers in development planning and approval processes.

The Coppabella Hills and Marilba Hills Precincts are located within the Yass and Wee Jasper landscape units. Key features of these two units, adapted from Fallding (2002), are presented in Table 5-2. These features, most pertaining to biodiversity attributes, have been considered in Section 7.4 of this EA.

Table 5-2: Key Features of Landscape Units after Fallding (2002)

	Yass landscape unit	Wee jasper landscape unit
General description	Undulating country fringed to the east by the low Mundoonan Range and in the south-west by the Murrumbidgee valley, including the Burrinjuck Reservoir. Largely occupied by extensive Box-Gum Woodlands, areas of Grassland-Woodland Mosaic and areas of Grasslands, the unit is fringed to the east and southwest by Dry Forest on the low ranges. Riparian Forests of River Red Gum and River Oak occur along the Murrumbidgee River.	A rugged unit whose major feature is the Murrumbidgee River below Burrinjuck Dam. The vegetation is largely Dry Forest with minor areas of Grassland and Box-Gum Woodland.
Vegetation Status	Dry forests on the fringing hills remain relatively intact in the east, though are largely cleared and fragmented in the southwest. The Box-Gum Woodlands have been severely cleared or modified throughout.	Large areas of dry forest still dominate much of the hilly country and some areas of Box-Gum Woodlands also remain. Grasslands are highly modified or cleared.
Land uses	Cropping, grazing, a town and several small villages, rural subdivisions, two major transport links, lake-based recreation, one medium-sized and one very small nature reserve.	Grazing, two small villages, recreation (caves and bushwalking), several areas of National Park and Nature Reserve.
Endemic features	• The region's core nesting habitat for Superb Parrot • The region's only population of Grey-crowned Babbler • Records of vagrant Major Mitchell's Cockatoos • Records of Striped Legless Lizard and Pink-tailed • Worm-lizard • The centre of the Yass Daisy distribution • A minor karst landscape within Hatton's Corner NR.	The region's most extensive karst landscapes. The cave system has yielded many records of the Eastern Bent-wing Bat and Large-footed Myotis The only populations anywhere of the Wee Jasper Grevillea and the only known record of Caladenia sp.'Burrinjuck' (a spider orchid) The only known regional records of Woolly Ragwort

5.1.9 Ecologically Sustainable Development (ESD)

Ecologically sustainable development (ESD) involves the effective integration of social, economic and environmental considerations in decision-making processes. In 1992, the Commonwealth and all state and territory governments endorsed the *National Strategy for Ecologically Sustainable Development*. In NSW, the concept has been incorporated in legislation such as the *EP&A Act* and Regulation.

For the purposes of the *EP&A Act* and other NSW legislation, the Intergovernmental Agreement on the Environment (1992) and the *Protection of the Environment Administration Act 1991* outline the following principles which can be used to achieve ESD.

(a) The precautionary principle: that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment

(ii) An assessment of the risk-weighted consequences of various options

(b) Inter-generational equity: that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations

(c) Conservation of biological diversity and ecological integrity: that conservation of biological diversity and ecological integrity should be a fundamental consideration

(d) Improved valuation, pricing and incentive mechanisms: that environmental factors should be included in the valuation of assets and services, such as:

(i) Polluter pays: that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement

(ii) The users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste

(iii) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems

The precautionary principle has been adopted in the assessment of impact; all potential impacts have been considered and mitigated where a risk is present. Where uncertainty exists, measures have been suggested to address the uncertainty.

The majority of potential impacts of the Proposal are likely to be localized and would not diminish the options regarding land and resource uses and nature conservation available to future generations. Parameters such as the site's soil, hydrology and native vegetation have been valued in terms of their broader contribution to the catchment and catchment processes. The reversibility of the Proposal has been specifically addressed in Section 9.5 and is considered to be an advantage of this type of development.

The impacts of the Proposal on biodiversity, including EPBC listed species, have been assessed in detail in the attached Biodiversity Assessments (summarised in Section 7.4).

The aims, structure and content of this EA have incorporated these ESD principles. The Draft *Statement of Commitments* in Section 10.2 provides an auditable environmental management commitment to these parameters. Based on the Social and environmental benefits accruing from the Proposal at a local and broader level, and the assessed impacts on the environment and their ability to be managed, it is considered that the development would be ecologically sustainable within the context of the above ESD definitions.

5.2 COMMONWEALTH LEGISLATION

5.2.1 Environment Protection and Biodiversity Conservation Act 1999

This Act provides for a Commonwealth assessment and approvals system for:

i) Actions that have a significant impact on 'matters of national environmental significance'

ii) Actions that (indirectly or directly) have a significant environmental impact on Commonwealth land

iii) Actions carried out by the Commonwealth Government

A Proposal requires the approval of the Environment Minister if an action is likely to have a significant impact on a matter of national environmental significance or listed as a matter of national significance which includes:

i) World Heritage Properties

ii) Wetlands of International Importance (Ramsar wetlands)

iii) Commonwealth Listed Threatened Species and Ecological Communities

iv) Commonwealth Listed Migratory Species

v) Nuclear action

vi) Commonwealth marine areas

vii) Commonwealth land

The Act aims to ensure the conservation and recovery of flora and fauna species and communities at a state and national level. The requirements of EPBC Act under Part 13 - Species and communities, are that the Minister must establish a list of threatened species, threatened communities and key threatening processes. The list must contain threatened species and communities as contained in Schedules 1 and 2 of the *Endangered Species Protection Act 1992*. Listed species are divided into the following categories: Extinct, extinct in the wild, critically endangered, vulnerable and conservation dependent. Threatened communities are divided into the following categories: Critically endangered and endangered. Key threatening processes are contained in Schedule 3 of the *Endangered Species Protection Act 1992*.

A search for Matters of National Environmental Significance based on the study area and a 50 kilometre buffer was undertaken using the Commonwealth Government's Protected Matters Search Tool. This tool covers World Heritage properties, National Heritage places, significant wetlands, migratory species, nationally listed threatened species and communities and other matters protected by the EPBC Act. The report generated by the Matters of National Environmental Significance Commonwealth Government's Protected Matters Search Tool is provided in full and discussed within the Biodiversity Assessment, provided in Appendix 3. A summary of the results of the Protected Matters Search Tool is provided in Table 5-3 below.

Table 5-3: Summary of the results of the Protected Matters Search tool

	Coppabella Hills Precinct	Marilba Hills Precinct
Threatened Species	20	20
Migratory Species	12	12
Invasive Species	14	14
Threatened Ecological Communities	2	2
World Heritage Properties	None	None
Australian Heritage Sites	49	49
Ramsar Wetlands	1	1
Nationally Important Wetlands	None	None
NPI Reporting Facilities	None	None
NPI Airsheds	None	None
NPI Catchments	None	None
Protected Areas	6	6

On the basis of the biodiversity investigations, the proposal is not considered likely to have an impact on EPBC listed species. To obtain certainty however, an EPBC referral would be lodged to determine whether, on the basis of Matters of National Significance, the Proposal would be considered a 'controlled action'.

5.2.2 Bilateral agreements

In accordance with subsection 45(4) of the *EPBC Act* and Division 16.1 of the EPBC Regulations 2000, the Commonwealth of Australia entered into a bilateral agreement with New South Wales. One of the aims of the agreement is to minimise duplication of environmental impact assessment processes, ensuring a co-ordinated approach for actions requiring approval from both the Commonwealth and the state. Should the Proposal be considered a 'controlled action' under the *EPBC Act* the referral would be assessed by the NSW DoP, funded by the federal agency.

While it is not considered that the Proposal represents a 'controlled action', as defined by the *EPBC Act 1999*, an EPBC referral was completed for the Proposal as a precautionary measure as detailed in Section 5.2.1, above. No other matters pertaining to this Proposal are relevant to the bilateral agreement.

5.3 LOCAL GOVERNMENT INSTRUMENTS AND POLICIES

The proposed Yass Valley Wind Farm is located across two local government areas, Yass Valley and Harden Local Government Area. Marilba Hills is located within the boundaries of the Yass Valley LGA, with Coppabella Hills located across the two LGA's.

5.3.1 Yass Valley Local Environmental Plans (LEPs)

The Yass Valley Local Government Area was created as part of a council amalgamation in February 2004. Yass Valley Council therefore has a number of Local Environmental Plans (LEP's) and Development Control Plans (DCP's) that apply to the Yass Valley Local Government Area. The LEP's and DCP's which applied to the former Yass, Yarrowlumla and Gunning LGA's continue to apply to those areas until such time that they are replaced by the new LEP and DCP (www.yass.nsw.gov.au 2008).

The Proposal site is located in No 1(a) Rural Agriculture Zone. Under the LEP, the objective of this zone is to set aside certain land for agricultural purposes and purposes incidental thereto. Agriculture (with some exceptions), dams and forestry developments are permitted without consent. Industries (other than extractive industries, home industries or rural industries) are prohibited. Development for other purposes requires development consent.

'Industries' in the LEP is defined in the Environmental Planning and Assessment Model Provisions 1980 and the Factories, Shops and Industries Act 1962, and does not include wind farms (Paul De Szell, Yass Valley Council pers. comm.). The Model Provisions contain a specific definition of 'generating works', which would encompass the Proposal; 'a building or place used for the purpose of making or generating gas, electricity or other forms of energy'. The wind farm Proposal is therefore not prohibited under the LEP, but would require development consent.

Permissibility under the LEP is important because, although Major Projects are approved by the Minister and planning instruments (other than State Environmental Planning Policies) do not apply, the Minister cannot approve projects which are not critical infrastructure projects, and which would (but for Part 3A) be prohibited under a planning instrument.

In addition, the Minister is to take into consideration the provisions of any environmental planning instrument that would have (but for Part 3A) substantially governed the carrying out of the project. The Minister would therefore have regard to the provisions of the Yass Valley LEP in assessing the Coppabella Hills wind farm Proposal. The Yass Valley Council is currently revising the LEP.

Yass Valley Council is also developing guidelines for a Development Control Plan (DCP) for the development of wind farms in the Shire. The DCP will incorporate elements of the Upper Lachlan and Goulburn Mulwaree Councils' DCPs relating to wind farms (Yass Tribune 2006). The Council is also preparing a new DCP covering rural and urban lands and commencing a community-based strategic planning process to manage change in the LGA (Yass Valley Council 2005).

5.3.2 Interim Development Order No. 1 – Shire of Harden

Although the majority of the Proposal area is located within the Yass Valley LGA, the western portion of the Coppabella Hills Precinct is located within Harden Shire LGA. The Harden Shire Council do not have a current LEP in place, though the council are in the process of developing a draft LEP. At present development controls are dictated by the Interim Development Order (IDO) No. 1 – Shire of Harden. Works proposed for the wind farm fall within lands zoned 1. (a) Non-urban "A." Developments that may be carried out without consent from the council on this land include Agriculture, some housing developments (pursuant to certain clauses) and forestry. Industries other than extractive home industries,

offensive or hazardous industries, rural industries and complying development may only be carried out with the consent of the Council and the concurrence of the Commission.

Under this IDO, the Proposal would require consent of the Council and the concurrence of the Commission. The "Council" means the Council of the Shire of Harden and the "Commission" means the New South Wales Planning and Environment Commission constituted under the New South Wales Planning and Environment Commission Act, 1974. This Act has been repealed and Harden Council are currently preparing an LEP consistent with the *Environmental Planning and Assessment Act* 1979.

6 CONSULTATION

6.1 GOVERNMENT CONSULTATION

6.1.1 Initial meetings

The Proponent met with the consent authority, the NSW Department of Planning, formally on 16 September, 2008, introducing the Proposal and seeking advice on the assessment process. The Proponent sought a determination from the Director General that the Proposal would be assessed as a Major Project under *Part 3A of the Environmental Planning and Assessment Act.* On 22 October 2008, the Proponent was issued with a letter from the Department of Planning confirming that the proposal would be assessed as Major Project under Part 3A of the EP&A Act.

6.1.2 Planning Focus Meeting (PFM)

The Planning Focus Meeting is a requirement for complex Major Projects. It is an opportunity to introduce the Proposal to government stakeholders who would have input into the environmental assessment process.

Participants met in Binalong on the 14th of October 2008 where a presentation on the Proposal was given by Epuron Project Director, Simon Davey (representative of the Proponent), and **ngh**environmental Project Manager, Brooke Marshall (representative of the environmental assessment team). Participants asked questions and presented issues of relevance to their agencies onsite. Marilba Hills was visited in the afternoon of the 14th. The following day, 15th October, the participants visited the main ridge of the Coppabella Hills Precinct. Epuron Project Manager, Julian Kasby, gave an overview of likely infrastructure placement and views to other ridges within the development envelope.

Participants included:

- Neville Osborne and Marek Cholinski, Department of Planning
- John Daunt, Department of Lands
- Dr Sandie Jones and Lyndel Walters, Department of Environment and Climate Change
- Cressida Gilmore, Department of Primary Industries
- John Franklin, Murrumbidgee Catchment Management Authority
- Sharon Langman, Harden Shire Council
- Suzanne Jurcevic, Yass Valley Shire Council
- Ben Bates and Mahesh Nagarajan, Country Energy
- Maurice Morgan, Roads and Traffic Authority
- Michael McManus, Transgrid
- Rodger Ubrihien, Bega Duo Designs (Traffic Impact Study representative)
- Simon Davey and Julian Kasby, Epuron (Proponent representative)
- Brooke Marshall and Tim Browne, **ngh**environmental (environmental assessment representatives)

Additionally, agencies unable to attend the PFM but expressing interest in the Proposal and further consultation included:

- Civil Aviation Safety Authority
- Department of Defence
- Department of Water and Energy

The minutes of the PFM are included in Attachment 5.

6.2 COMMUNITY CONSULTATION

Wind farm developments and approvals in Australia have elicited polarised responses from the community, highlighting the need to appropriately identify and consult with community stakeholders early in the development process. The Proponent has informed and consulted with the local community during the planning and development of the Yass Valley Wind Farm Proposal, as discussed below.

6.2.1 Community Consultation Plan (CCP)[8]

A Community Consultation Plan was prepared by Epuron for the Proposal (Attachment 6). It began by developing the objectives of consultation, which were:

- To ensure that the community is fully informed about the Proposal
- To provide opportunities for the community to receive information and provide feedback about the Proposal
- To incorporate the feedback into the design of the wind farm where possible
- To provide multiple opportunities for ongoing dialogue with the community
- To engage with all neighbouring landowners and understand any potential impacts from the Proposal

The format of this Plan included:

- Community profile of the Yass-Harden area
- Consultation objectives
- Issue management
- Project-based activities
- Documentation of activities undertaken (to be completed post-construction)

The plan was used to guide consultation during the development of the Proposal. The intention of the plan was that it be adapted as community feedback was received so that consultation activities were a pragmatic response to the issues raised by the community.

Key consultation activities included an open house session attended by a range of specialists working on the Proposal, follow-up phone calls and correspondence, face-to-face meetings with neighbouring and

[8] During the consultation process, the Yass Valley Wind Farm constituted proposed infrastructure at three precincts: Coppabella Hills, Marilba Hills and Carrolls Ridge. This Environmental Assessment (EA) deals only with Coppabella Hills and Marilba Hills. Carrolls Ridge Precinct is covered by a separate EA.

concerned landowners, attendance at the local Landcare meeting in Binalong, release of media statements, newspaper advertisements and community newsletters. The Proponent has also proposed to attend a local council meeting at both Yass and Harden to discuss the proposed wind farm.

6.2.2 Implementation of the Community Consultation Plan

While the majority of the consultation process focussed on *informing* the community about issues relating to the Proposal, activities to engage the community in *two-way dialogue* were also undertaken for the purpose of incorporating community concerns, local knowledge and thereby maximising the suitability of the Proposal to the site and the community's acceptance of the Proposal. Examples of this included the open house event, follow-up correspondence and face-to-face meetings with community stakeholders.

Open house

The open house forum allowed the opportunity for members of the community to speak individually or in small groups to the Proponent representatives and to persons undertaking parts of the environmental assessment. The open house format is helpful in avoiding potential conflict in a public meeting for contentious issues, allowing a flow of stakeholder dialogue throughout the event rather than a more constrained discussion that can be hijacked by the most vocal individuals. It allows for a larger proportion of stakeholders to voice their individual concerns with the relevant representatives in a less confrontational situation. It also allows the presentation of issues and information to be tailored to individual queries.

The open house session was held on 10 December 2008 at the Royal Tara Motel, Binalong. A community newsletter preceded the event which was also advertised in the local media (newspaper and radio). The event ran from 2:00-7:00pm. Representatives from the Proponent (five representatives), nghenvironmental (two representatives), Bega Duo Designs (one representative) Heggies (one representative) and ERM (one representative) were present to discuss the Proposal specifics (including general questions about wind farms and wind farm development), the environmental planning process, biodiversity, noise and visual impacts. A summary of the work completed to date was distributed as well as feed back forms. Photomontages and noise modelling of the latest turbine layout were posted on the walls of the hall.

Thirty-six people registered their attendance on the day. It is estimated that in total, approximately 55 people attended. Notable observations made on the day included:

- The majority of people who registered their attendance at the open house reside in the surrounding villages of Binalong and Bookham
- Some attendees were interested in the flora and fauna work and also the construction management plan in relation to weed and erosion control
- Several people wanted to know what the status of the Conroy's Gap Project Application, and what the intentions for construction were
- Some people were concerned with the potential visual impacts and the effect they may have on property value
- Some people were concerned about the potential noise impacts that may result from operation of the wind farm
- A number of people expressed their support for renewable energy and wind farms, as verified in the feedback form summary

- Two attendees requested that a residential visual assessment was conducted from their property

In conversations with the community throughout the day, it became apparent that the amount of local knowledge about existing wind farm developments and wind farm impacts was greater than previously encountered in the Yass/Goulburn area in similar open house forums conducted by **ngh**environmental on behalf of Epuron over the last three years. Also apparent was a larger degree of misinformation about various environmental impacts, gained from word of mouth and anecdotal information obtained from the internet. Both factors assisted the effectiveness of the consultation by facilitating discussion.

Feedback forms & open house follow-up

Seven community feedback forms (dealing with the three precincts as one proposal) were received on the day and five were received via post. An example of the feedback form is presented in Attachment 7. Blank feedback forms were left at the post office in Binalong to allow any community members who were unable to attend the open house to comment on the Proposal. The community feedback forms allowed the community an opportunity to comment on the proposed wind farm through answering a number of questions. The issues of most concern were that of visual, noise and community impacts. The results are tallied below.

Table 6-1: Results of feedback forms and Open House follow up

What do you value most about the local area?	**Tally**
Views	8
Community / family ties	8
Historic values	7
Other	2
Work opportunities	1
Recreation opportunities	1
What is you interest in the local area?	
Live nearby	9
Industry	4
Recreation	1
Work nearby	2
Other	1
Which statements best describe you?	
See from house	6
Resident in the area	7
See from property or work	4
See from place of recreation	2
Involved landowner	0
What do you like about wind farms	
See them as an alternative energy option for Australia	9
Nothing	3
What do you dislike about wind farms	
Visual impact	1
Noise pollution	2
Impact to the Environment	1
Nothing	8
If you have concerns about this proposal, please state them under any headings that are relevant below:	

a) Environmental concerns		
	Bird kill	2
	Impacts to other animals	2
	Uncertain environmental value	1
b) Visual concerns		
	Reduction in value of land	1
	Too large	1
c) Aboriginal / heritage concerns		
	none	
d) Noise issues		
	Sound levels	2
e) Recreational issues		
	none	
f) Health issues		
	unsure	1
g) Community concerns		
	Divides community	1
h) Other		
	Owner's participation in local community	1

Face-to-face consultation

To better understand the potential issues associated with the Proposal, Epuron attempted to arrange a face-to-face meeting with landowners directly neighbouring the project area. This was conducted by Dr Richard Finlay-Jones, a landowner management a community consultation consultant. Where requested, Epuron provided the most up-to-date information possible on various different aspects of the project and provided supplementary material to answer general wind farming questions.

Binalong Landcare meeting

Representatives from the Binalong Landcare group were present at the Open House in Binalong and expressed interest in issues such as soil erosion and environmental management during construction. Epuron was invited to give a presentation at the next Landcare meeting on the 16th February 2009. Two representatives from Epuron attended the meeting and provided an overview of the project, the current status and proposed timeline for the project, and answered questions relating to general and specific wind farm inquiries.

Notable observations on the night included:

- A general interest in the potential environmental impacts of wind farms including, noise impacts, visual impacts, land values and the possibility of bush fires. (A report conducted by The Australia Institute titled *The Facts and Fallacies about Wind Farms* was subsequently sent out to the Landcare coordinator for distribution, see https://www.tai.org.au/file.php?file=DP91.pdf).
- An interest in the specifications of the roads constructed on site for turbine delivery.
- Questions relating to the Environmental Management Plan and how it would be audited.
- A general interest in land management relating to both grazing stock and regeneration of disturbed areas.

- Interest in the opportunity for local jobs to be created and for materials to be sourced from within the region.

In conversations with members of the group after the meeting, it became apparent that there was a general support for the project and the potential benefits to the community, however, there were concerns over the constructability and land management as the terrain is quite steep.

Newsletters

The first newsletter introduced the Proposal in August 2008; outlining an indicative time frame for submission to the consent authority and advising of opportunities for receipt of community input. It was distributed to all residents within 5km of the site; 110 landowners in Yass Valley and Harden Shire.

The second newsletter in November 2008 provided updated Proposal information (regarding the number of turbines) and invited the community to attend the open house session to be held locally. It was distributed to all residents within 5km of the site; 110 landowners in Yass Valley and Harden Shire.

A third newsletter would accompany the submission of the EA, to advise where the reports can be viewed by the public and to thank the community for their participation to date.

Copies of all community consultation material (Community Consultation Plan, local community questionnaire, broader perceptions survey, community newsletters, media releases and letters received from key stakeholders are included as attachments (Attachment 8).

Media articles

During the Proposal development period, a number of articles were published in the local media. The majority of these articles expressed viewpoints by individuals, community groups or other stakeholders. These articles maintained the awareness of issues surrounding the wind farm, and the Proponent responded where appropriate via media interviews.

7 ASSESSMENT OF KEY ISSUES

7.1 SCOPING AND PRIORITISATION OF ISSUES

Reforms to the *Environmental Planning and Assessment Act 1979* and associated planning instruments (Part 3A) provide for improvements to efficiency in the assessment and approval process, by allowing assessments to focus on key issues.

Key issues are those with the potential to produce significant environmental or human impacts. They have been identified with respect to this Proposal in the Director General's Requirements (refer to Section 5.1.3). The impact assessment process that this EA report documents is focussed on these key issues. Table 7.1 summarises the key issues and the investigation strategies employed to investigate them. Section 7 summarises the methodologies, results and mitigation measures recommended by these investigations, for each key issue individually.

Additional issues were identified using the risk analysis methodology, Section 8, Table 8-1. These additional issues are discussed separately in Section 8.

Table 7-1 Categorisation of key impact areas related to the Proposal

Issue	Investigation strategy
Visual	Specialist report including photomontages of turbine layouts
Noise	Specialist report including modelling and mapping
Biodiversity	Specialist report including flora, fauna Separate desktop investigation of Mitchell landscapes
Aboriginal archaeology	Specialist report, including consultation
Aviation	Desktop review and consultation
Communications	Desktop review and consultation
Electromagnetic Fields (EMF)	Desktop review and consultation
Traffic and transport	Specialist report
Fire and bushfire	Desktop review and consultation

7.2 VISUAL IMPACT

A Landscape and Visual Assessment (LVA) of the proposed Yass Valley Wind Farm was undertaken by Environmental Resources Management (ERM). The LVA is presented in full in Appendix 1. The LVA assesses all three precincts of the proposed Yass Valley Wind Farm. This Environmental Assessment is for the Coppabella Hills and Marilba Hills Precincts only, however as the Carrolls Ridge Precinct may form part of the Yass Valley Wind Farm it is included to ensure that the landscape and visual assessment for the entire wind farm was prepared on a conservative basis.

7.2.1 Methodology

The methodology used within the visual assessment was based on the *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria (May 2003)* as well as past projects undertaken by ERM in the visual assessment of wind farms in New South Wales, Victoria, South Australia and New Zealand. This methodology is supported by the *Wind Farms and Landscape Values, National Assessment Framework.*

The methodology used within the visual assessment of the proposed Yass Valley Wind Farm included the following steps.

- Describing the visual components of the proposed Yass Valley Wind Farm.
- Describing peoples' perception of wind farms in the landscape based upon past research in Australia and overseas.
- Defining the viewshed of the proposed Yass Valley Wind Farm based upon the parameters of human vision.
- Defining the Landscape Units which are based on physical characteristics of the area within the viewshed.
- Undertaking a Seen Area Analysis of the proposed turbine visibility area using the Geographical Information Systems software (GIS).
- Assessing the visual impact of the proposed wind farm from publicly accessible viewpoints within the viewshed of the proposed wind farm, including information partly based on photomontages and distances of the viewer.
- Assessing the visual impact from residential properties within the wind farm locality.
- Discussion of mitigation measures and how they may reduce the visual impact to residences.
- Examining the cumulative visual impact of the Yass Valley Wind Farm against other approved or existing wind farms in the area.[9]
- Describing the potential impact of the developments' night lighting.
- Preparation of photomontages (by Garrad Hassan) to illustrate the visual impact of the proposed development. Photomontages have been prepared in accordance with ERM methodology.

[9] The approved Conroy's Gap Wind Farm has been included in all photo montages to assess the cumulative impacts.

- Conducting a sequential viewpoint analysis along the Hume Highway and Burley Griffin Way.

7.2.2 Existing environment

The areas surrounding the proposed Yass Valley Wind Farm are predominately cleared hilly farm land, with existing infrastructure including roads, rail, transmission lines, towers, power lines, and communication towers as well as the typical infrastructure and buildings associated with farming activities.

The proposed Yass Valley Wind Farm is located on low hills and ridgelines on the north and south side of the Hume Highway. The topography within the viewshed can be described as rolling hills, often creating enclosed visual corridors. Typically the hills and valleys have been cleared for farming activities, however much of the existing farmland also contains scattered remnant trees.

The Yass Valley Wind Farm is located on hilly areas where the elevation change across the site may vary from 500-820 m.

7.2.3 Results

Visual components of the wind farm

These include, but are not limited to, wind turbines, power lines, substations and access roads.

The wind turbines are the most visually apparent element of a wind farm proposal. The proposed wind turbines would be up to 150 m tall to the tip of blade. The nacelle will be up to 100 m from ground level and the blades have a total diameter of up to 100 m. The following table summarises the proposed components of the wind farm

Item	Maximum values
Hub Height (Approx)	100 metres (Approx)
Rotor Diameter (Approx)	100 metres (Approx)
Overall Height (Approx)	150 metres (Approx)
Proposed number of turbines	152 turbines (Approx)

People's perception of wind farms

Studies undertaken in the Southern Tablelands region, within Australia and overseas indicate an increasing level of public support for wind farm developments. Perception studies continually show that in many Australian and overseas examples, between 60-70% of people find wind turbines an attractive element in the landscape, with up to 15% of respondents undecided and 20% dislike wind farms. Public opinion research on wind farms in New South Wales has been limited. Although community consultation is undertaken as part of the planning process for wind farms, this consultation is mostly qualitative in nature, in that it seeks the views on a number of aspects of the wind farm development from specific stakeholders, including the local community, and those further away, as well as the views of special interest groups, government agencies and local government involved or impacted by the development.

Some social research has been undertaken by government agencies as well as by wind farm Proponents, to ascertain people's perception and response to wind farms in the New South Wales and Victorian landscapes and the outcomes of this research is consistent.

A study was commissioned by Epuron and conducted by ERM, to ascertain the regions view towards wind farms. The study was conducted from the 27th of July and concluded on the 2nd of August 2007. This study was previously quoted in the Planning Application Report for the Gullen Range Wind Farm. The study area however, included the Goulburn – Crookwell – Yass regions (Southern Tablelands), thus it has geographical relevance for this project.

Results have shown a discernable rise in the level of public acceptance, with almost 9 out of 10 (89%) of respondents supporting development of wind farms in the Southern Tablelands. Furthermore 71% of respondents would support a wind farm development within 1 km of their residence, and 67% found wind farms to be visually appealing.

Viewshed and zones of visual influence

The area that may potentially be visually affected by the wind turbines is called the viewshed. The viewshed for the proposed Yass Valley Wind Farm is based on the parameters of human vision. Given that the overall height of the wind turbines would be up to 150 m, the viewshed can be considered to extend to a distance at which the 150 m wind turbines would take up less than 5% of the full vertical field of view. Typically the field of view of a person is 10°; therefore, 0.5° is less than 5% of the typical vertical field of view. Therefore a wind turbine 150 m high viewed from a distance of 17.0 km would take up 5% of the vertical field of view, which has been considered as the viewshed for the Yass Valley Wind Farm.

Table 7-2 Zone of Visual Impact (ZVI)

Distance from an observer to the nearest wind turbine	Visual impact
> 17 km	*Visually insignificant* A very small element in the viewshed that is difficult to discern and would be invisible in some lighting or weather circumstances.
8.5 km – 17 km	*Potentially noticeable, but would not dominate the landscape.* The degree of visual intrusion would depend on the landscape sensitivity and the sensitivity of the viewer. However, the wind turbines do not dominate the landscape.
3.0 km -8.5 km.	*Potentially noticeable and can dominate the landscape.* The degree of visual intrusion would depend on the landscape sensitivity and the sensitivity of the viewer
1.5-3.0 km	*Highly visible and would usually dominate the landscape* The degree of visual intrusion would depend on the wind turbines' placement within the landscape and factors such as foreground screening.
< 1.5 km	*Would be visually dominant in the landscape from most viewing locations.* Dominates the landscape in which they are sited.

Larger townships within the viewshed of the proposed Yass Valley Wind Farm include:

- Binalong – approximately 8km north of the Marilba Hills Precinct
- Bowning – approximately 8.5km east of the Marilba Hills Precinct
- Galong – approximately 14km north of the Coppabella Hills Precinct
- Jugiong – approximately 15km west of the Coppabella Hills Precinct
- Yass – approximately 17km east of the Marilba Hills Precinct

There are also several named 'localities' that consist of a few dwellings and/or buildings and with no shopping or convenience services.

Landscape Units and Sensitivity

Landscape units are based on areas with similar visual characteristics in terms of topography, geological features, soil, vegetation, and land use. The following sections describe the underlying patterns of these elements to derive the landscape units within the viewshed.

The units are broken up into 5 categories:

- Landscape Unit 1 – "Gently Undulating and Flat Cleared Farmland";
- Landscape Unit 2 – "Steeply Undulating Cleared Farmland";
- Landscape Unit 3 – "Forested Hills";
- Landscape Unit 4 – "Rural Townships"; and
- Landscape Unit 5– "Recreation Resorts".

The visual sensitivities of the area are affected by the level of anthropogenic modification in the landscape. These are discussed in detail in the Landscape and Visual Assessment (LVA), Appendix 1. The landscape sensitivities are summarised below.

Table 7-3: Landscape Sensibility table

Landscape unit	Sensitivity
Unit 1 ***Gently Undulating and Flat Cleared Farmland***	Low This unit is highly modified, contains visible infrastructure, is not topographically dramatic and does not contain large areas of water.
Unit 2 ***Steeply Undulating Cleared Farmland***	Medium This landscape is largely cleared of vegetation however the steeply folded hills create an appealing landscape.
Unit 3 ***Forested Hills***	Medium to High This landscape is attractive
Unit 4 ***Rural Townships***	Medium The concentration of houses increases the visual sensitivity of this landscape unit.
Unit 5 ***Recreation Resorts***	High Used for recreation and to enjoy views of the landscape.

Seen area analysis

A Seen Area Analysis shows those areas within the viewshed from which wind turbines, or sections of wind turbines, may be visible. The extent to which a wind farm is visible depends upon the nature of the intervening topography. A maximum tip height of 150m, with a tower height of 100m, was used for the analysis and as such represents a worst case scenario.

The Seen Area Analysis for the Yass Valley Wind Farm was based on 10m contour data, solely on topography. That is vegetation that could potential screen the visibility of the wind farm along roadsides and around dwellings was not considered in this analysis.

The table below shows the range of visibility options that have been mapped in this GIS based analysis.

It is important to note these zones are not exclusive. For example a location that has the potential to view a wind turbine in its entirety falls into Zone A. A viewer at this location would also be able to see "any part of the wind turbine blades" and therefore would also fall into Zone D.

Zone	Extent to which the wind turbines are visible
Zone A	One or more wind turbines in their entirety
Zone B	The entire swept path of the blades of one or more wind turbines
Zone C	At least half of the swept path of one or more wind turbines
Zone D	Any part of the wind turbine blades of one or more wind turbines

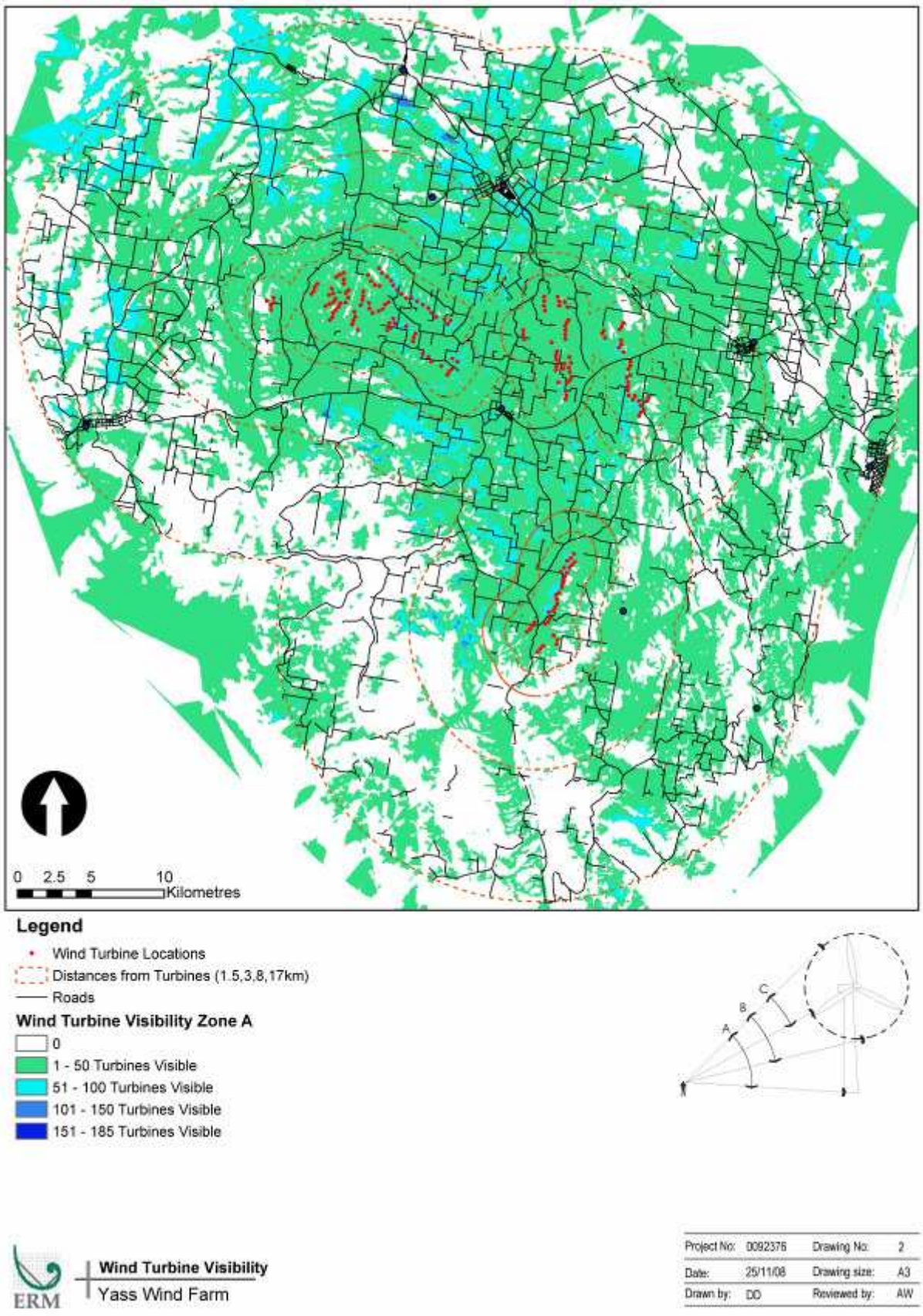


Figure 7-1: Turbine visibility Zone A

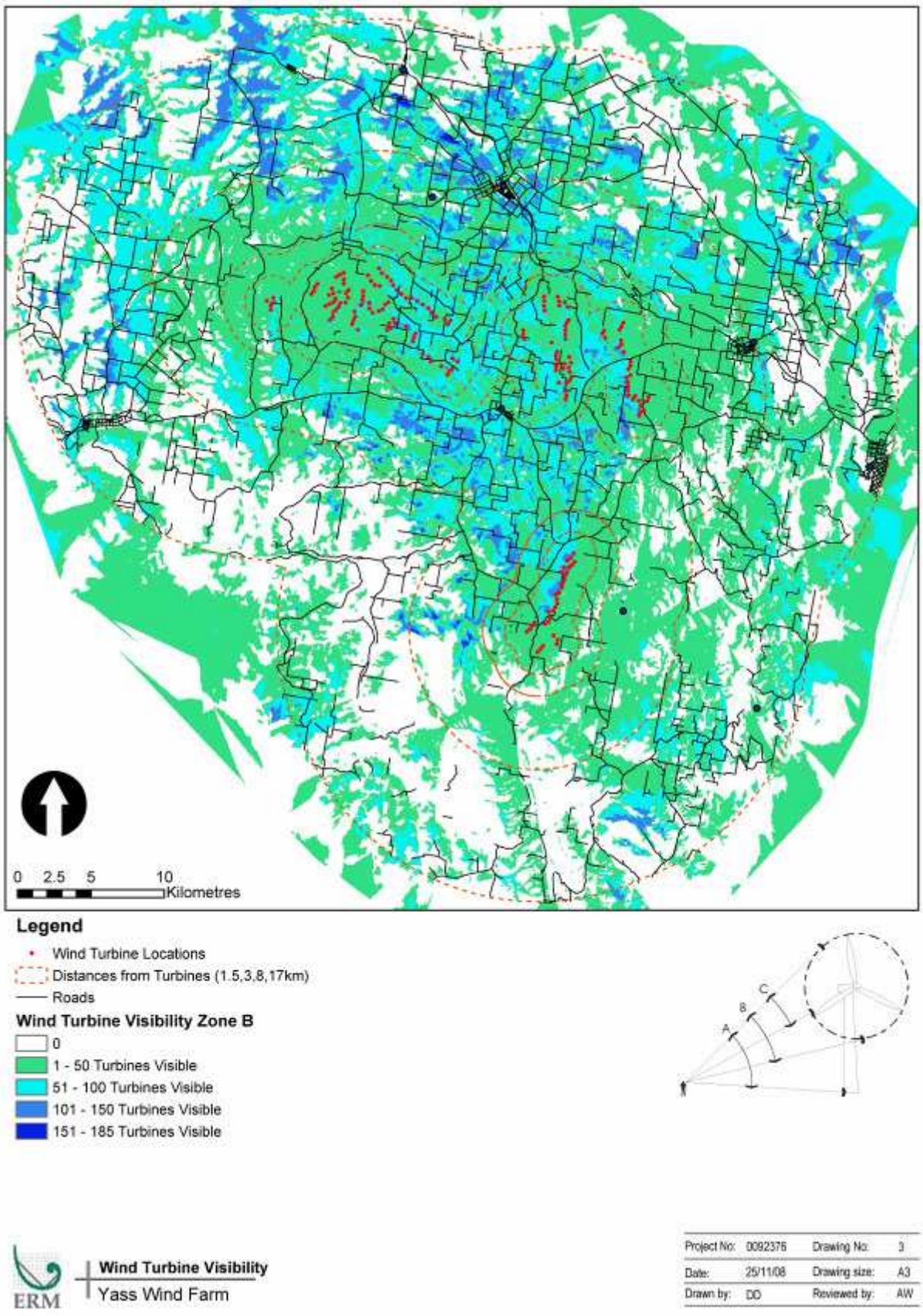


Figure 7-2: Turbine visibility Zone B

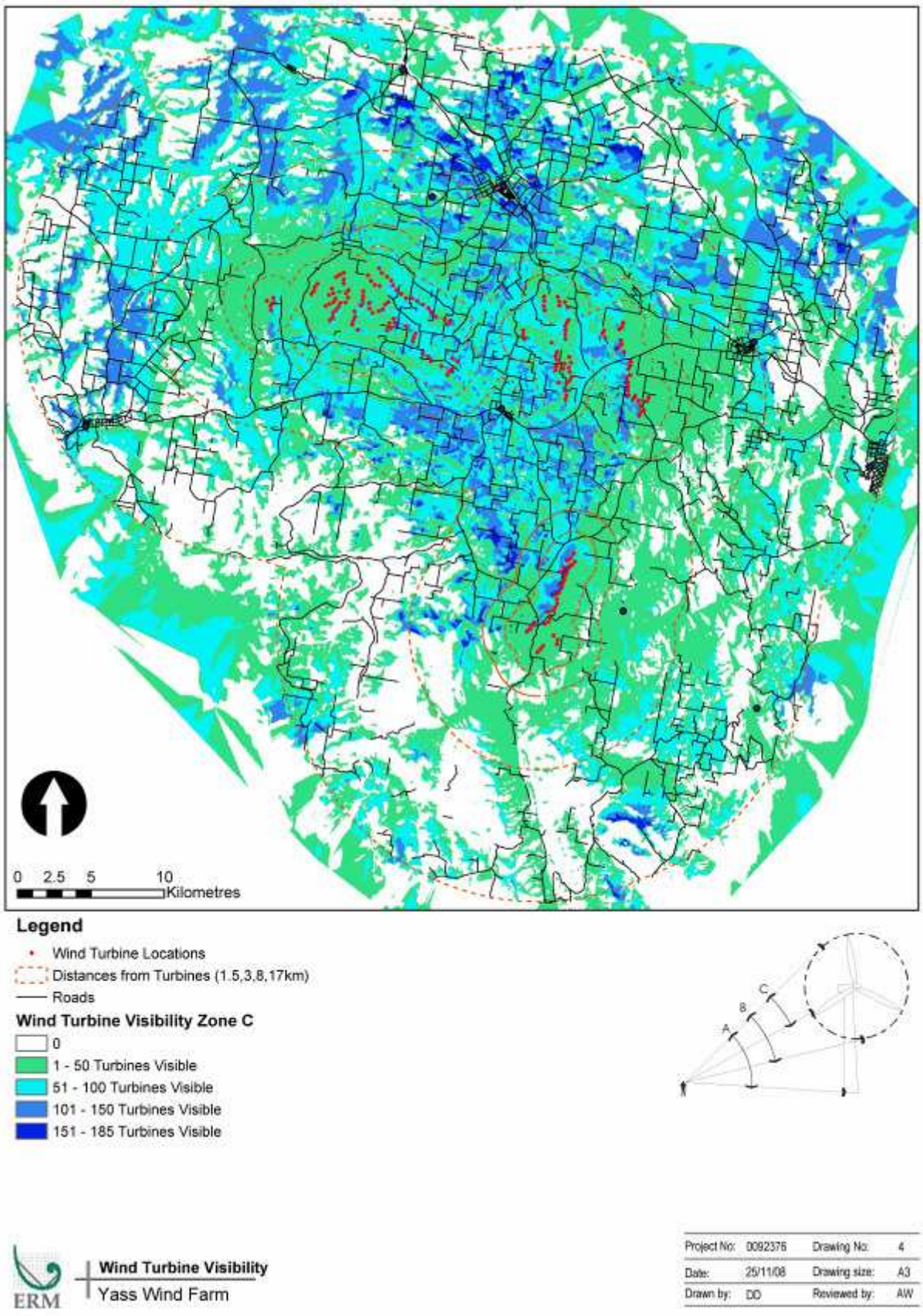


Figure 7-3: Turbine visibility Zone C

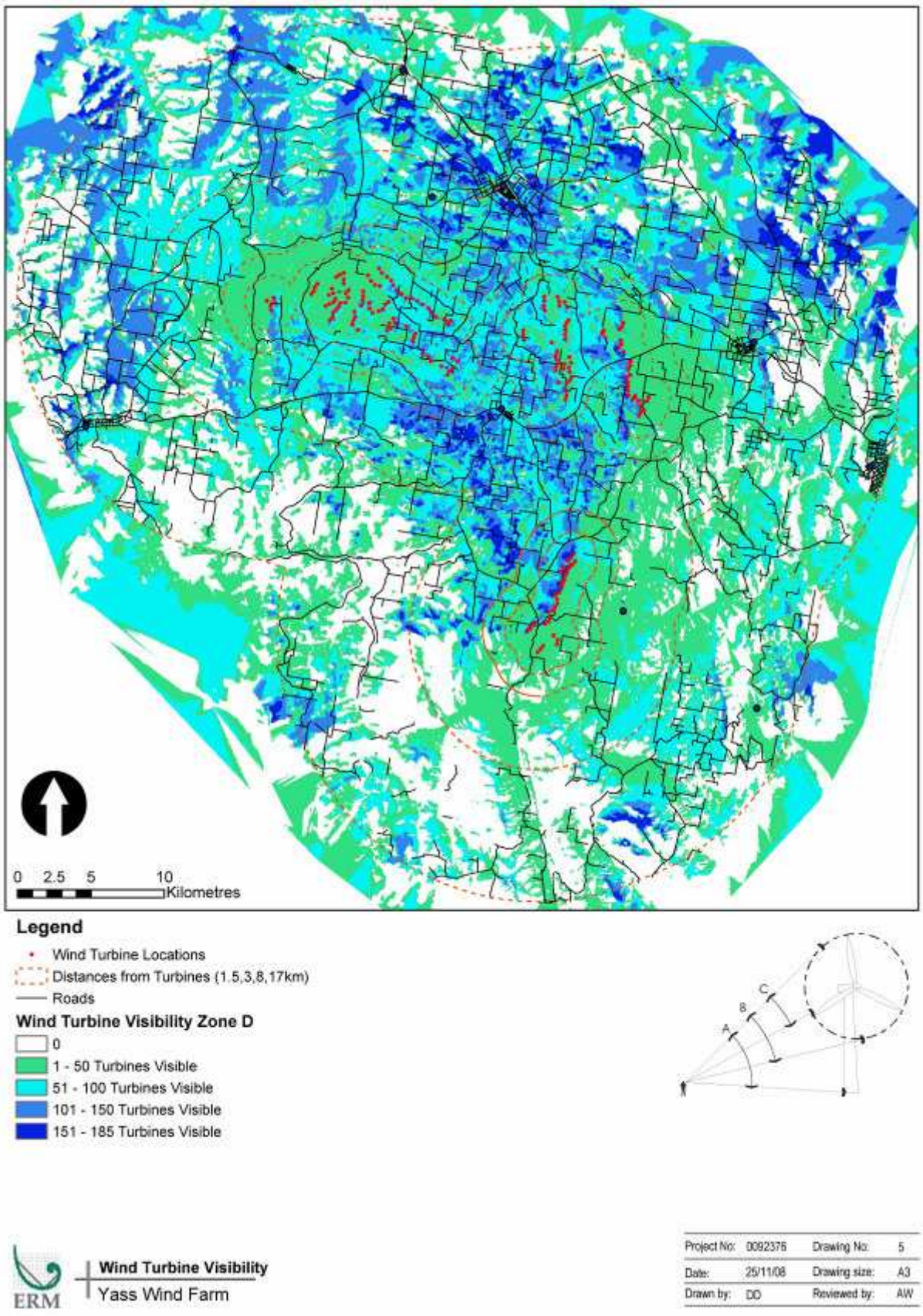


Figure 7-4: Turbine visibility Zone D

Publicly visible viewpoints

The selection of viewpoints in the LVA seeks to provide for a representative range of views from publicly accessible areas within the viewshed. These have been selected around the wind farm primarily in areas that were identified in the Zone of Visual Influence (ZVI) analysis from which viewers would be able to potentially see wind turbines while generally within 8.5 km of a wind turbine. Further details are provided in Section 7 of the LVA.

33 publically visible viewpoints have been selected in the areas of:

- Yass Township
- Hume Highway
- Coppabella Road
- Barramangra Road
- Talmo
- Illalong Road
- Burrley Griffin Way
- Yass Road
- Black Range Road
- Whitfields Road
- Binalong
- Garryowen Road

In addition to this, 11 sequential viewpoints were selected to assess the visual impact from the Hume Highway and Burley Griffin Way, refer to Section 8 of LVA for further details.

Within each assessment of the public viewpoints the following information was recorded and researched:

- Viewpoint location and description (including GPS co-ordinates and map)
- Distance from the viewpoint to the nearest wind turbine, turbine number and nearest visible wind turbine with turbine number
- Landscape unit description
- Image of the viewpoint location
- Landscape sensitivity and viewer numbers
- Photomontage if required

A summary of the publicly visible viewpoints and the overall conclusion as to the potential impact the wind farm on publicly accessible viewpoints identified that most of the potential visual impacts are of a minor or medium level. There are no locations within the public domain where the potential visual impact is assessed as high. In part this is because the majority of the surrounding landscape has been assessed as having a medium level of sensitivity and therefore the highest visual impact in these areas would be medium.

The main areas with higher levels of potential impact are along the Hume Highway and to a lesser extent along Burley Griffin Way. However the assessment of community perception within this Yass region, for many viewers using the highways the presence of the wind farm may be a positive element within the roadside vistas.

Photomontages have been prepared for 10 locations surrounding the site. Due to the resolution required to portray these montages, they are provided separately in Appendix C of the LVA. A selection has been extracted from the Visual Impact Assessment as an example.

Figure 7-5: Photomontage from viewpoint SVP1

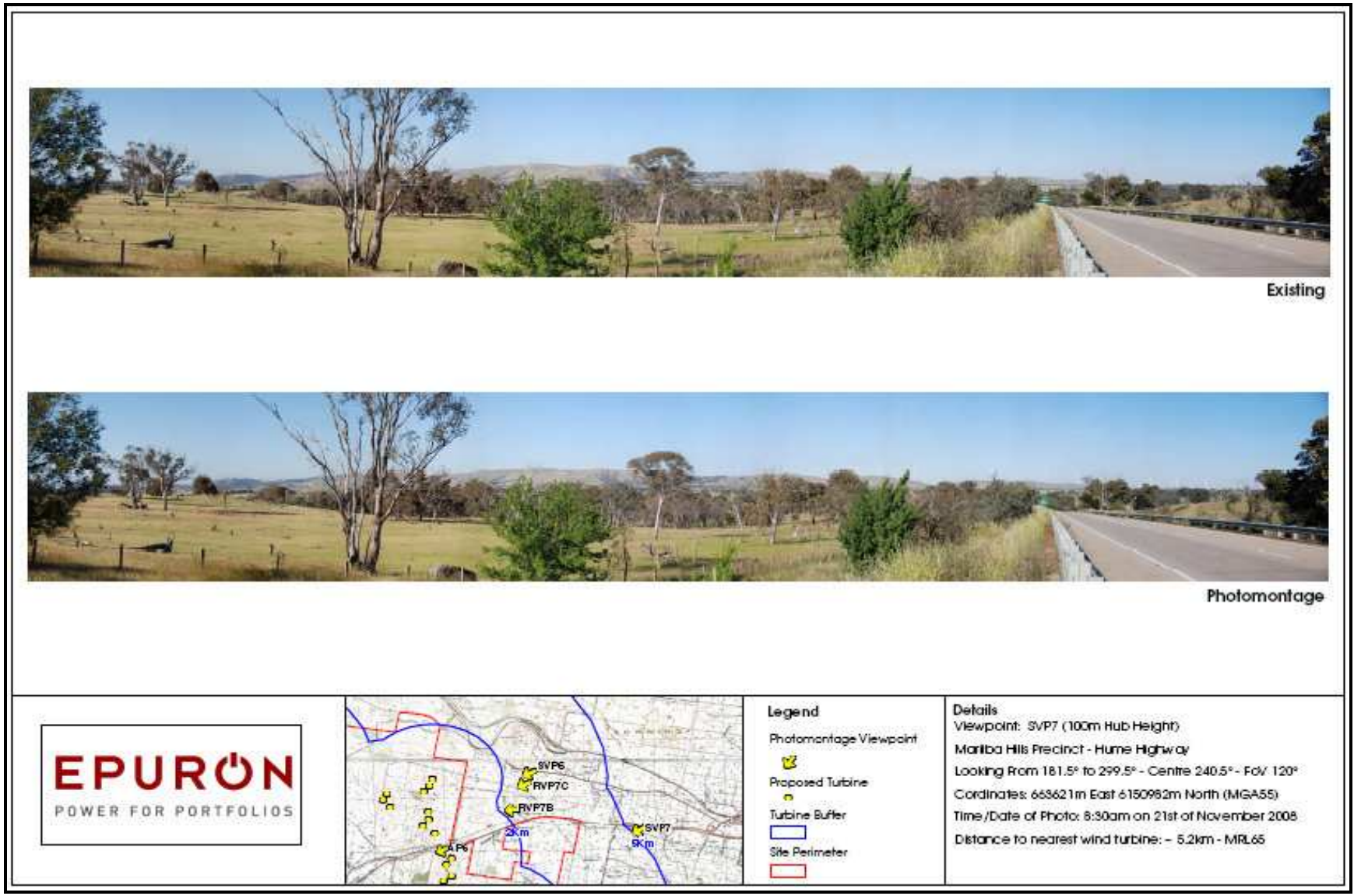


Figure 7-6: Photomontage from viewpoint SVP7

Residential Viewpoints

The LVA methodology used in this report is supported by past Victorian Planning Panel decisions and recent NSW Land and Environment Court decisions. The major impact of wind turbines on residential properties occurs where wind turbines are within 1.5 km; however, wind turbines can be dominant to 3km, with the greatest potential impact being to neighbouring non-participatory resident properties.

In total there are four non-participatory residences within 1.5km of all turbines. A residential impact assessment was conducted at eight residences, and a total of five montages were prepared for a selection of these residences. Further detail is provided in section 9 of the the LVA in Appendix 1.

The eight residential viewpoints are as follows

- "Tullyvale Hall" (House #G14)
- "The Pines"Goondah Road, Goondah (House #M02)
- 918 Burley Griffin Way" (House #M22
- "Gwandoban" (House #C53)
- "Naranghi" (House #C54)
- The Crisp Galleries, Hume Highway (House #C34)
- "Deepwater", Hume Highway, Bookham (House #C41)
- 55 Illalaong Road (House #C42)

Within each assessment of the residential viewpoints the following information was recorded and researched:

- Viewpoint location description (including GPS co-ordinates, map and aerial of the existing conditions of the residence)
- Distance from the viewpoint to the nearest wind turbine, turbine number and nearest visible wind turbine with turbine number
- Sensitivity of the house (eg. orientation, screening)

In these assessments of residential viewpoints the overall visual impact was typically assessed as being moderate to low when the wind turbines were visible and there was no existing screening. In part, this is because of existing vegetation or anthropogenically modified structures surrounding the residence, the residence orientation, the distance towards the wind turbines and the perception of the owners of the residence towards wind farms. Landscape mitigation possibilities for the residences with a higher visual impact also help reduce the impact of the wind farm on individual residences.

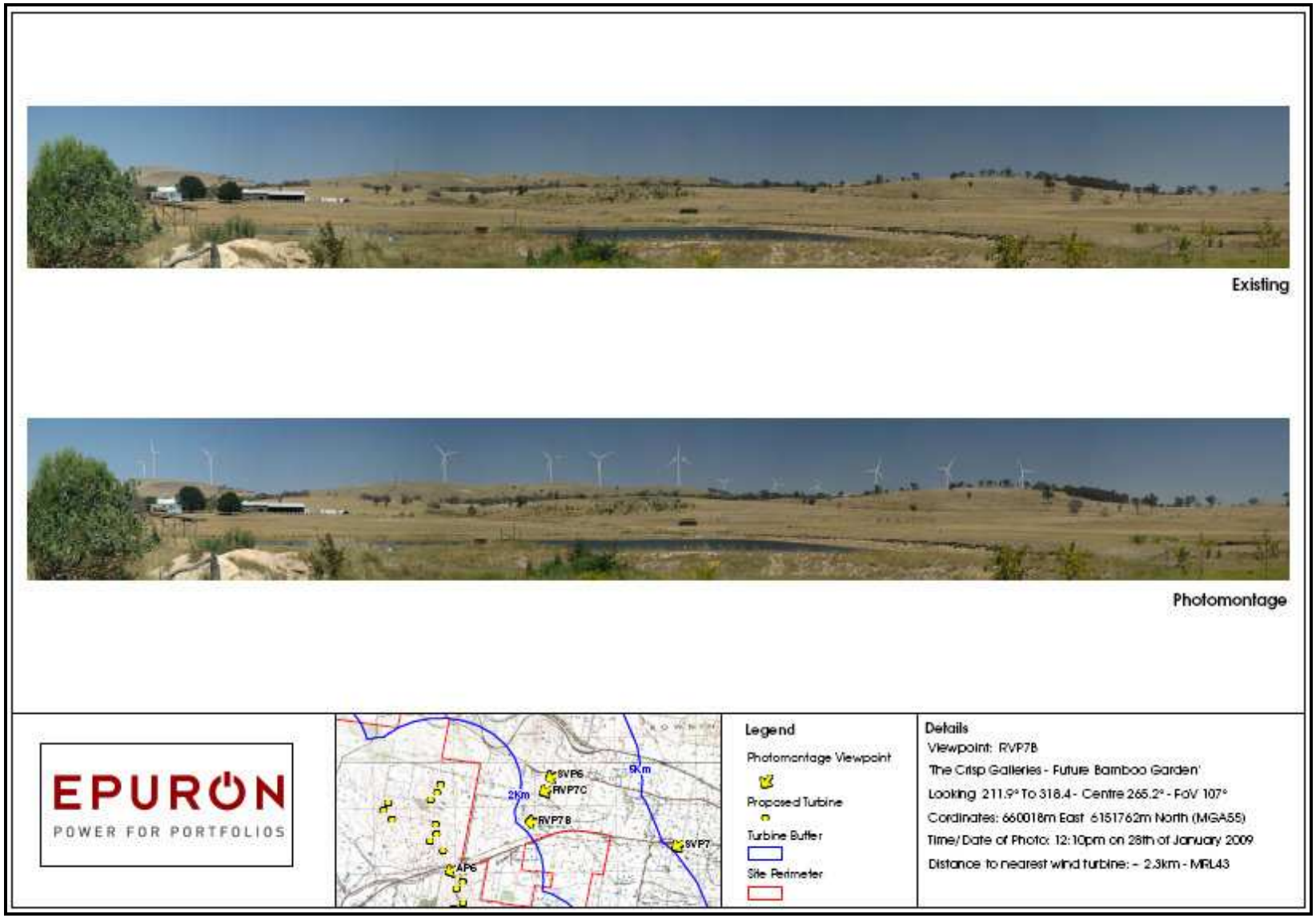


Figure 7-7: Photomontage from viewpoint RVP7B

Cumulative Impact

The presence of multiple wind farms in an area can create a cumulative visual impact. This can occur when either sequential and/or simultaneous views to wind turbines from publicly accessible viewpoints or from private viewing locations lead to change in a communities, resident's or visitor's perception of a region.

There are no locations within the township of Yass where one can perceive the Yass Valley Wind Farm. Therefore as there are no views to multiple wind farms from Yass there would be no direct cumulative impact on the township of Yass. The proposed Yass Valley Wind Farm would be visible from the townships of Bookham and Bowning, with limited views from Binalong. Therefore, there would be some cumulative impact on these townships cause by the construction of the Yass Wind Farm.

Wind turbines at the Gunning Wind Farm and the Yass Wind Farm may also be visible from the Hume Highway behind the Cullerin Range Wind Farm. However, as has been demonstrated previously, views from the Hume Highway to the Yass Wind Farm are very limited to the road between Bowning and some distance west of Bookham.

For these reasons, whilst it may be possible for more than one wind farm to be viewed while travelling through the Yass Valley, the cumulative impact would be minimal. The main impact on Highway users would remain the nearby Cullerin Range Wind Farm.

There may be a cumulative visual impact for users of roads near the Yass Valley Wind Farm and continuing past other wind farms. However these are typically small gravel roads, serving local farms and the cumulative impact would be negligible.

This assessment of the cumulative visual impact of the Yass Wind Farm has concluded that there would be minimal cumulative visual impact and that the changes to peoples' perception of the surrounding area would not be significantly changed by the presence of multiple wind farms in the locality.

Obstacle lighting

The assessment of the viewshed of the Yass Valley Wind Farm has identified the low density of occupants within the surrounding area as well as the relatively low usage of the local road network. In essence this has highlighted the fact that the wind farm is located in an area with little night time lighting – albeit with few night time viewers.

The Assessment of night lighting impact has been made with recourse to a limited number of trials have been undertaken in Victoria and experience from existing lighting at Mt Millar in South Australia. These trials have identified that the type of lights do make a difference to the visual impact; there are forms of lighting that can be used to reduce visual impact. Hazard identification lights are still an obvious element in the landscape, particularly where there are few light sources and these will be an obvious addition to the night panorama. There are few light sources in the proposed location of the Yass Valley Wind Farm. Wind turbines will therefore be an obvious addition to the night panorama. However, few light sources are also an indication of few viewers. If lights are required by CASA, it is considered that the solution constructed at Mt Millar provides an acceptable level of visual impact while providing the required level of night time hazard identification.

A cumulative impact can potentially be envisaged for travellers on the Hume Highway, passing multiple Wind Farms where hazard identification lighting may be visible. However, whilst the lighting may be visible, it will only be one further element in a traveller's experience which obviously includes the frequent presence of rear tail lights, headlights and lights from nearby houses and farms. As such the cumulative visual impact for these road users will be minimal. There would also be some residents located

in the area around the Yass Valley Wind Farm which may also be able to see the hazard identification lighting from other wind farms.

However, although residents may be able to see hazard identification lighting of multiple wind farms such impact would effect few houses, and be a relatively small visual impact because when people are at home at night and when inside lights are on, windows become mirrors, reflecting the interior of the house and not allowing views to the low level lights in the distance.

Obviously when curtains or blinds are closed, there is also no visibility to the proposed lights in the surrounding area. Therefore at night in most situations, a viewer needs to be outside to even see the proposed hazard identification lights.

For these reasons there would be negligible cumulative impact from the proposed hazard identification lighting if they were installed both at the Yass Valley Wind Farm and other wind farms in the vicinity.

7.2.4 Impact assessment - construction and decommissioning

Wind turbines are considered the most visually apparent element of the wind farm proposal. The proposal seeks wind turbines up to 150m tall to the blade tip, with the nacelle up to 100m from the ground level and blades with a total diameter of up to 100m.

The proposed wind farm would include a number of 33kV/132kV transformers. Each wind turbine would have its own transformer. Each turbine would then be connected by cabling to the substation. In general, the interconnecting cables would be underground.

Each precinct would require the following components:

- A substation
- A control building
- Office building
- A small car park to service the buildings
- Access tracks
- Aviation obstacle lighting (applicable if the wind turbines exceed 110 m above ground level)

Topsoil would be removed to a suitable founding layer.

The period from pre-construction through to completed tests following commissioning of the wind turbine generators is likely to be 24-36 months.

7.2.5 Impact assessment – operation

The landscape and visual assessment demonstrates that the proposed Yass Valley Wind Farm would generally have a low visual impact within the Yass locality and the surrounds of the Southern Tablelands in New South Wales. This area is known for high wind speeds and therefore has potential for wind energy projects.

The low visual impact conclusion is supported by the following issues that are discussed further in the LVIA included as Appendix 1):

- Perception studies, as detailed in the LVIA, demonstrating an increasing support of wind farms in the Yass locality and within Australia. The majority of viewers do not object to the construction of wind turbines on any but the most sensitive and localised landscapes.

- The proposed Yass Valley Wind farm is located in a modified landscape. This includes agricultural activity, associated structures and other forms of human intervention
- There is low visual impact on the surrounding townships. There are limited locations from which long distance views are available from the townships of Yass to the east and the villages of Bowning and Binalong to the east and north-east towards the wind farm.
- The main visibility is from the main roads. Although there would be views from the Hume Highway and the Burley Griffin Way, the overall impact is expected to be medium due to the predominately medium landscape sensitivity.
- There would be a visual impact on viewers using the minor roads within the Yass locality especially where these run along the wind farm precincts. Some lesser used (including unsealed) roads run along and through the proposed wind farm. However these roads have far fewer users than the major roads and highways. While there would be a visual impact from these roads, it is considered to be minor from the locations as the viewer numbers are low.
- The level of cumulative visual impact for users of Burley Griffin Way would be less as there are few opportunities for sequential wind farm views. It is therefore assessed as being a low adverse visual impact.
- Users of the Hume Highway would have views of the existing Cullerin Range Wind Farm and possibly the Gunning Wind Farm in addition to the proposed Yass Valley Wind Farm. However, it has been shown that views from the Hume Highway to the Yass Valley Wind Farm are very limited due to screening on the Highway between Bowning and some distance west of Bookham.
- The assessment of the cumulative visual impact of the Yass Valley Wind Farm has concluded that there would be minimal cumulative visual impact and that the changes to peoples' perception of the surrounding area would not be significantly changed by the presence of multiple wind farms in the locality.
- If obstacle identification lighting is required by CASA the visual impact would be low. The area already contains multiple night light sources.

7.2.6 Mitigation measures

This assessment concludes that there would be no need for management options to include planting along public roads as a visual mitigation measure; however a commitment is made to protect the visual amenity of residential properties.

SoC[10]	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
1	Deterioration of visual amenity at surrounding residences	Mitigate impacts	The proponent would offer vegetative screening of any residence within 3 km of a wind turbine. The proponent would write to the owner of each residence outlining the offer and process. A site visit would determine the extent and type of planting required Species selection would be determined in consultation with landholders using specialist advice. This offer would remain in place for a period of 1 year after project construction, to allow people time to either adjust or to decide that landscape filtering or screening is warranted. Planting would be completed within 2 years of completion of project construction.	Post Construction	OEMP	X	X
2	Deterioration of visual amenity at surrounding residences	Mitigate impacts	The Proponent would make reasonable efforts to locate powerlines, substations and control buildings in areas which minimise the visual impact where practical. Vegetative screening would be provided around substations and control buildings where they were visible from neighbouring residences.	Planning	DoP	X	X

[10] SoC: Statement of Commitment

7.3 OPERATIONAL AND CONSTRUCTION NOISE IMPACTS

7.3.1 Approach

A noise impact assessment was completed by an independent acoustic consultant for the Coppabella Hills and Marilba Hills Precincts of the proposed Yass Valley Wind Farm. The precincts were assessed by Marshall Day Acoustics Pty Ltd, and the entire report is presented in Appendix 2.1.

The noise impact assessment was undertaken in accordance with the South Australia Environmental Protection Authority, *Environmental Noise Guidelines: Wind Farms (2003)*, as requested in the Director-General's Requirements. The acceptability criteria is that the wind farm noise should not exceed the greater of, an amenity limit of 35dBA or existing background noise plus 5dBA.

New South Wales adopts the methodology and criteria from the SA EPA guidelines, and as such, this document has been used as the sole basis for assessing operational noise from the proposed Yass Valley Wind Farm. The approach of the assessments were as follows:

- Preliminary predictions of wind farm noise levels were modelled for each receiver using computer noise modelling software SoundPLAN. The results were used together with site photographs and topographical data to identify receiver locations that would be relevant for assessing the effects of wind farm noise from the development. Marshall Day selected eleven (11) receivers at Coppabella Hills and seven (7) receivers at Marilba Hills Precincts for background noise monitoring.
- All models generated as part of the noise assessment used the algorithm described in *IS9613-2: 1996 – Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*. This standard facilitates the prediction of noise levels through spherical spreading effects and directivity and allows for variables including screening, atmospheric absorption and ground attenuation.
- Background noise monitoring was conducted at each relevant receiver for a 2-week period equivalent to approximately 2000 data points. Simultaneous monitoring of local weather conditions was undertaken in order to determine periods of rainfall. Where it was determined that rainfall had occurred, the representative background noise data were excluded from the dataset. Extraneous noise was also excluded from the dataset.
- A regression analysis was performed on measured background noise data, with a third order polynomial giving a best-fit line representing the site-specific background noise level across the wind speed range of interest.
- The noise criteria for new wind farm developments, as stipulated by the South Australian EPA, were then applied to the derived background noise levels in the wind speed range of interest in order to determine noise limits at each receiver location.
- Finally, a comparison was made between the predicted wind farm noise levels and the noise limits determined in accordance with the SA Guideline for each receiver in order to establish compliance.

Assessment of construction noise has been conducted in accordance with the NSW DECC document *Environmental Noise Control Manual*. The noise criteria adopted for this development is that the L_{10} level measured over a period of not less than 15-minutes when the construction site is in operation should not exceed the background noise level (L_{90}) by more than 10dB.

A blasting noise and vibration assessment was conducted in accordance with ANZEC guidelines. Time of day, air-blast overpressure level and ground vibration peak particle velocity are all considered.

An outline assessment of construction vibration was conducted in accordance with the NSW DECC document *Assessing Vibration: a technical guide* (DEC2006/43), February 2006. In addition, for evaluation of vibration in buildings due to construction we have referred to British standard BS 7385 Part 2: 1993 *Evaluation and measurement for vibration in buildings Part 2. Guide to damage levels from ground-borne vibration*.

Noise from construction traffic on local roads was assessed in accordance with the NSW DECC's *Environmental Criteria for Road Traffic Noise (ECRTN)*.

7.3.2 Existing environment

In general there are very few residences that surround the Coppabella Hills Precinct with only five (5) dwellings located within 2 kilometres of the nearest turbine, all of which are involved with the project.

The Marilba Hills Precinct is located on two adjacent ridgelines which have been designated Marilba-1 and Marilba-2 within the noise assessment report (Appendix 2.1). There are very few residences in the surrounding areas with 15 dwellings located within 2km of the nearest turbine, eight (8) of which are involved with the project.

7.3.3 Impact assessment - construction and decommissioning

An impact assessment of the potential construction noise levels likely to occur during the construction phase of the project was undertaken. Construction tasks associated with the project include the following:

- Access road construction
- Turbine tower foundation construction
- Trench digging to accommodate underground cabling
- Assembly of turbine tower, nacelle and rotor blades.

The SA Guidelines require measurements to be conducted in 10 minute intervals, while the NSW *Industrial Noise Policy* request 15 minute interval data. Given that almost all wind data, including the wind farm site monitored data, is in 10 minute intervals, this period was used for all measurements.

Results from the construction noise assessment indicated that the predicted noise levels associated with the use of a variety of different machinery during the construction of the wind farm would comply with the limits described in the Environmental Noise Control Manual (NSW EPA, 2004).

The predicted construction blasting noise and vibration levels have been found to comply with ANZEC guidelines. A maximum instantaneous charge (MIC) of approximately 30kg is recommended.

The predicted construction vibration levels have been found to comply with DECC guidelines at all receiver locations.

7.3.4 Mitigation measures

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
3	Construction noise	Minimisation	The Proponent will employ appropriate noise reduction strategies to ensure the recommendations of the NSW Environmental Noise Control Manual are met. Strategies may include the re-orientation of machinery, rescheduling of noisy activities, installation of temporary noise barriers, improved vehicle noise control and the use of 'quiet work practices' (such as reducing or relocating idling machinery).	Detailed design	CEMP	x	x
4	Construction noise	Minimisation	The Proponent would only undertake construction activities associated with the project that would generate audible noise at any residence during the hours: • 7:00 am to 6:00 pm, Monday to Friday, • 8:00 am to 1:00 pm Saturday; and • At no time on Sundays or public holidays	Detailed design	CEMP	x	x
5	Construction noise	Minimisation	Meet ANZECC guidelines for control of blasting impact at residences.	Detailed design	CEMP	x	x

7.3.5 Impact assessment – operation

Two turbine types have been considered and modelled for the purpose of this assessment. A representative turbine (REpower MM92) has been modelled to demonstrate that SA EPA guidelines are achievable with the proposed indicative layout, and a worse case turbine (Vestas V90 3MW) has been modelled to show the maximum potential noise impact.

In total 50 dwellings were considered for the Coppabella Hills Precinct, with 11 receivers being selected for background noise monitoring. Over 70 dwellings were assessed for the Marilba Hills Precinct, with 7 receivers being selected for background noise monitoring. The methodology and justification for the selection of these receivers is detained in Section 5 of the Noise Impact Assessment (NIA) (Appendix 2.1).

The assessment of all receivers located within 5km of the proposed wind farm was found to be fully compliant in accordance with SA EPA and World Health Organisation guideline criteria when using the REpower MM92. The results from the worst case scenario, modelling the V90 3MW, showed that there is marginal exceedence (within the 3dB error margin of the model) would be experienced at several receiver locations. Noise mitigation measures would need to be implemented which could include operating the turbine in a noise reduced mode or switching the turbine off under certain conditions. Table 11 of the NIA (Appendix 2.1) summarises the results of the assessment for relevant receivers.

Tests for tonality have been independently conducted on behalf of the turbine manufacturers in accordance with *IEC-61400-11*. For the wind speed range analysed (6–10 m/s) tonality was not deemed to be audible (ΔLta <-3) and hence no penalty was applied. Infrasound is not tested as an obligatory part of IEC 61400-11. It should be noted that in general modern WTGs do not exhibit significant infrasound emissions.

A total of three substation options on the Coppabella Hills Precinct and two options on the Marilba Hills Precinct have been modelled for the assessment of transformer noise. The assessment assumed dual 100MW transformers at all locations.

MDA has estimated the sound power level of each transformer as 102dBA. This level has been estimated from Australian Standard AS2374.6-1994 *–Power transformers – Determination of transformer and reactor sound levels.*

Predicted noise levels from the transformer installations are expected to be below existing ambient background.

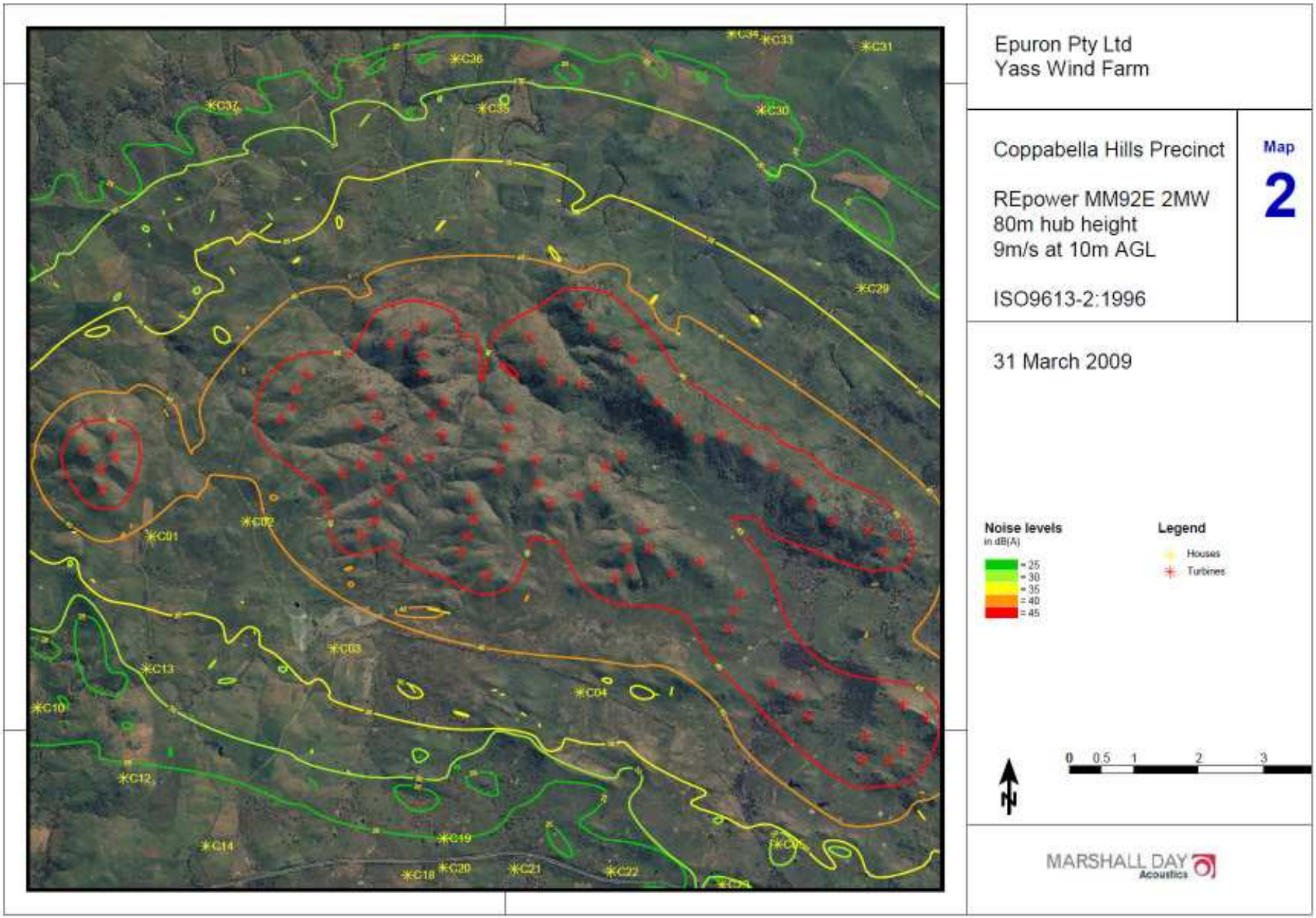


Figure 7-8: Predicted noise plot for turbine type MM92 – Coppabella Hills Precinct

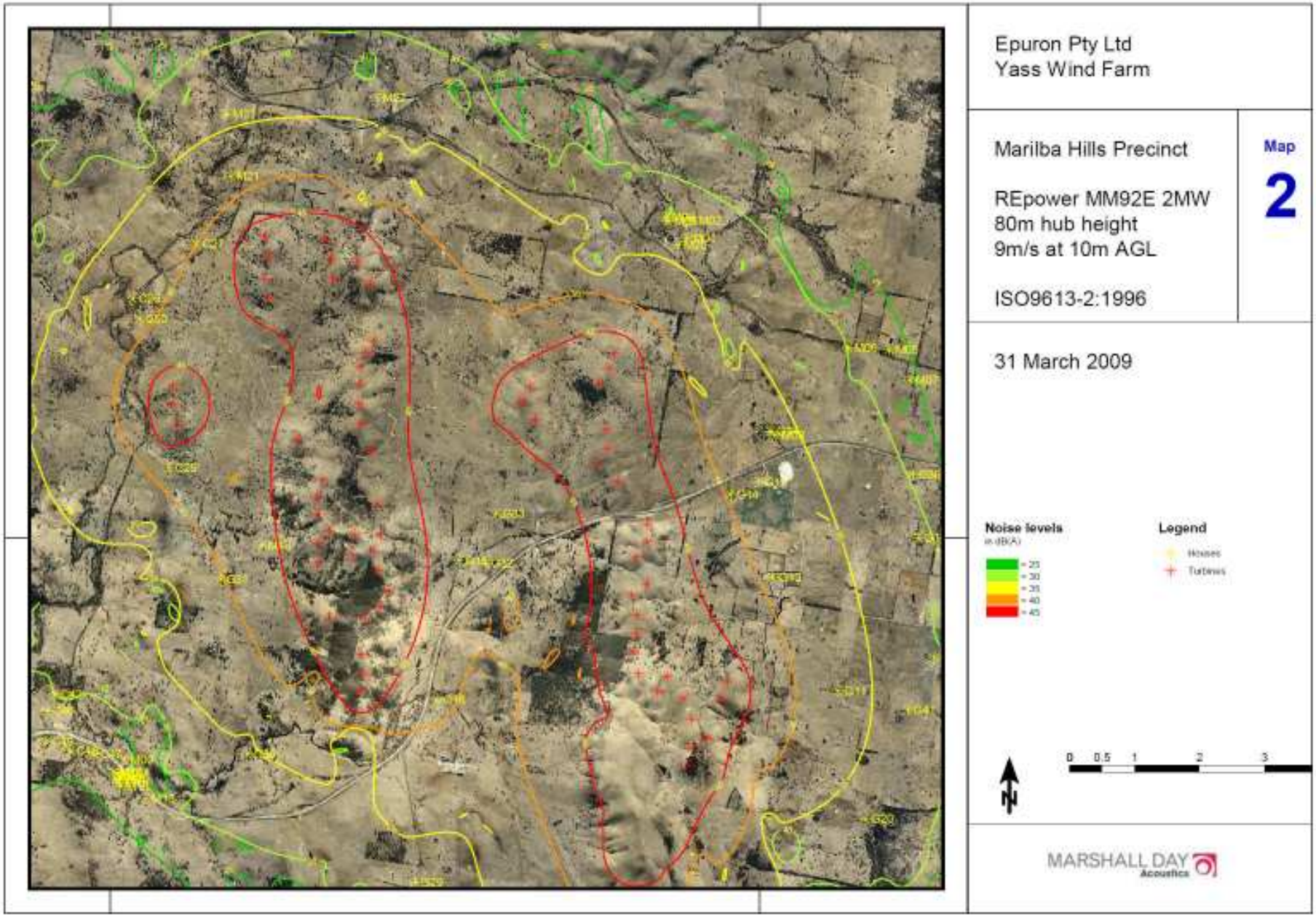


Figure 7-9: Predicted noise plot for turbine type MM92 – Marilba Hills Precinct

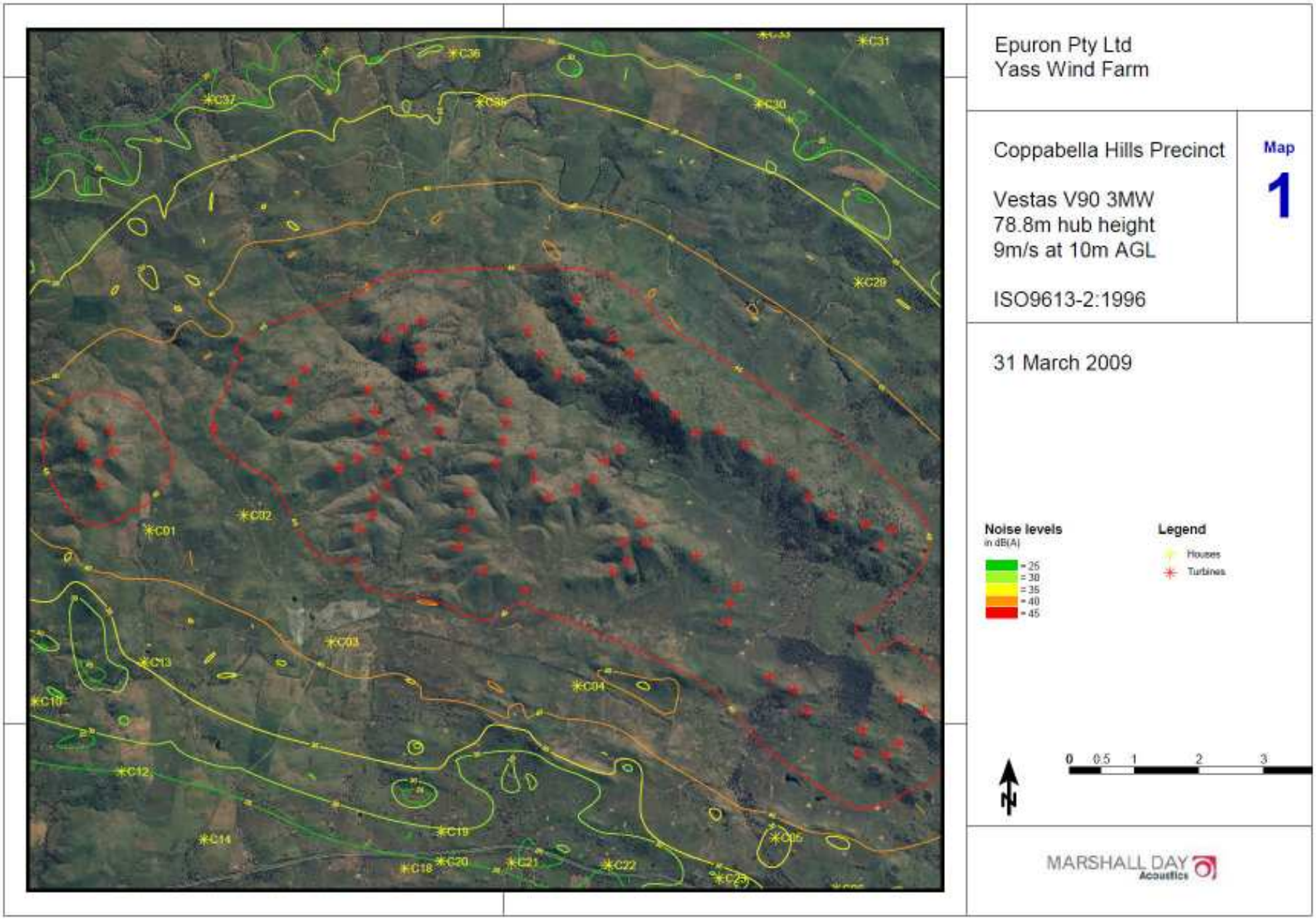


Figure 7-10: Predicted noise plot for turbine type V90 – Coppabella Hills Precinct

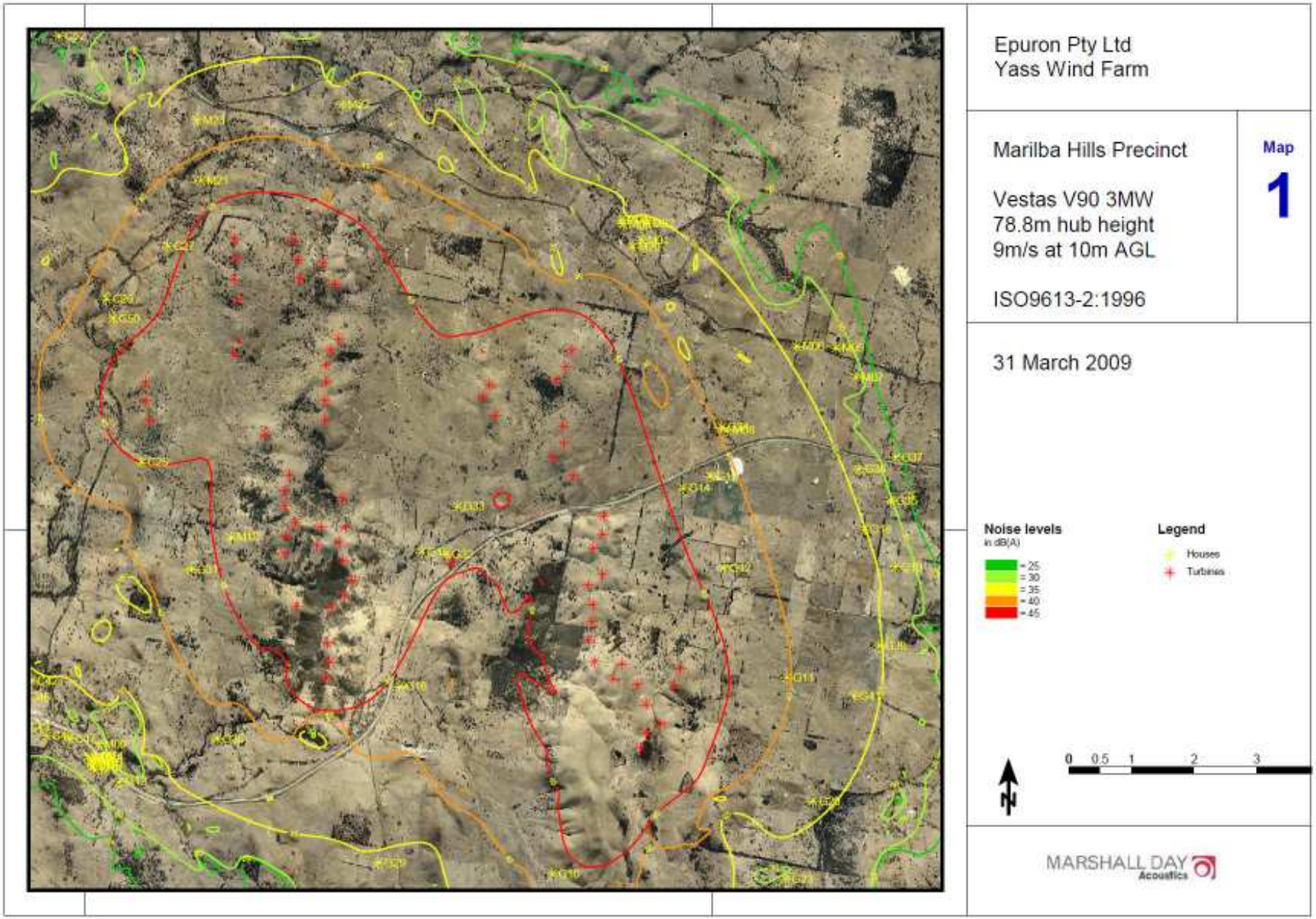


Figure 7-11: Predicted noise plot for turbine type V90 – Marilba Hills Precinct

7.3.6 Mitigation measures

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
6	Operational noise	compliance	The Proponent will ensure final turbine selection and layout complies with the SA EPA Noise Guidelines of 35 dB(A) or background plus 5 dB(A) (whichever is higher) for all non-involved residential receivers. (other than those which have entered into a noise agreement with the Proponent in accordance with the SA EPA Noise Guidelines)	Detailed design	OEMP	x	x
7	Operational noise	Compliance	The Proponent will ensure final turbine selection and layout complies with the World Health Organisation Guidelines for Community Noise requiring 45 dB(A) or background plus 5 dB(A) (whichever is higher) for all involved residential receivers and all non-involved residential receivers which have entered into noise agreement with the Proponent in accordance with the SA EPA Noise Guidelines	Detailed design	OEMP	x	x
8	Operational noise	Compliance	Prior to construction, the Proponent will prepare and submit to the Department of Planning a noise report providing final noise predictions based on any updated background data measured, the final turbine model and turbine layout selected, to demonstrate compliance with the relevant guidelines for all residences	Detailed design	OEMP	x	x
9	Operational noise	Mitigate	If operational monitoring identifies exceedances, the Proponent would give consideration to providing mechanical ventilation (to remove the requirement for open windows), building acoustic treatments (improving glazing) or using turbine control features to manage excessive noise under particular conditions.	Detailed design	OEMP	x	x
10	Operational noise	compliance	Develop and implement an operational noise compliance testing program.	Detailed design	OEMP	x	x

7.4 FLORA AND FAUNA

7.4.1 Approach

A separate biodiversity assessment was undertaken to document the existing environment and evaluate potential biodiversity impacts at each precinct: Coppabella Hills and Marilba Hills. Each assessment is appended in full in Appendix 3.1 and 3.2, respectively. The assessments were undertaken in the following stages, following the Guidelines for Threatened Species Assessment (DEC and DPI 2005) for development applications assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*:

Steps in the assessment process

Preliminary assessments: Desktop analysis and a short site visit were undertaken to identify dominant vegetation types and habitat features, species and communities of conservation significance which may be present in the study area and obtain site information necessary to plan and design the field survey. The regional context of the proposal is also documented, as specific characteristics of wind farm development, such as the height of infrastructure and extensive length of transmission and access corridors, suggest the potential for impacts to extend well beyond the proposed site. District scale habitat features, such as movement corridors, are identified in this process.

Field survey: All parts of the site which have potential to carry infrastructure, termed the 'development envelope' (DE) were subject to field assessment, rather than a focus on one final infrastructure layout. The development envelope approach allows fine-scale development planning and site decisions to be informed by the findings of the assessment. For example, high biodiversity values areas can be identified and avoided early in the project design process. It also provides resilience to layout alterations, which are commonplace in wind farm development.

Comprehensive field surveys[11] were undertaken using dedicated botanical and zoological teams[12]. Surveys were stratified based on vegetation type, condition and landscape position[13] and aimed to determine the likelihood for threatened species, populations and communities to occur and be affected by the proposal. Table 7-4 Table 7-4: Survey timing and effort summary by precinct

summarises the survey methods and effort employed at each precinct.

Constraints mapping and impact assessment: The results of the field survey were documented, and potential for impacts evaluated in three separate reports; one per precinct. Recommendations were made to avoid high constraint areas where possible and to minimise and offset impacts where avoidance was not possible.

[11] Detailed survey methodologies are described in each biodiversity assessment, Sections 5.1 Flora methods and 6.1 Fauna methods (located in Appendix 3.1: Coppabella Hills Precinct and Appendix 3.2: Marilba Hills Precinct).

[12] The roles, qualifications and experience of team members are provided in Section 11 of the Coppabella Hills Precinct Biodiversity Assessment and Section 10 of the Marilba Hills Precinct Biodiversity Assessment.

[13] Survey effort is overlaid on the development envelope in each biodiversity assessment; Figure 5.1 of the Coppabella Hills Precinct Biodiversity Assessment and Map Set 1 of the Marilba Hills Precinct Biodiversity Assessment.

Where potential for significant impact was identified, Assessments of Significance (pursuant to the NSW *Threatened Species Conservation Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, as appropriate) were undertaken to characterise the significance of the impact.

Iterative assessment and offsetting:

nghenvironmental provided biodiversity advice on several layout revisions, as the infrastructure placement was varied to reflect overlaying constraints, including biodiversity constraints. Follow-up visits and separate investigations were undertaken where further investigation was required. Where high impact areas could not be avoided, specific mitigation measures have been formulated as Statements of Commitment, including the requirement for further assessment in some cases. The preparation of an Offset Plan, pending finalisation of the infrastructure layout, forms one such Statement of Commitment. The aim of the Offset Plan is to ensure a net environmental improvement is obtained for the proposal.

Survey effort, timing and optimality

The main survey was undertaken in September 2008, following good rains about a month previously. A follow-up November survey was undertaken to better target grass species, difficult to identify in spring. Some species which flower in response to irregular disturbance events such as fire will have gone unrecorded. Cool evenings in September did not prove optimal for some species of fauna (particularly reptiles and microchiropteran bats). Follow-up January 2009 surveys were undertaken to address this limitation.

Additional research

Additional research was undertaken to inform the conclusions of threatened species impact evaluations. This included the preparation of a literature review, specific to wind farm risk to birds and bats. Furthermore, a recommendation of both biodiversity assessments was the need to understand more about the use of the sites by microbats. To address this recommendation, a further microbat survey was undertaken. Both of these additional reports are appended to this EA: Appendix 3.3 *Wind Farm Risks to Birds and Bats*, and Appendix 3.4 *Microbat Study: Proposed Yass Valley Wind Farm*. The latter was also subject to a peer review by Greg Richards (Australian bat specialist), May 2009. This additional research has informed the assessment of impact and development of mitigation measures.

Precautionary principle

The survey effort across both precincts was considered by the authors of these reports to have been appropriate to the identification of biodiversity constraints and the assessment of the significance of potential impacts. Uncertainty is addressed by applying the precautionary principle. That is, lack of detection was not grounds to rule out any species. If suitable habitat and local records were present, the species was assumed to be present and a precautionary course of action was recommended.

Table 7-4: Survey timing and effort summary by precinct

Precinct:	Coppabella Hills, Development Envelope = 2829.10 Hectares	Marilba Hills, Development Envelope = 4140.00 Hectares
Preliminary site visit	1-3 September 2008 One botanist, two project officers	1-3 September 2008 One botanist, two project officers
Main survey	16-22 September 2008 Two botanist and one technical assistant (60 person hours in total). In each vegetation type, plot-based quadrats, random meanders (after Cropper 1993), spot inspection and condition assessments were undertaken. Vegetation types were assigned after Thomas et al. (2000) and Gellie (2005). Fauna team consisted of two Biodiversity Project Officers (responsible for fauna survey; 4 days each onsite) and one technical assistant (responsible for habitat assessment; 2 days onsite). Mammal trapping 210 trap nights Bird census 17.5 person hours Reptile searches 11.5 person hours Frog census 6 person hours Call play-back 3.25 person hours Spotlighting 5 person hours Anabat 5 overnight surveys Habitat evaluation 37 surveys	26-28 March 2007 (Cluster 7 only) Mammal trapping 24 trap nights Bird census 4 person hours Reptile searches 1.5 person hours Nocturnal surveys 40 person hours Anabat 3 overnight surveys 16-22 September 2008 (remainder of site) Two botanists and one technical assistant (58 person hours in total). In each vegetation type, plot-based quadrats, random meanders (after Cropper 1993), spot inspection and condition assessments were undertaken. Vegetation types were assigned after Thomas et al. (2000) and Gellie (2005). Fauna team consisted of two Biodiversity Project Officers (responsible for fauna survey; 4 days each onsite) and one technical assistant (responsible for habitat assessment; 2 days onsite). Mammal trapping 216 trap nights Bird census 3 person hours Reptile searches 7.75 person hours Nocturnal surveys 3.23 person hours Anabat 3 overnight surveys Habitat evaluation 17 surveys
Follow up surveys	6-7 November 2008 Additional vegetation surveys, habitat assessments and reptile surveys 19-23 January 2009 Additional microbat surveys[14] (2 overnight surveys) 9-11 March 2009 Additional flora and habitat evaluation (6) for new transmission option	8-9 November 2008 Additional vegetation surveys and habitat assessment 19-23 January 2009 Additional microbat surveys (2 overnight surveys) and nocturnal surveys 9-11 March 2009 Additional flora and habitat evaluation (6) for new transmission option

[14] The additional microbat surveys were documented as a stand-alone report, Appendix 3.5 *Microbat Study: Proposed Yass Valley Wind Farm.*

7.4.2 Existing environment

Regional context

Much of the sub-catchment has been cleared of woodland vegetation, particularly evident in the north of the sub-catchment, with remaining remnants small and disconnected. Within this landscape, roadside corridors, travelling stock routes and riparian vegetation are likely to provide important connectivity.

Several reserves are located within close proximity of the site. These include Burrinjuck Nature Reserve and Burrinjuck Waters State Park, Hattons Corner Nature Reserve, Wee Jasper Nature Reserve and Brindabella National Park and State Conservation Area.

A major east-west riparian corridor crosses approximately 15km south of the precincts, following the Murrumbidgee River west, the Lake Burrinjuck system centrally, fed by the Yass River and Goodradigbee River to the east.

Four maternity caves for the vulnerable Eastern Bent-wing Bat (TSC Act) are known in NSW. One is the Church Cave at Wee Jasper, approximately 35km 'as the bat flies' south of the precincts.

Coppabella Hills Precinct

Vegetation and disturbance within the precinct

Three broad groupings of Box-Gum woodland and derived native pasture occur in this precinct: box-gum woodland, long-leaved box-red stringybark dry shrub/grass forest and riparian river red gum forest.

Forests and woodlands in the precinct have been progressively ring-barked and felled over the past two centuries to provide pasture. Clearing and agriculture has produced a range of direct and indirect impacts to flora habitats, including altered microclimate, loss of pollinator and dispersal fauna, erosion of soils, particularly wind erosion from exposed ridge tops, elevated soil nutrients and rising saline groundwater. Agricultural activities have also resulted in the colonisation of a range of introduced plant species.

Flora and fauna recorded within the precinct

A total of 165 vascular plant species were recorded during the flora survey, including 51 exotic species. A full list of species recorded in the eleven survey zones (Clusters 1-10 and the potential offset area), and their typical cover/abundance. One threatened species: Yass Daisy *Ammobium craspedioides* was identified at the subject site.

Ninety-four vertebrate species were recorded during the surveys. This included 65 birds, 17 mammals, 8 reptiles and 4 frog species. The highest fauna species richness was recorded from woodland habitats (45 species), followed by wetland habitats (40 species), disturbed woodland (39 species) and ridges (19 species). Threatened fauna included the Superb Parrot *Polytelis swainsonii* and Diamond Firetail *Stagonopleura guttata*.

Marilba Hills Precinct

Vegetation and disturbance within the precinct

Remnant native vegetation derived from two Southern Region dry shrub/grass forest types and several box gum woodland types is present in the precinct. The vegetation types which most closely correspond to remnants in the precinct include box-gum woodland and derived grassland, long-leaved box dry grass forest and broad-leaved peppermint/ brittle gum dry grass forest.

The subject site has been impacted by agricultural activities including clearing, grazing and, in lowland areas, ploughing and pasture improvement. In heavily grazed and sheep camp areas on some ridge rests, asteraceous weeds such as Capeweed and thistles, Paterson's Curse and European Nettle dominate. In less disturbed areas with a tree canopy the most common exotic species at the time of the spring survey were annuals, particularly Chickweed and Quaking Grass.

Flora and fauna recorded within the precinct

A total of 232 vascular plant species were recorded during the flora survey, including 73 exotic species. One threatened species, the Yass Daisy (*Ammobium craspedioides*), was identified at the subject site.

In total, 107 vertebrate fauna species were recorded during the surveys. This comprises 62 birds, 11 terrestrial and arboreal mammals, 12 microbats, 17 reptiles and 5 frog species. The highest fauna species richness was recorded from woodland habitats. Threatened fauna included the Superb Parrot *Polytelis swainsonii,* Speckled Warbler *Pyrrholaemus saggitatus,* Diamond Firetail *Stagonopleura guttata* and Eastern Bentwing Bat *Miniopterus schreibersii.*

Table 7-5: Key biodiversity features by precinct

Precinct	Coppabella Hills Precinct	Marilba Hills Precinct
Vegetation		
Vegetation types	Box-gum woodland, long-leaved box-red stringybark dry shrub/grass forest and riparian river red gum forest.	Box-gum woodland and derived grassland, long-leaved box dry grass forest and broad-leaved peppermint/brittle gum dry grass forest.
Vegetation of conservation significance	**Box gum woodland** Falls into the TSC Act definition of EEC. Three areas would also fall into the EPBC Act definition of CEEC. **Dry grass** Falls in to the TSC Act definition of EEC. One small area would also fall into the EPBC Act definition of CEEC. **Pasture** Where native species are dominant, these areas would fall into the TSC Act definition of EEC (derived from Box Gum Woodland)[15].	**Box gum woodland** The majority of the site belongs to the box-gum woodland EEC listed under the TSC Act, including Yellow Box, Blakely's Red Gum or White Box stands and treeless areas (native pasture) dominated by native grasses. Given their landscape context and floristics, long-leaved box stands have also been included within the EEC. Several areas also qualify under the EPBC Act definition of CEEC on the basis of groundcover diversity or patch size/tree density.
Noxious weeds	Devil's Claw, Paterson's Curse Scotch Thistle, Sweet Briar Blackberry, Serrated Tussock	Paterson's Curse, Horehound Scotch Thistle, St John's Wort Serrated Tussock, Sweet Briar Blackberry, Yellow-flowered Devil's Claw
Threatened or significant species		
Flora	Yass Daisy	Yass Daisy
Fauna	Superb Parrot, Diamond Firetail, Rainbow Bee-eater	Superb Parrot, Speckled Warbler, Diamond Firetail, Rainbow Bee-eater, Satin Flycatcher, Eastern Bent-wing Bat[16]

[15] The broad definition of the Act would see much of the Coppabella and Marilba development envelopes designated as low or moderate EEC. No areas without tree cover would be considered high quality at either precinct.

[16] Recorded outside of the occupation period of the Wee Jasper maternity cave.

Maps sets

Maps sets included within each Biodiversity Assessment contain the following information:

Flora and fauna survey sites

Ecological communities, vegetation condition and significant flora features

Fauna habitat and significant fauna features

Biodiversity constraints mapping

The size of the precincts necessitates multiple maps per precinct (Coppabella – 9 maps, Marilba – 5 maps) and for this reason they have not been provided in the EA. Please refer to the Appendix 3.1 Coppabella Hills Precinct Biodiversity Assessment (Figures 5.1, 5.6, 6.1, 7.1), the Appendix 3.2 Marilba Hills Precinct Biodiversity Assessment (Map sets 1-4).

7.4.3 Threatened species assessments

Where potential for construction or operation related impact was present, Assessments of Significance, pursuant to NSW and Commonwealth legislation, were undertaken to characterise the significance of the impacts. These included assessments for the following species:

Table 7-6: Listed species with potential for impact

Scientific Name	Common Name	Listing[17]	Coppabella Hills	Marilba Hills
FLORA				
Ammobium craspedioides	Yass Daisy	V, v	x	x
Thesium australe	Austral Toadflax	E, e		x
Caladenia sp *Burrinjuck*	Burrinjuck Spider Orchid	E, e	x	x
Cullen parvum	Small Scurf-pea	E		x
Swainsona sericea	Silky Purple Pea	V		x
ECOLOGICAL COMMUNITIES				
White Box Yellow Box Blakely's Red Gum Woodland (TSC Act) / Yellow Box – White Box- Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (EPBC Act)		EEC, ceec	x	x
FAUNA				
Oxyura australis	Blue-billed Duck	V	x	x
Ardea ibis	Cattle Egret	m	x	
Haliaeetus leucogaster	White-bellied Sea-Eagle	m	x	
Pyrrholaemus saggitatus	Speckled Warbler	V	x	x
Lophoictinia isura	Square-tailed Kite	V	x	x
Stagonopleura guttata	Diamond Firetail	V	x	x
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	x	x
Grantiella picta	Painted Honeyeater	V	x	x
Xanthomyza phrygia	Regent Honeyeater	E, e, m	x	x
Melithreptus gularis gulari	Black-chinned Honeyeater (eastern subspecies)	V		x
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	x	x
Callocephalon fimbriatum	Gang-gang Cockatoo	V	x	x
Lathamus discolor	Swift Parrot	E, e, m	x	x

[17] V: Vulnerable *TSC Act*, E: Endangered *TSC Act*, EEC: Endangered Ecological Community *TSC Act*, v: Vulnerable *EPBC Act*, e: Endangered *EPBC Act*, ceec: Critically Endangered Ecological Community *EPBC Act*

Scientific Name	Common Name	Listing[17]	Coppabella Hills	Marilba Hills
Neophema pulchella	Turquoise Parrot	V	x	x
Polytelis swainsonii	Superb Parrot	E, e	x	x
Ninox connivens	Barking Owl	V	x	x
Hirundapus caudacutus	White-throated Needletail	m	x	
Merops ornatus	Rainbow Bee-eater	m	x	
Petaurus norfolcensis	Squirrel Glider	V	x	x
Phascolarctos cinereus	Koala	V	x	x
Chalinolobus picatus	Little Pied Bat	V	x	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	x	
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	x	x
Myotis adversus	Large-footed Myotis	V	x	x
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	x	x
Suta flagellum	Little Whip Snake	V	x	
Aprasia parapulchella	Pink-tailed Worm-lizard	V, v	x	x
Delma impar	Striped Legless Lizard	V, v	x	x

7.4.4 Impact assessment - construction and decommissioning

Habitat removal

Construction and decommissioning impacts at all precincts include direct flora and fauna habitat loss and habitat modification, for the installation of infrastructure. The greatest impact would occur during construction as, during decommissioning, all below ground footings would remain in place.

The proposal would result in the removal of specific areas of vegetation within the development envelope, to install the turbine towers and surrounding hardstand areas, control building, substation, new and widened access tracks, power-line footings for overhead lines and trenches for underground cables. Some of this vegetation would be removed permanently (footings), some would be maintained for easements and some areas would be able to be rehabilitated, post construction.

Indirect impacts

Additional areas would be susceptible to trampling and compaction, increased sedimentation and nutrient input, weed ingress and contamination, due to the operation of large machinery and the disturbance of soils. Fragmentation of habitat, temporary noise, dust and vibration impacts, were also considered as indirect impacts within the biodiversity assessments.

Impact area estimations

Impact area estimations were undertaken to calculate the footprint of the development, within the development envelope, and attribute areas of direct impact to the vegetation types they would occur in. As the development envelope assessment aims to ensure flexibility, the calculation of impact areas must be undertaken on a 'worst case scenario' basis, in order to ensure that impacts are not underestimated.

This has been derived by including the following assumptions:

Native pasture

Pasture derived from box gum woodland within all precincts can fit the definition of an Endangered Ecological Community. The EEC definition under the TSC Act is broad in terms of vegetation structure and condition. It encompasses treeless formations dominated by native grasses, including examples in poor-moderate condition with low forb diversity. The EEC therefore covers a wide range of relative conservation significance. EEC status does not necessarily equate to high conservation value. For example, grazed native pastures derived from box gum woodland dominated by native grasses but with very low native forbs diversity would form part of the EEC. However this vegetation is locally very abundant, is likely to have low natural recovery potential and is considered to have relatively low conservation value.

Crane operation area

The crane operation area takes in the turbine footing, crane hard stand area and additional area required for manoeuvring the turbine blades during assembly. The total area required for crane operation has been assumed to constitute a temporary loss of habitat.

Tracks

The total area of tracks has been assumed to constitute a permanent loss of habitat. It is likely that a considerable amount of this area will overlap existing tracks or will be able to be rehabilitated after the construction phase. However, as existing tracks will require upgrade and the final location may be altered, the total track area has been used in impact area calculations.

Transmission lines

While there is potential to locate underground trenches within roads, this has not been assumed for the purpose of these impact area calculations. As vegetation within overhead power line easements will require maintenance, the entire easement width has been used in impact area calculations. For areas without tree cover however, the impact areas will be very small (limited to posts hole disturbance).

Specific to each precinct and vegetation type, the following impact area estimations have been derived.

Table 7-7 Coppabella Hills maximum impact areas by vegetation type

Coppabella Hills Precinct									
Infrastructure	**Quantity**	**Width (m)**	**Length (m)**	**Area (ha)**	**P**	**BGW**	**DSGF**	**RRGF**	**RO**
Turbine footing [a]	86.00	25.00	25.00	**5.38**	3.63	0.50	0.06	0.00	1.19
Crane hardstand [c]	86.00	22.00	40.00	**7.57**	5.11	0.70	0.09	0.00	1.67
Crane operation area (includes footing and hardstand) [c]	86.00	50.00	50.00	**21.50**	14.50	2.00	0.25	0.00	4.75
Tracks [a]	1.00	8.00	67063.65	**53.65**	42.67	6.95	0.07	0.00	3.96
Underground powerlines onsite [c]	1.00	2.00	21905.29	**4.38**	3.45	0.77	0.03	0.00	0.13
Overhead powerline cabling / easement [b]	1.00	20.00	14517.82	**29.04**	13.27	15.27	0.36	0.14	0.00
Overhead power pole footings [a]	145.18	1.00	1.00	**0.01**	0.01	0.01	0.00	0.00	0.00
Substation and control bldg [a]	3.00	2.00	18330.43	**11.00**	7.14	3.86	0.00	0.00	0.00
Concrete batch plant [c]	1.00	75.00	100.00	**0.75**	0.75	0.00	0.00	0.00	0.00
Construction compound, staging and storage [c]	1.00	300.00	100.00	**3.00**	3.00	0.00	0.00	0.00	0.00
Development envelope (DE)				**2829.10**					
Percentage of DE permanently removed				**2.48**					
Breakdown by impact type:									
a Permanent habitat loss (includes all footings and tracks)				**70.04**	53.44	11.32	0.13	0.00	5.15
b Habitat modification (transmission easement maintenance)				**29.04**	13.27	15.27	0.36	0.14	0.00
c Temporary habitat loss (areas that can be rehabilitated post construction)				**24.26**	18.08	2.27	0.22	0.00	3.69

P: Pasture, BGW: Box Gum Woodland, DSGF: Dry Shrub/Grass Forest, RRGF: Riparian River Red Gum Forest, RO: Rocky Outcrops

Table 7-8 Maximum impact areas on each woodland vegetation condition class and on high and moderate constraint Box Gum Woodland EEC[18].

Calculations are based on the indicative infrastructure layout provided by the Proponent.

Coppabella Hills Precinct							
Woodland vegetation types	**Permanent habitat loss [a] within each condition class**						**Total of each vegetation type within DE**
	Good	**Moderate / good**	**Moderate**	**Poor / moderate**	**Poor**	**Total**	
Box Gum Woodland	0.17	0.17	0.21	2.95	7.84	**11.34**	892.11
Long-leaved Box Dry Grass Forest	0.00	0.04	0.00	0.04	0.06	**0.13**	91.01
Riparian River Red Gum	0.00	0.00	0.00	0.00	0.00	**0.00**	11.27

Coppabella Hills Precinct		
Woodland vegetation types	**Permanent habitat [a] loss within each class**	
	High constraint EEC	**Moderate constraint EEC**
Box Gum Woodland	0.59	2.99
Total area within the DE	**265.24**	**717.88**

[18] Endangered Ecological Community (EEC) Box-Gum Woodland includes both box-gum woodland and long-leaved box dry grass forest treed remnants. EEC of high conservation value are woodland remnants in good, moderate to good, and moderate condition. EEC of moderate conservation value are woodland remnants in poor to moderate and poor condition.

Table 7-9 Marilba Hills maximum impact areas by vegetation type

Marilba Hills Precinct										
Infrastructure	**Quantity**	**Width (m)**	**Length (m)**	**Area (ha)**	**P**	**BGW**	**BGBPF**	**DSTF**	**LBDGF**	**BGWke**
Turbine footing [a]	66.00	25.00	25.00	**4.13**	3.25	0.82	0.06	0.00	0.00	0.00
Crane hardstand [c]	66.00	22.00	40.00	**5.81**	4.58	1.14	0.09	0.00	0.00	0.00
Crane operation area (includes footing and hardstand) [c]	66.00	50.00	50.00	**16.50**	13.00	3.25	0.25	0.00	0.00	0.00
Tracks [a]	1.00	8.00	63834.46	**51.15**	43.80	7.35	0.00	0.00	0.00	0.00
Underground powerlines onsite [c]	1.00	2.00	18330.43	**3.67**	2.92	0.75	0.00	0.00	0.00	0.00
Overhead powerline cabling / easement [b]	1.00	20.00	40031.00	**80.06**	40.52	37.89	0.21	1.44	0.00	0.00
Overhead power pole footings [a]	400.31	1.00	1.00	**0.04**	0.02	0.02	0.00	0.00	0.00	0.00
Substation and control bldg [a]	5.00	150.00	85.00	**6.38**	2.55	3.83	0.00	0.00	0.00	0.00
Concrete batch plant [c]	1.00	75.00	100.00	**0.75**	0.75	0.00	0.00	0.00	0.00	0.00
Construction compound, staging and storage [c]	1.00	300.00	100.00	**3.00**	3.00	0.00	0.00	0.00	0.00	0.00
Development envelope (DE)				**4140.00**						
Percentage of DE permanently removed				**1.49**						
Breakdown by impact type:										
a Permanent habitat loss (includes all footings and tracks)				**61.70**	49.62	12.01	0.06	0.00	0.00	0.00
b Habitat modification (transmission easement maintenance)				**80.06**	40.52	37.89	0.21	1.44	0.00	0.00
c Temporary habitat loss (areas that can be rehabilitated post construction)				**19.79**	16.42	3.18	0.19	0.00	0.00	0.00

P: Pasture, BGW: Box Gum Woodland, BGBPF: Brittle Gum – Broad-leaved Peppermint Forest, DSTF: Dry Shrub – Tussock Grass Forest, LBDGF: Long-leaved Box Dry Grass Forest, BGWke: Box-Gum Woodland – *Kunzea ericoides*

Table 7-10 Marilba Hills maximum impact areas on Box Gum Woodland EEC[19] vegetation based on condition class and constraint level.

Calculations are based on the indicative infrastructure layout provided by the Proponent.

Marilba Hills Precinct						
EEC	**Permanent habitat loss a within each condition class**					
	Good	**Moderate / good**	**Moderate**	**Poor / moderate**	**Poor**	**Total**
Box Gum Woodland	0.29	0.00	1.18	7.84	2.69	12.00

Marilba Hills Precinct			
	Permanent habitat loss [a] within each class		
	High constraint EEC	**Moderate constraint EEC**	**Low constraint EEC**
Box Gum Woodland EEC	1.47	7.84	
Total area within the DE	527.00	1275.00	2182.00

[19] Box-Gum Woodland EEC includes both box-gum woodland and long-leaved box dry grass forest remnants. In general terms, poor and poor-moderate condition class EEC without tree cover (native pasture) represent low constraint, poor and poor-moderate classes with tree cover represent moderate constraint, moderate and good condition classes represent high constraint (refer Section 7). Condition classes are defined in section 5.1.2 of the Marilba Hills Precinct Biodiversity Assessment, Appendix 3.2.

For flora and ecological communities, the results of these assessments indicated that impacts to generally poor and poor-moderate condition stands of the EEC White Box - Yellow Box –Blakely's Red Gum Grassy Woodland will occur as a result of the development, but will not be significant in the local context, since degraded remnants of the community are still relatively common in the local area. Stands in moderate-good and good condition would generally be excluded from the development envelope and protected from direct and indirect impacts during the works. Similarly, the core populations of the Yass Daisy and potential habitat for other threatened woodland flora species would be excluded from the development envelope, and the proposal would not produce impacts to these species such that local populations would be placed at risk of extinction.

For fauna at Coppabella Hills and Marilba Hills, the construction of the wind farm would result in the loss of a small area of marginal habitat for threatened woodland bird and reptile species. The habitat affected is generally degraded and woodland habitat in similar condition is relatively abundant in the precinct. Accordingly, it is not considered that there will be significant faunal impacts at either of these two precincts.

The development envelopes have been mapped in terms of constraints within each biodiversity assessment to ensure that construction impacts avoid, then minimise and offset according to the biodiversity values of the precincts. In this way, construction impacts are considered highly manageable.

7.4.5 Impact assessment - operation

Turbine operation impacts

Turbine operation impacts are relevant to fauna, particularly those that are able to forage or disperse within the 'rotor sweep area', within 40-150m above ground. There are two types of risk posed by the operational turbines to fauna.

- Blade-strike and barotrauma: The significance of blade-strike mortalities or injuries such as barotrauma[20] is species-specific. If the species is at low density in the landscape or susceptible to multiple collision events (such as for flocking species), blade-strike may threaten a local population. If the species is a top order predator or key stone species, there may also be ecological ramifications for other species.
- 'Avoidance' behaviour caused by the presence of the turbines and associated infrastructure: Depending on where the turbines are located, this may affect foraging patterns, nesting, roosting or movements around the site. It equates to a loss or modification of habitat and therefore can have resultant impacts on the carrying capacity of the site.

Literature review, risk assessment and assessments of significance were undertaken to characterise the impacts to threatened and significant species. For microbat species, an additional survey and assessment were completed to address this specific issue. High risk was considered to coincide with species that flock in large numbers or are top order predators. Risks are considered manageable for all species, with the implementation of specific mitigation measures set out in Section 8 of each of the biodiversity assessments (Appendix 3.1, 3.2) and Section 5 of the Microbat Study (Appendix 3.4).

[20] Rapid or excessive air-pressure change near moving turbine blades has been linked to bat fatalities as a result of haemorrhaging of the lungs (Baerwald et al. 2008).

Maintenance impacts

Maintenance and monitoring visits would be required, although existing farm and construction tracks would be used and impact on vegetation is expected to be minimal. Access tracks would be maintained to minimise ongoing erosion and sedimentation impacts. The impacts of major repairs would be similar in nature to construction impacts, but more limited in extent. The proposal would produce an ongoing pollution risk from the oil-cooled substation, requiring design measures to ensure that any spill could be contained and treated expeditiously. These impacts are highly manageable.

Cumulative impacts

The biodiversity impacts associated with each precinct have been assessed separately in standalone Biodiversity Assessments for each precinct. Cumulative impacts are considered within each of these assessments. For both precincts, the loss or modification of habitat during construction has been reduced using a constraints mapping methodology, to concentrate infrastructure in areas of least environmental constraint. This acts to reduce the cumulative impact of the proposal.

The key impact of wind farms, with respect to cumulative impacts, is the potential to generate continuing losses of some species with low reproductive rates (such as Wedge-tailed Eagles and Eastern Bentwing Bats), and thereby create a 'mortality sink' with potential to affect populations at a regional level (Jonzen et al. 2005). Mitigation strategies are included in this proposal to address this risk.

The impacts of the wind farm on biodiversity values would combine with existing impacts resulting from land clearing, agricultural activities, weeds and hazards. It is important to recognise that the district has experienced extensive losses to ecosystem integrity and stability. Woodland and grassland communities in particular, which coincide with prime agricultural land, and riparian and wetland communities have been heavily impacted. It is likely that many woodland flora and fauna species have become locally extinct, and many are in continuing decline. There is a time lag, or 'extinction debt', operating which will mean that decline and extinction will continue for many species for decades to come, regardless of management responses. Further impacts on lowland environments are expected from soil and water salinisation, soil erosion and sedimentation, weed invasion and spread, disruption to river hydrology due to farm dam construction and water extractions and habitat fragmentation and clearing resulting from residential sub-division and building.

To address cumulative biodiversity impacts, this EA includes mitigation measures to reduce impacts on areas of higher conservation significance and to offset the area to be disturbed by the proposal. Offsets are considered to be required, where impacts cannot be avoided, in order to achieve a 'maintain or improve' environmental outcome. The approach taken by this assessment is to offset the quantum of habitat loss associated with the proposal, based on the finalised infrastructure layout. The broader environmental benefits of establishing renewable energy sources have not been considered in the assessment or offset plan. Therefore, coupled with measures to offset habitat loss, the contribution of the proposal to reducing the adverse environmental impacts of fossil fuel based electricity generation is anticipated to constitute an overall 'improve' outcome.

Offset principles

Offsets are considered to be required, where impacts cannot be avoided, in order to achieve a 'maintain or improve' environmental outcome. The approach taken by this assessment is to offset the quantum of habitat loss associated with the proposal, based on the finalised infrastructure layout. The broader environmental benefits of establishing renewable energy sources have not been considered in the assessment or offset plan. Therefore, coupled with measures to offset habitat loss, the contribution of the

proposal to reducing the adverse environmental impacts of fossil fuel based electricity generation is anticipated to constitute an overall 'improve' outcome.

Thirteen biodiversity offset principles are outlined in the *Guidelines for Threatened Species Assessment* (DEC and DPI 2005), to ensure that the offsets achieve long-term conservation outcomes. These principles would be addressed in the offset plan, committed to in a Statement of Commitment of the proposal.

There is land available of suitable vegetation type and quality within the site boundaries of the proposal able to be utilised as offsets. The Proponent has identified several sites with a total area in excess of 500Ha, sufficient to offset the worst case scenario for disturbance area (refer to Figure 7-12 and Figure 7-13). The identified area is owned by landowners already involved in the proposal and initial consultation has indicated that an offset program in these areas would be achievable.

No biometric surveying has been done in these areas to calculate offsets. Vegetation type and condition for most of these areas was determined as part of the biodiversity assessments and demonstrates these areas include the vegetation types that would need to be offset.

Specifically, for Coppabella Hills, offset areas are available in Areas 4, 6 and 7 (refer to Figure 3-1 of the Coppabella Hills Biodiversity Assessment). These areas comprise Long-leaved Red Stringybark Dry Grass Forest (good condition) and Box Gum Woodland (areas of poor – moderate, moderate to good condition, good condition). Foraging resources for fauna include hollow-bearing trees in woodland and disturbed woodland and modified wetlands. Impact areas proposed at Coppabella Hills are detailed in Table 7-7 and include Pasture (majority of impact area), Box Gum Woodland, Dry Shrub/Grass Forest and Rocky Outcrops.

Specifically, for Marilba Hills, offset areas are available in Areas 2 and 4 (refer to Figure 3-2 of the Marilba Hills Biodiversity Assessment). These areas comprise Long-leaved Box Dry Grass Forest (moderate condition) and Box Gum Woodland (areas of moderate, moderate to good condition). With reference to fauna, both areas are relatively large woodland areas. Area 2 contains woodland birds including the Superb Parrot, Rainbow Bee-eater and Speckled Warbler. Impact areas proposed at Marilba Hills are detailed in Table 7-9 and include Pasture (majority of impact area), Box Gum Woodland, and a minor amount of Brittle Gum – Broad-leaved Peppermint Forest.

For both precincts, and particularly at Coppabella Hills, the offset areas include poor and good condition Box Gum Woodland EEC. This is considered a good outcome as this offsetting strategy would protect the best areas but also would allow improvement of poor condition areas.

Key thresholds statement

Risk assessments, impact evaluations and assessments of significance were carried out to characterise the significance of potential impacts for the threatened species identified within the Biodiversity Assessments[21]. The following key thresholds statements, provided in accordance with Step 5 of the Threatened Species Guidelines (DEC and DPI 2005), are based on the information in these assessments.

1. Will the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, maintain or improve biodiversity values.

This threshold is most relevant to the construction phase. The infrastructure layouts have been modified to minimise impacts, using a constraints mapping process. Statements of Commitment include measures to

[21] Full risk assessments, evaluations of impact and assessments of significance are included at the end of each biodiversity assessment: Coppabella Hills Precinct Appendices D, E and F of Appendix 3.1 and Marilba Hills Precinct Appendices C, D, E and F of Appendix 3.2.

mitigate specific residual impacts and offset all areas that would be impacted by the proposal. The aim of the offset plan will be to ensure a long-term improvement in biodiversity values, through securing and managing for biodiversity outcomes suitable quantum of native vegetation. This will ensure improved biodiversity values at the local scale. Coupled with the contribution of the proposal to the long-term reduction in greenhouse gas emitting electricity sources, the proposal will result in a net gain in biodiversity values.

2. Is the proposal likely to reduce the long-term viability of a local population of the species, population or ecological community

This threshold is most relevant to the operational phase, where collisions may pose a population level risk to some species. Assessments of significance have been used to characterise the impacts to threatened species at risk of adverse impact. Where uncertainty exists, mitigation measures have been committed to which would address the risk to long-term viability of a local population of the species, population or ecological community. For collision risks, an adaptive management monitoring program would be developed to ensure that turbine operation does not pose undue risks and that exceedences are responded to. In some instances, mitigation takes the form of further research or survey prior to turbine construction.

3. Whether or not the proposal is likely to accelerate the extinction of a species, population or ecological community or place it at risk of extinction.

In addressing point 2 above, through the effective implementation of the Statements of Commitment, the proposal would ensure that no species, population or ecological community is placed at accelerated risk of extinction.

4. Whether or not the proposal will adversely affect critical habitat.

No areas of critical habitat have been declared within the district.

Further work

The requirement for further surveying work to be undertaken at both Coppabella and Marilba Hills precincts have been identified, targeting areas where hollow-bearing trees may be removed and where threatened species may occur. It is planned that additional survey work would be conducted during spring 2009. This additional work would include a determination of the importance of habitat provided by hollow bearing trees to threatened species. It would also include, targeted searches for Burrinjuck Spider Orchid and threatened grassy woodland species would be undertaken in areas of potential habitat where impacts could not be avoided. The aim of this work is to provide more rigour to the assumptions of the biodiversity assessment. The results would be incorporated into the Submissions Report.

Conclusion

Measures to address identified construction and operational impacts of the proposal have been incorporated into the Statements of Commitment to ensure the project would be managed to avoid a significant impact to any species, population or endangered community. Specifically, the proposal is well able to be managed to have a low impact on flora and fauna values at Coppabella Hills and Marilba Hills Precincts.

With the measures discussed below, the proposal now reflects the biodiversity values of the precincts and is considered able to meet the requirement to maintain or improve biodiversity values.

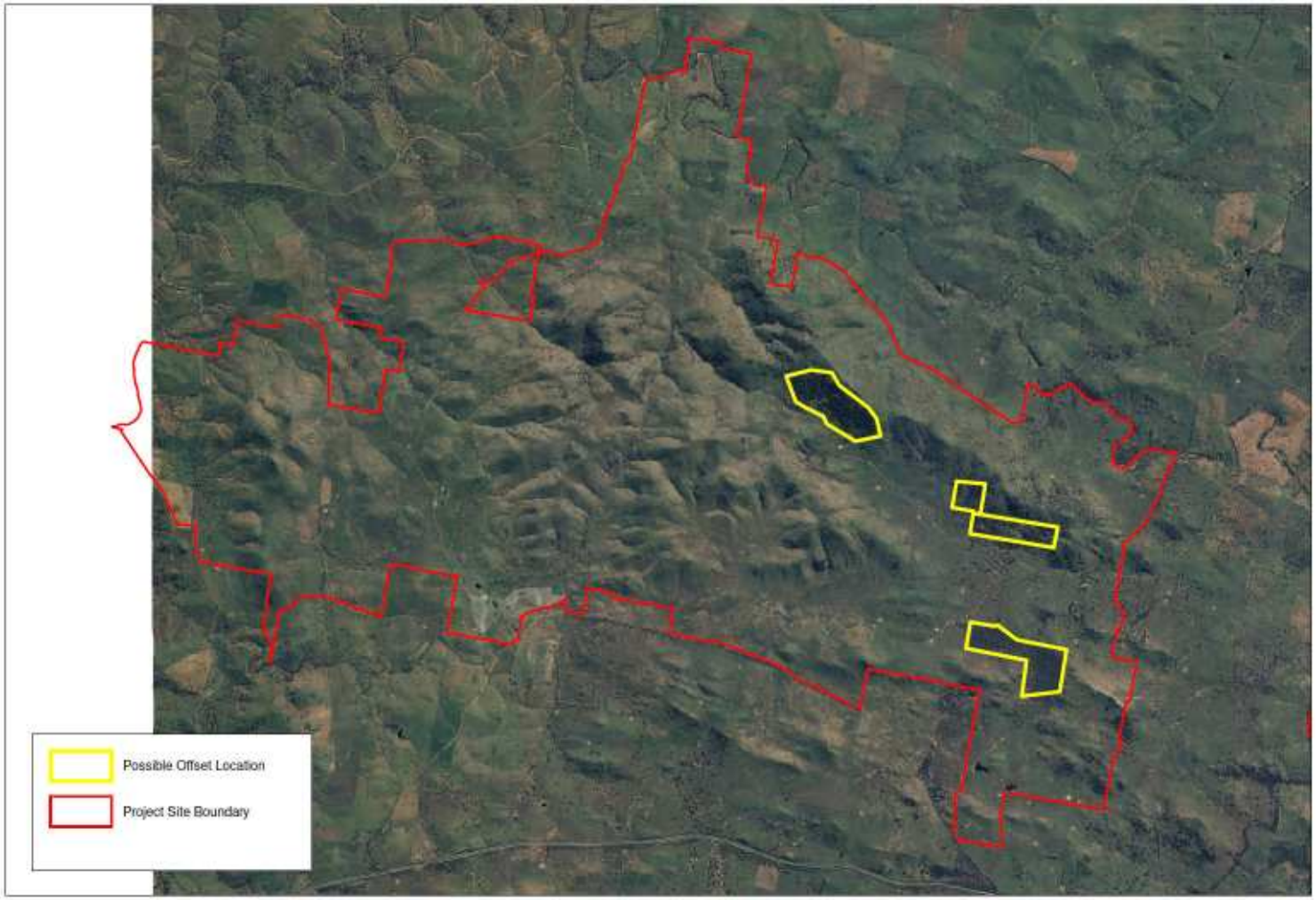


Figure 7-12 Options for offsetting: Coppabella Hills Precinct

Areas within the site boundaries identified as suitable and feasible to provide offsets for areas of habitat that would be removed by the proposal.

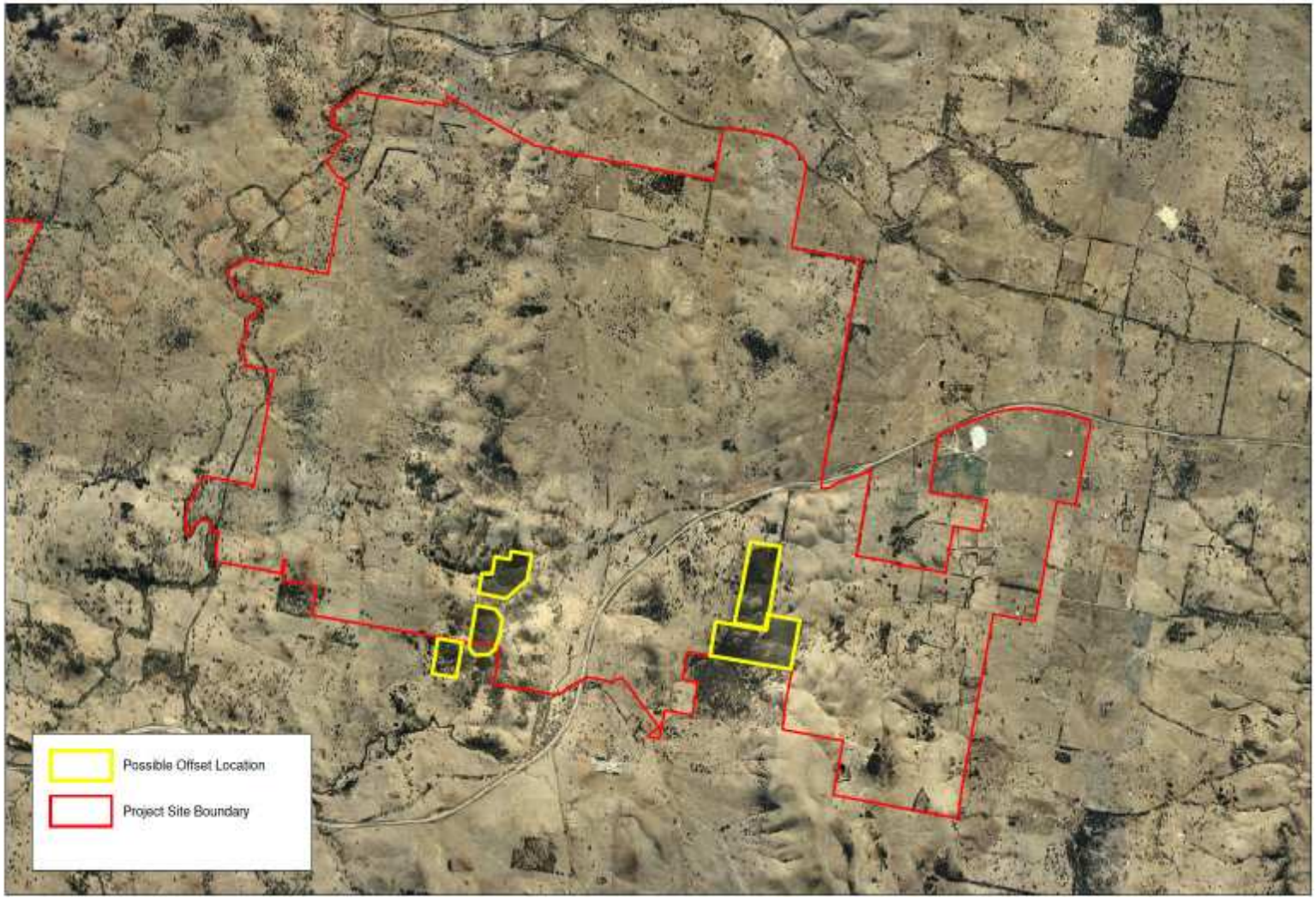


Figure 7-13 Options for offsetting: Marilba Hills Precinct

Areas within the site boundaries identified as suitable and feasible to provide offsets for areas of habitat that would be removed by the proposal.

7.4.6 Mitigation Measures

Recommendations within the biodiversity assessments centre on management specific to constraints zones (high, moderate and low) as well as habitat and species-specific measures. As three different Biodiversity Assessments were undertaken, in come areas the Statements of Commitment refer to these documents for additional detail.

SoC	IMPACT	OBJECTIVE	MITIGATION TASKS	PROJECT PHASE	AUDITING[22]	Coppabella Hills	Marilba Hills
11	Loss or modification of habitat	Avoid, minimise, offset	All infrastructure would be sited entirely within the development envelope assessed in the Biodiversity Assessments. Where this is not possible, additional assessment would be undertaken and the appropriate approval would be sought (ie. variation to Conditions of Approval).	Detailed design of infrastructure layout	CEMP	x	x
12	Loss or modification of habitat	Avoid, minimise, offset	All infrastructure would be sited to avoid high constraint areas (including high constraint habitat features) and minimise impacts in moderate constraint areas. These areas are identified within Appendix 3.1 of the Coppabella Hills Precinct Biodiversity Assessment (Figure 7.1), and Appendix 3.2 of the Marilba Hills Precinct Biodiversity Assessment (Map set 4).	Detailed design of infrastructure layout	CEMP	x	x
13	Loss or modification of habitat	Avoid, minimise, offset	Where high constraint areas cannot be avoided, micrositing of infrastructure would be undertaken with input from an ecologist, to minimise impacts (includes road widening and transmission easement).	Detailed design of infrastructure layout	CEMP	x	x

[22] The Construction and Operation Environmental Management Plans (CEMP and OEMP) are documents submitted to Dept. Planning prior to construction and operation. Incorporation of these commitments within these management plans allows each commitment to be auditable.

SoC	IMPACT	OBJECTIVE	MITIGATION TASKS	PROJECT PHASE	AUDITING[22]	Coppabella Hills	Marilba Hills
14	Loss or modification of habitat	Avoid, minimise, offset	Where hollow-bearing trees cannot be avoided, nest boxes would be installed to replace this resource. This measure is considered supplementary to offsets that would also take into account the removal of hollows.	Detailed design of infrastructure layout	CEMP	x	x
15	Loss or modification of habitat	Avoid, minimise, offset	Works should be sited outside known Yass Daisy population areas and Commonwealth-listed CEEC areas identified in Appendix 3.1 Coppabella Hills Precinct Biodiversity Assessment (Figure 5.6), and Appendix 3.2 Marilba Hills Precinct Biodiversity Assessment (Map set 2).	Detailed design of infrastructure layout	CEMP	x	x
16	Loss or modification of habitat	Avoid, minimise, offset	Where rocks and boulders cannot be avoided, they would be placed directly adjacent to the works area to preserve the availability of refuge.	Construction	CEMP	x	x
17	Loss or modification of habitat	Avoid, minimise, offset	Should dams be required to be removed during site development, alternative watering points would be established to compensate for their loss, where practical and with the agreement of the landowner.	Construction	CEMP	x	x
18	Loss or modification of habitat	Avoid, minimise, offset	Additional targeted surveys would be undertaken, if the identified areas would be impacted by the proposal. These areas include: **Coppabella Hills** • Hollow-bearing trees targeted for removal. **Marilba Hills** • Burrinjuck Spider Orchid, undertaken in mid-October, where the dry forest remnant in the far south of Cluster 7 would be impacted by the proposed works. • Threatened grassy woodland species, undertaken in Spring, if the secondary grassland on the south-western side of Cluster 7 would be substantially impacted.	Detailed design of infrastructure layout	CEMP	x	x

SoC	IMPACT	OBJECTIVE	MITIGATION TASKS	PROJECT PHASE	AUDITING[22]	Coppabella Hills	Marilba Hills
19	Loss or modification of habitat	Avoid, minimise, offset	Contractors and staff would be made aware of the significance and sensitivity of the constraints identified in the Biodiversity Assessment constraint map set for each precinct during the site induction process.	Construction	CEMP	x	x
20	Loss or modification of habitat	Avoid, minimise, offset	A buffer twice the distance of the tree drip-line would be established in sensitive areas identified in the Biodiversity Assessment constraint map set for each precinct to ensure indirect impacts (such as compaction, noise and dust) are minimised where practical..	Construction	CEMP	x	x
21	Loss or modification of habitat	Avoid, minimise, offset	The Proponent would commit to preparing and implementing an Offset Plan, to offset the quantum and condition of native vegetation to be removed, in order to achieve a positive net environmental outcome for the proposal. Offset areas would reflect the actual footprint of the final layout (ie footing areas and new tracks) not the maximum impact areas included in Table 7-7 and Table 7-9 (which include easements and existing tracks). The Offset Plan would be prepared in consultation with DECC, prior to construction.	Prior to construction	CEMP	x	x
22	Loss or modification of habitat	Avoid, minimise, offset	An adaptive Bird and Bat Monitoring Program would be developed prior to construction and would include the collection of baseline (pre-operation) as well as operational monitoring data.	Prior to construction	CEMP, OEMP	x	x
23	Loss or modification of habitat	Avoid, minimise, offset	A Biodiversity Management Plan would be prepared within the CEMP to document the implementation of biodiversity measures, sourcing the Biodiversity Assessments prepared for each precinct for area-specific measures. This would include construction and operational activities.	Prior to construction	CEMP	x	x
24	Loss or modification of habitat	Avoid, minimise, offset	An EPBC referral would be submitted to determine whether the proposal constitutes a 'controlled action' under the meaning of the *Environment Protection and Biodiversity Conservation Act 1999.*	Detailed design of infrastructure layout	CEMP	x	x

SoC	IMPACT	OBJECTIVE	MITIGATION TASKS	PROJECT PHASE	AUDITING[22]	Coppabella Hills	Marilba Hills
25	Loss or modification of habitat	Avoid, minimise, offset	A flora and fauna assessment would be undertaken prior to decommissioning to identify biodiversity constraints and develop specific impact mitigation measures.	Decommissioning	OEMP	x	x

7.5 MITCHELL LANDSCAPES

7.5.1 Existing environment

Mitchell Landscapes are an ecosystem classification system which provides an overview of geology, geomorphology, topography, soils and geodiversity for bioregions within NSW. Data exists on the level of modification (such as clearing) that has occurred within the Mitchell Landscape mapping units and in this way the significance of further impact can be evaluated. For example, a Mitchell Landscape which has been over 70% cleared since European settlement would be considered significant; further clearing within this landscape may have ecological implications for the bioregion. This data is used by Catchment Management Authorities within NSW.

Five Mitchell landscapes occur within the development envelopes of the two precincts, Table 7-11. As the precincts occur within the Murrumbidgee Catchment Management Authority (CMA), it is the percentage cleared since European settlement within this CMA that is significant. As can be seen, all five landscapes are considered significant, having been extensively modified (84-91% cleared) since European settlement.

Table 7-11 Mitchell Landscapes within the development envelopes of Coppabella Hills and Marilba Hills

Mitchell Landscape	% cleared since European settlement within the Murrumbidgee CMA [23]	Coppabella Hills Precinct (Ha)	Marilba Hills Precinct (Ha)
Boorowa Volcanics	90	2101.09	687.19
Young Hills and Slopes	91	2.13	-
Murrumbidgee - Tarcutta Channels and Floodplains	95	39.44	-
Marilba Range	84	-	1888.74
Burrinjuck Ridges	89	-	344.51

Although not statutorily required for Part 3A Major Projects, the *Native Vegetation Act 2003* states that vegetation in moderate to good condition (as determined by the Environmental Outcomes Assessment Methodology - EOAM) within overcleared Mitchell landscapes is not permitted to be cleared. Although this Act does not apply to Part 3A developments, an appropriate goal of the Proposal should be to avoid or minimise impacts within these overcleared vegetation types.

[23] Source: 'revised percent cleared' as stated in the DECC BioMetric: Terrestrial Biodiversity Tool for the NSW Property Vegetation Planning System Website, http://www.environment.nsw.gov.au/projects/BiometricTool.htm

7.5.2 Impact assessment - construction and decommissioning impacts

Impact types, extent and vegetation condition have been discussed in Section 7.4. Loss of native vegetation and degradation of native vegetation are the key potential impacts of the construction phase.

A discrete development footprint is proposed, relative to the site boundaries and development envelopes. Approximately 2.48% of the Coppabella Hills Precinct development envelope and 1.49% of the Marilba Hills Precinct development envelope would be directly and permanently affected by the Proposal.

Constraints mapping has been undertaken as part of the Biodiversity Assessments (presented in Appendix 3.1 Coppabella Hills Precinct Biodiversity Assessment (Figure 7.1), and Appendix 3.2 Marilba Hills Precinct Biodiversity Assessment (Map set 4) to ensure that infrastructure placement is sensitive to the type and condition of existing native vegetation. In general, low constraint zones have been cleared and modified by long histories of grazing, resulting in native vegetation of relatively low conservation value. Vegetation of better quality or conservation significance has been mapped as a moderate constraint and mitigation measures developed to minimise impacts. High constraint areas represent moderate to good condition Endangered Ecological Communities (EECs) or areas with potential for quality threatened species habitat and these areas would be avoided (discussed in detail in Section 7.4 Flora and Fauna).

The potential for degradation of native vegetation through indirect or secondary impacts of construction is readily managed. Erosion, sediment and weed controls are set out in Sections 7.4 Flora and Fauna, 8.1 Hydrology and 8.2 Soils and Landforms. No additional mitigation measures are considered to be required, specific to Mitchell Landscapes.

Decommissioning of the wind turbines would involve similar impact types to the construction phase. A reduced level of impact is anticipated however, as all below-ground structures (footings, concrete slabs, underground cabling) would remain *insitu* reducing the amount of excavation required and associated environmental impacts to native vegetation, water and soils and landforms. No additional mitigation measures are considered to be required, specific to Mitchell Landscapes.

7.5.3 Impact assessment - operation

No additional mitigation impacts or mitigation measures are considered to be required, specific to Mitchell Landscapes, for the operational phase of the development.

7.6 ABORIGINAL ARCHAEOLOGY

7.6.1 Approach

New South Wales Archaeology Pty Ltd has undertaken an Indigenous archaeological and heritage assessment of the proposed Yass Valley Wind Farm, Appendix 4. This assessment has been conducted in accordance with the consultation process as outlined in the Interim Guidelines for Aboriginal Community Consultation - Requirements for Applicants (NSW DEC 2004). The field survey and assessment has been undertaken with representatives from Buru Ngunawal Aboriginal Corporation, Young Local Aboriginal Land Council, and Onerwal Local Aboriginal Land Council.

The study has sought to identify and record Aboriginal objects, to assess the archaeological potential of the landform elements and to formulate management recommendations based on the results of background research, a field survey and significance assessment.

The investigation has included a literature review, field survey and analysis of results. Field work was undertaken over an 18 day period[24] in December 2008 and February 2009. A landscape based approach has been implemented during this study; the proposal area has been divided into a number of Survey Units each of which has been defined on the basis of a landform morphological type. Survey Units are utilised as a framework of recording, analysis and the formulation of management and mitigation strategies.

The New South Wales DECC (formerly National Parks and Wildlife Service) has prepared a draft document which provides a series of guidelines regarding the assessment and management of Aboriginal cultural heritage in New South Wales. This report has been prepared in accordance with these draft guidelines (NSW NPWS 1997).

Additionally the study has been conducted in accordance with the Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation (NSW DEC July 2005). The Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation have been prepared specifically for development applications assessed under Part 3A of the Environmental Planning and Assessment Act 1979.

The archaeological and heritage report documents the following:

- The Aboriginal consultation process undertaken for the project and the involvement in the project of the Aboriginal community
- A description of the proposal and whether or not it has the potential to result in impacts to Aboriginal cultural heritage
- A description of the impact history of the proposal area
- The methodology implemented during the study
- The landscape and natural resources of the study area in order to establish background parameters
- A review of archaeological and relevant literature and heritage listings on the NSW DECC Aboriginal Heritage Information Management System
- A synthesis of local and regional archaeology
- A predictive model of Aboriginal object type and location relevant to the proposal area
- The cultural and archaeological sensitivity of the landforms subject to proposed impacts
- A review of Non-Indigenous history of the proposal area and the results of relevant heritage database searches
- The field survey results
- The significance of Aboriginal objects
- An assessment of the impact of the proposal on Aboriginal objects and places
- A description and justification of the proposed outcomes and alternatives and

[24] Field work included the assessment of the Carrolls Ridge Precinct, not discussed further within this Environmental Assessment.

- A series of recommendations relating to management and mitigation based on the results of the investigation
- A description and justification of the proposed outcomes and alternatives
- A series of recommendations relating to management and mitigation based on the results of the investigation.

7.6.2 Existing Environment

A review of previous investigations in the area has been undertaken in order to define the existing information relating to Indigenous archaeology and heritage and to provide an analytical context to the assessment. This information is reviewed in Section 7 of the archaeology and heritage report (presented in Appendix 4 of this EA).

Searches of the New South Wales Department of Environment and Climate Change (the NSW DECC) Aboriginal Heritage Information Management System (AHIMS) have indicated that there are no previously recorded sites located within the proposed impact areas (AHIMS #23853; #23852; #23851: 1st October 2008).

Coppabella Hills: The search area measured 221 km² and encompassed eastings: 631000 – 648000, and northings: 6149000 – 6162000. No previously recorded sites are listed on AHIMS for this area.

Marilba Hills: The search area measured 156 km² and encompassed eastings: 650000 – 663000, and northings: 6144000 – 6156000. 17 previously recorded Aboriginal objects are listed on AHIMS for this area, none of which are located within the proposal area.

While there are no previously recorded Aboriginal objects in the proposal area, the AHIMS register only includes sites which have been reported to NSW DECC. Accordingly, this search cannot be considered to be an actual or exhaustive inventory of Aboriginal sites situated within the local area. Generally, sites are only recorded during targeted surveys undertaken in either development or research contexts. It can be expected that sites will be present within the proposal area but that to date they have not been recorded and/or reported to NSW DECC.

There have been no previous archaeological studies conducted within the proposal area itself and few have been undertaken within the immediate local area. The construction of a relevant predictive model of Aboriginal site type and location is therefore based on a review of research conducted across the broader region. This review suggests that the most common Aboriginal object recordings in the region are distributions of stone artefacts. In the region a general correlation between different types of watercourses and the nature of the evidence of past Aboriginal occupation is evident. Higher artefact density sites are located near to permanent water sources and low density artefact distributions are found elsewhere. Rare site types include rock shelters, scarred trees, quarry and procurement sites, burials, stone arrangements, carved trees, contact sites and traditional story or other ceremonial places. A detailed predictive model of Aboriginal object type and location is set out in Section 7 of the archaeological and heritage report.

The proposal area can be characterised as a woodland resource zone. The hills would have possessed limited biodiversity and a general lack of water; accordingly they are likely to have been utilised by Aboriginal people for a limited range of activities which may have included hunting and gathering, travel through country and possibly ceremonial. Such activities are likely to have resulted in low levels of artefact discard. Given the often steeply undulating nature of the hill crests, artefacts are likely to be located in spatially discrete areas such as knolls or saddles, rather than being continuous in distribution.

The nature of stone artefacts discarded can be expected to have been correspondingly limited in terms of artefact diversity and complexity.

By comparison the valleys between the hills are likely to have possessed greater levels of biodiversity given the likely presence of chains of ponds and possibly also swamp features along drainage lines; in addition a more reliable source of water is likely to have been present in valleys for much of the year. Such areas are likely to have been utilised more frequently and possibly by greater numbers of individuals at any one time; certainly the valleys are likely to have been the favoured camp locations while people utilised the broader local area. Accordingly the levels of artefact discard in valleys can be predicted to be correspondingly higher; artefact diversity and complexity is also likely to be greater.

The results of the archaeological assessment conducted in each of the three precincts is summarised below.

Coppabella Hills

The Coppabella Hills development area has been divided into 24 Survey Units. The Coppabella Hills development envelope surveyed during this assessment measured approximately 458 hectares in area. It is estimated that approximately 207 hectares of that area was subject to survey inspection. Ground exposures inspected are estimated to have measured 46 hectares in area. Of that ground exposure area archaeological visibility is estimated to have been 31 hectares. Effective Survey Coverage is therefore relatively high and calculated to have been 6.9% of the surveyed area.

A total of 70 Aboriginal object locales were recorded. Artefacts were recorded in all Survey Units except SU4, SU8, SU10, SU12, SU13, SU14 and SU22, all of which are assessed to be of low archaeological potential on environmental grounds. Artefacts were recorded along the majority of crests in which turbines are proposed; the majority of locales contain either single or otherwise very few artefacts. Given the relatively large areas of exposure, and the very few artefacts recorded, it is concluded that artefact density, is very low generally in the Coppabella Hills proposal area.

Several Survey Units and locales within some Survey Units have been predicted to contain subsurface artefacts in low/moderate density including several ridge saddles, a large upland basin and the valleys.

Marilba Hills

The Marilba Hills development area has been divided into 33 Survey Units. The Marilba Hills development envelope surveyed during this assessment measured approximately 488 hectares in area. It is estimated that approximately 301 hectares of that area was subject to survey inspection. Ground exposures inspected are estimated to have been 16 hectares in area. Of that ground exposure area archaeological visibility is estimated to have been 13 hectares. Effective Survey Coverage is therefore calculated to have been 2.7% of the surveyed area. The presence of thick grass cover at Marilba accounts for the lower effective survey coverage in Marilba Hills compared to the other precincts.

A total of 31 Aboriginal object locales were recorded in 15 of the Marilba Survey Units. It is recognised that Effective Survey Coverage was very low across the Marilba study area. Nevertheless the majority of Survey Units in which artefacts were not recorded are assessed to be of low archaeological potential on environmental grounds. Artefacts were recorded along many of the crests in which turbines are proposed. The majority of locales contain either single or otherwise very few artefacts. Given the very few artefacts recorded, it is concluded that artefact density, generally is very low in the Marilba Hills proposal area. Several exceptions to this trend have however been identified. Several Survey Units and locales within some Survey Units have been predicted to contain subsurface artefacts in low/moderate density including several ridge saddles, and the valleys.

7.6.3 Impact assessment – construction and decommissioning

As noted above the majority of the Aboriginal object locales recorded in the proposal area are low or very low density stone artefact distributions; these are assessed to be of low archaeological significance. In addition however a number of Aboriginal object locales have been identified which are assessed to be of low/moderate or moderate archaeological significance.

The construction of the Yass Valley Wind Farm will result in substantial physical impacts to any Aboriginal objects which may be located within direct impact areas - irrespective of their archaeological significance. That is, any Aboriginal object situated within an area of direct impact will be comprehensively disturbed, and/or destroyed during construction.

As with any development the chances of impacting Aboriginal objects, particularly stone artefacts, is high given that they are present in a continuum across the landscape and located on or within ground surfaces. Yass Valley Wind Farm is no exception in this regard and it would be impossible to have a development of this nature without causing direct physical impact.

However in regard to the majority of Aboriginal object locales such as artefact scatters assessed to be of low significance, the impacts can be viewed as being of correspondingly low significance. On the other hand, impacts to any object locales which are assessed to be of higher archaeological significance can be viewed as being of correspondingly higher significance. This assessment forms the basis for the formulation of management strategies which aim to mitigate impacts.

The Survey Units and Aboriginal object locales recorded in the proposal area do not surpass scientific significance thresholds which would act to preclude the construction of the proposed wind farm. Based on a consideration of the predictive model applicable to the environmental context in which impacts are proposed, and the results of the study, it is concluded that the proposed impact areas do not warrant further investigation such as subsurface test excavation. The environmental contexts in which the turbines (and associated impacts) are proposed contain eroded and disturbed soils as a result of high levels of environmental degradation; generally these soils have low potential to contain intact and/or stratified archaeological deposit. Furthermore, the majority of the proposed impact areas are not predicted to contain artefact density sufficient to warrant test excavation. It is considered that subsurface testing is unlikely to produce results, different to predictions made in respect of the archaeological potential of the landforms in question.

Given the nature and density of the majority of artefact locales recorded in the proposal area and the generally low scientific significance rating they have been accorded, unmitigated impact is considered appropriate; a strategy of impact avoidance is not warranted in regard to these locales.

However several Aboriginal object locales are assessed to be of low/moderate or moderate archaeological significance. Accordingly it is generally recommended that limiting the extent of impacts to these locales, if at all feasible, should be given consideration.

As a form of mitigation of overall construction impact to the archaeological resource within the proposal area it is proposed that a reasonably detailed and broad scale research program of archaeological excavation and analysis be undertaken within a sample of the proposed impact areas prior to construction. This is justified for some Survey Units on ridge tops which are assessed to be of low archaeological significance, as excavation opportunities in these areas rare and therefore of increased significance. It is justified in Survey Units assessed to be of low /moderate or moderate archaeological significance in areas where the proposal is unable to limit the extent of impacts (limiting the extent of impacts has been recommended as a first course of action, where this is feasible).

The rationale for including individual survey units within the broad scale research program is given in Section 12.1 and Section 12.2 of the Archaeology Assessment, in Tables 19, 20 and 21 (Appendix 4 of this EA). The rationale considers both predicted artefact density and the elevated significance of these Survey Units (greater than low significance). In committing to this program, the Proponent addresses the large area of impact of the proposal (and the concomitant extent of impacts to the archaeological resource), the large degree of impact that excavation has on the archaeological resource directly within the development footprint, and the paucity of detailed archaeological information currently available in the region.

Detailed management and mitigation strategies are outlined and justified in Section 12 of the archaeology and heritage report Appendix 4; they are outlined below in summary form:

- No Survey Units have been identified in the proposal area to warrant further archaeological investigation such as subsurface test excavation; the Effective Survey Coverage achieved during the field survey was relatively high and can be considered to have been generally adequate for the purposes of determining the archaeological status of the proposed impact areas.
- None of the Survey Units in the proposal area have been assessed to surpass archaeological significance thresholds which would act to entirely preclude proposed impacts.
- The majority of the Aboriginal object locales recorded are very low or low density distributions of stone artefacts. The archaeological significance of these locales is assessed to be low. Accordingly a management strategy of unmitigated impact is considered to be appropriate.
- Many of the Aboriginal object locales and/or discrete areas within Survey Units are assessed to be of low/moderate or moderate archaeological significance. Accordingly, in regard to these areas it is generally recommended that limiting the extent of impacts to these locales, if at all feasible, should be given consideration.
- In regard to these locales it is recommended that a research program of sub-surface excavation be undertaken as a form of Impact Mitigation. This would be incorporated within a broader research program proposed.
- As a form of mitigation of overall construction impact to the archaeological resource within the proposal area it is proposed that a program of archaeological salvage excavation and analysis be undertaken in a sample of impact areas prior to construction as defined in Tables 19, 20 and 21 in section 12 of the archaeology report.
- The development of an appropriate research project should be undertaken in consultation with an archaeologist, the relevant Aboriginal communities and the NSW Department of Conservation and Climate Change.
- It is recommended that additional archaeological assessment is conducted in any areas which are proposed for impacts that have not been surveyed during the current assessment. It is predicted that significant Aboriginal objects can occur anywhere in the landscape and accordingly if present they need to be identified and impact mitigation strategies implemented prior to impacts.
- The Proponent should, in consultation with an archaeologist, develop a Cultural Heritage Management Protocol, which documents the procedures to be followed for impact avoidance or mitigation. The development of an appropriate Cultural Heritage Management Protocol should be undertaken in consultation with an archaeologist, the relevant Aboriginal communities and the NSW Department of Conservation and Climate Change.

- Personnel involved in the construction and management phases of the project should be trained in procedures to implement recommendation relating to cultural heritage where necessary.

7.6.4 Impact assessment - operation

It is considered unlikely that there would be any impact to Indigenous sites during the operation of the wind farm.

7.6.5 Mitigation Measures

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
26	Unavoidable disturbance to Aboriginal objects (stone artefacts) located in generally continuous albeit low density distribution across the proposal area.	Mitigate disturbance	A salvage program of archaeological excavation and analysis would be undertaken in a sample of impact areas prior to construction. The development of an appropriate research project would be undertaken in consultation with an archaeologist, the relevant Aboriginal communities and the NSW Department of Conservation and Climate Change.	Construction and decommissioning	CEMP	x	x
27	Disturbance to an Aboriginal object of low/moderate or moderate significance	Minimise disturbance	The Proponent would minimise the extent of impacts to areas assessed to be of low/moderate or moderate archaeological significance, where possible. A program of salvage subsurface excavation would be undertaken in impact areas at these locales prior to construction as a form of Impact Mitigation. The scope of this program is provided in Tables 19, 20 and 21 of Section 12 of the Archaeological Assessment, which identify the survey units that would be targeted in the program.	Construction and decommissioning	CEMP	x	x
28	Disturbance to an unidentified Aboriginal object	Minimise risk	The Proponent would conduct additional archaeological assessment in any areas which are proposed for impacts that have not been surveyed during the current assessment.	Construction and decommissioning	CEMP	x	x
29	Inadvertent impacts to Aboriginal objects	Minimise risk	The Proponent would develop a Cultural Heritage Management Protocol which documents the procedures to be followed for minimising risk and implementing mitigation strategies. This would be	Construction and decommissioning	CEMP	x	x

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
			undertaken in consultation with an archaeologist, the relevant Aboriginal communities and the NSW Department of Conservation and Climate Change.				

7.7 AIRCRAFT HAZARD IMPACTS

7.7.1 Approach

The development of the Coppabella Hills and Marilba Hills Precincts of the Yass Valley Wind Farm would involve the construction of up to 152 wind turbines, each with a height of up to 150 meters to the blade tip. Due to the height of the wind turbines, potential impacts to aviation safety have been assessed for the construction, decommissioning and operational phases of the wind farm. The air safety issues that have been considered for the proposed wind farm include:

- Proximity of the proposed wind farm to landing fields
- Potential intrusion into air traffic zones and regulatory requirements
- Potential effects on activities such as use of private landing strips.

7.7.2 Existing Environment

Landing fields are classified according to whether instrument landings are available. The nearest airfield to the wind farm site providing instrument landings is the Canberra International Airport. Canberra Airport is approximately 60 km southeast of the proposed wind farm site and as a result Civil Aviation Safety Authority (CASA) has advised that there are no regulated aerodromes within the vicinity of the proposed wind farm. CASA advised that the Obstacle Limitation Surfaces reach a distance of 15 km from the field. The Obstacle Limitation Surfaces (OLS) are conceptual surfaces associated with a runway, which identify the lower limits of the aerodrome airspace above which objects become obstacles to aircraft operations and must be reported to CASA.

Due to the current land use of the proposed wind farm site, potential impacts to aerial spraying of agricultural areas are considered negligible.

Airservices Australia was notified on 17 July, 2008 in relation to the Proposal. A preliminary high level assessment of the Proposal was carried out and at the time, the Proponent was advised that there were radar links in the vicinity of the wind farm and that there was the potential to impact the navigational aid systems. Airservices were unable to provide specific details regarding the number of turbines in question. The Proponent will continue to work with Airservices to resolve any issues associated with the navigational aid systems and intends to engage a consultant to conduct a detailed investigation. Full details are provided in the Communication Impact Assessment (Appendix 5).

The Department of Defence was notified in writing on 17 July, 2008 in relation to the Proposal. A response from Mr John Kerwan of the Department of Defence dated 5 August 2008 was sent to the Proponent.

The letter stated that the Department of Defence had conducted a preliminary assessment with regard to the possible impact of the Coppabella Hills, Marilba Hills & Carrolls Ridge Precincts (the Yass Valley Wind Farm) on military aircraft operations, radio communications and the operation of navigational aids and radars. The Department of Defence advised that the proposed development will be outside any areas affected by the Defence (Areas Control) Regulations (DACR). The DACR control the height of objects (both manmade structures and vegetation) and the purpose for which they may be used within approximately 15 km radius of Defence airfields. In addition, the Proposal has been assessed as unlikely to affect existing Defence communications within the region.

7.7.3 Impact Assessment - construction and decommissioning phases

The physical placement of turbines on the site is the cause of the potential for air hazard impacts. As turbines are installed in the construction phase, mitigation of this impact must be undertaken prior to the construction of the wind turbines.

CASA guidelines for aviation warning lighting for a group of wind turbines are currently being reviewed and Advisory Circular 1390-18(0) has been withdrawn by CASA. At the time of writing this Environmental Assessment there are currently no requirements for aviation obstacle lighting, however, it is understood that the new CASA guidelines may require the project to install such lighting.

The (withdrawn) advisory circular defined that interval between turbines and obstacle beacons should not exceed 900m. Accordingly, if it is considered by CASA or and independent consultant that the project is likely to be a hazard to aircraft, it is expected that up to 40 turbines in the proposed project may require aircraft warning lights. Requirements would be discussed with CASA once the final turbine layout is selected however it is assumed that aviation warning lighting will be required in accordance with CASA guidelines and therefore the impacts have been assessed in the Visual Impact Assessment of this EA. Accordingly, if CASA considers that the project is likely to be a hazard to aircraft, the Proponent would liaise with CASA to determine the appropriate number, location and type of aircraft warning beacons to be fitted on wind turbines prior to the commencement of construction.

The Royal Australian Air Force (RAAF AIS) has requested that the Proponent supply location and height details once the final position of the wind turbines have been determined and before construction commences. After construction is complete, the Department of Defence requests that the Proponent provide RAAF AIS with 'as constructed' details for the wind turbines, wind monitoring masts and electricity transmission lines if applicable.

Subject to the conditions stated in the letter (consultation with CASA in relation to Obstacle Marking and provision of location and height details to RAAF AIS) the Department of Defence has no objection to the proposed wind farm.

The minor, private airstrips in the local area rely on visual rather than instrument-based landings and, as the turbines are clearly visible structures, it is considered unlikely that the development would pose any additional hazard to the users of these airstrips. The location of these airstrips in relation to the Proposal is presented in Figure 7-14. There are no certified or registered airstrips in the vicinity of the proposal.

7.7.4 Impact Assessment - operation

No additional impacts other than those discussed and addressed above are specifically related to the operational phase of the project.

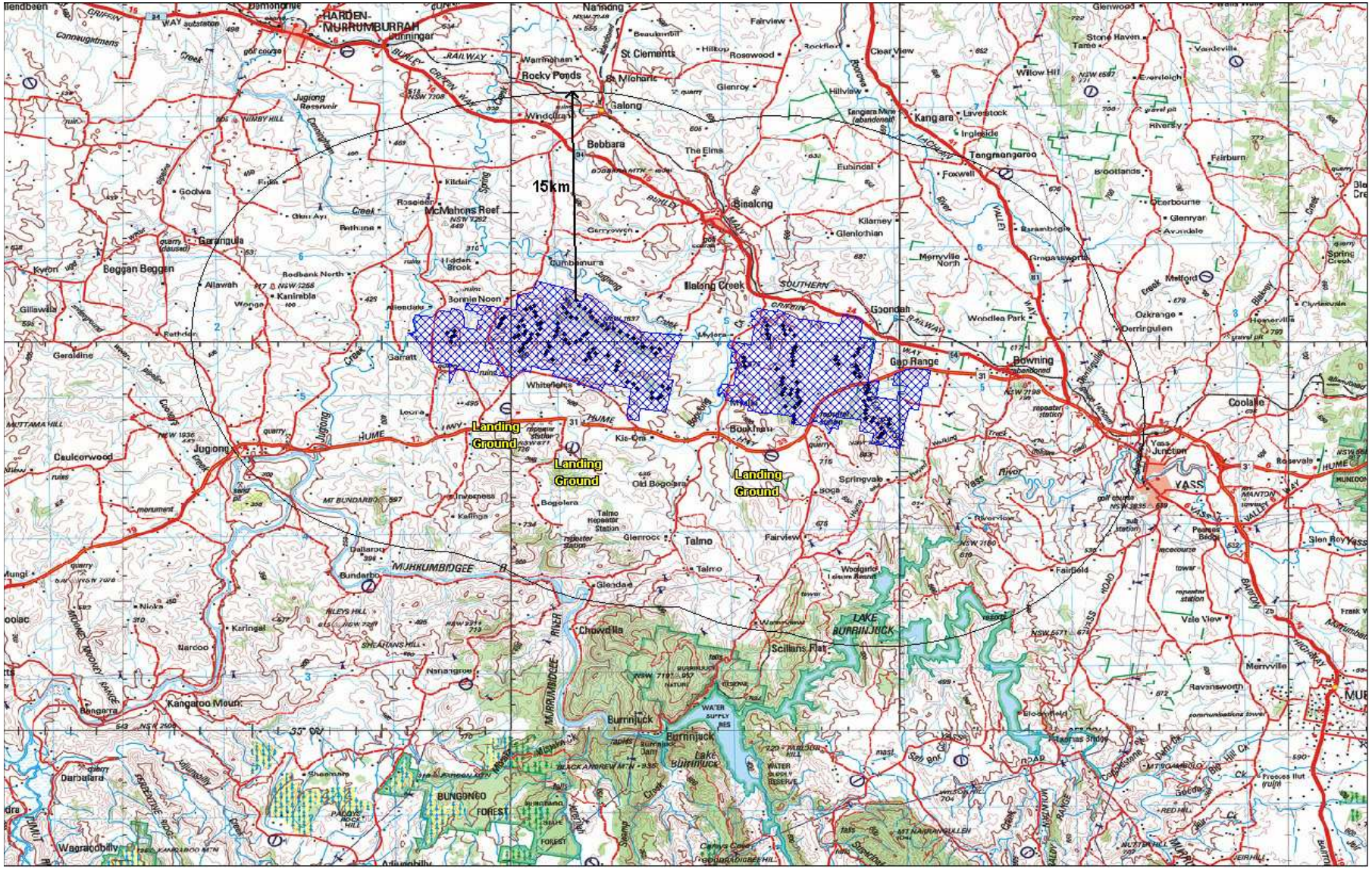


Figure 7-14: Location of airstrips in relation to the Proposal

7.7.5 Mitigation Measures

SoC	Impact	Objective	Mitigation Tasks	Project Phase	Auditing	Coppabella Hills	Marilba Hills
30	Creation of Hazard	Minimise risk	Liaise with CASA and determine the appropriate number, location and type of aircraft warning beacons to be fitted on wind turbines prior to the commencement of construction.	Pre-construction	DoP	X	X
31	Creation of Hazard	Minimise risk	The Proponent would liaise with all relevant authorities (CASA, Airservices, and Department of Defence) and supply location and height details once the final locations of the wind turbines have been determined and before construction commences.	Pre-construction	DoP	X	X

7.8 COMMUNICATION IMPACTS

A communication impact assessment report was prepared by Epuron Pty Ltd. The objectives of this investigation were to identify the potential for impacts from the proposed Yass Valley Wind Farm on existing telecommunications services in the vicinity of the proposal, and to identify appropriate mitigation strategies for potential impacts. The full investigation including a glossary of acronyms used in the investigation, maps, footnotes and references is presented in Appendix 5.

7.8.1 Approach

The following approach was adopted to identify the potential impact of the Yass Valley Wind Farm proposal on telecommunications:

- Identify license holders within a 25km radius of the proposed wind farm, and point-to-point links in the vicinity of the three precincts, using information provided on the Australian Communications and Media Authority (ACMA) RADCOM database.
- Provide written notification of the proposal and seek comments from each license holder identified via the ACMA RADCOM database search.
- Record and review all responses received to identify any issues raised by license holders.
- Discuss issues raised with relevant license holders with the aim to resolve or identify mitigation options.
- Carry out an assessment of the "Fresnel zone" associated with each fixed point-to-point communications link in the vicinity of each precinct. (A Fresnel zone is one of number of concentric ellipsoids of revolution which define volumes in the radiation pattern of an aperture).
- Determine appropriate 'exclusion zones' for the proposed indicative turbine layout based on Fresnel zone calculations and advice from license holders.
- Confirm that all turbines (including blades) are located outside the 'exclusion zone'.
- Determine appropriate additional mitigation measures which may be required.

7.8.2 Existing Environment

The potential impacts of the proposed Yass Valley Wind Farm on the four most commonly used telecommunications services have been investigated separately and are summarised below.

These services include:

- Television and radio broadcast services
- Mobile phone services
- Radio communication services

Aircraft navigation services.

Mitigation measures are stated at the end of the section, under these service headings.

Television and radio broadcast services

Summary of existing services and facilities

The ACMA RADCOM database lists the following broadcasters for television and radio active in the areas of Yass (2582) and Binalong (2584).

Table 7-12 Existing services: television and radio

EXISTING SERVICES AND FACILITIES					
	Television	**Radio**			
	Southern NSW TV1:	Canberra RA1:	Canberra RA2:	Goulburn RA1:	Yass RA1:
Yass	ABC, CBN, CTC, SBS and WIN	1ART, 1CBR, 1CMS, 1WAY, 1XXR, 2ABCFM, 2CA, 2CC, 2CN, 2JJJ, 2PB, 2RN, 2ROC, 2SBSFM	1RPH	2ABCFM, 2ABCRN, 2ABCRR, 2GN, 2JJJ, 2RN, 2SNO.	2YAS
Binalong	ABC, CBN, CTC, SBS and WIN	-	-	-	-

Television

The Black Mountain Tower situated atop Black Mountain, ACT, is the nearest TV transmission source for the locality of the proposed Yass Valley Wind Farm. Black Mountain is approximately 55km South East of the Carrolls Ridge Precinct (the most southern section of the proposed Yass Valley wind farm).

Television Interference (TVI) is dependent on a range of factors including; environmental factors (topography, direct signal strength, transmitter type, and receiver type) and wind farm design factors (turbine elevation, rotor size and orientation, speed of rotation, blade material and pitch). Due to the variability of local conditions and the characteristics of antennae used in particular installations, there is a degree of uncertainty regarding predicted levels of interference.

The zone of potential interference for a wind farm is the resultant total of the effects from the individual turbines. There are approximately 60 houses within a 5km radius of the proposed Coppabella Hills precinct (refer to Appendix 5).

Very High Frequency (VHF) TV reception at dwellings within approximately 1 km of the wind farm turbines and with antennas having turbines located with +/- 25 degrees angle of their reception direction would have some probability of noticeable “ghosting” at times.

For Ultra High Frequency (UHF) TV, time variant ghosting may be evident out to approximately 2 km for turbines located +/- 20 degrees from the reception direction. Digital TV is not susceptible to visible “ghosting” degradation. For any confirmed wind farm interference problems where TV antenna system improvements are unsuccessful, the use of the digital TV services in the area may be the best solution, requiring the provision of a digital set top converter.

It is difficult to assess the likely impact on specific house locations. During the operational phase of the proposal it is possible that television reception could be affected at some of these locations unless some

form of mitigation is introduced. The International Telecommunications Union Recommendation ITU-R BT.805 states that impacts beyond 5 kilometres are unlikely.

Radio

The level of radio broadcast interference experienced can be influenced by a variety of variables including; abnormal weather conditions, multi-path distortion (reception of a signal directly from a transmitter and also a reflected signal from hills, structures etc.), overloading (when an FM receiver receives too strong a signal) and electrical interference.

Low power national FM stations on 107.7 & 106.9MHz are listed on the Wades Hill TV site at Crookwell. National, community and commercial services on 101.5, 102.3, 105.5, 104.7, 98.3, 99.1, 92.7, 91.9, 91.1, 106.3 and 103.9MHz are located on Black Mountain. Potential wind farm impacts on MF radio are highly unlikely and therefore the stations serving the area have not been listed.

Mobile phone services

This section covers GSM and 3G mobile phone services (high frequency communications links used for mobile transmission networks are discussed in the next section - Radio communication services). Figures showing the existing local mobile phone coverage from the three main providers are presented in Appendix 5.

A mobile phone network consists of a system of adjoining zones called 'cells', which vary in size with a radius of 2-10 km. Each cell has its own base station that sends and receives radio signals throughout its specified zone. Mobile phone antennas need to be mounted clear of surrounding obstructions such as buildings to reduce 'dead spots' and allow the base station to effectively cover its intended cells. No GSM/CDMA mobile services are registered at sites in the close vicinity of the proposed wind farm. The Telstra mobile service from Wades Hill, Crookwell is considered too distant to be affected by the wind turbines[25].

Radio communication services

Organisations identified as operating radio communication licences (including fixed link communications) within 25km of the proposed wind farm were consulted. Each was asked to provide independent comments / advice on the possibility of the Yass Valley Wind Farm development interfering with their communications links (license holders within 25km listed in full in Appendix 5).

A fixed link radio transmission is a point-to-point transmission path typically between two elevated topographical features. The transmission path may become compromised if a turbine is located within the direct line of sight ("Fresnel zone") around the line-of-sight between the sending and receiving antennae. Communication is only likely to be affected if a turbine is in the line-of-sight between the two sending and receiving antennae or within a zone of the line-of-sight of these antennae.

The point-to-point communication links were identified and mapped in the vicinity of the proposed wind farm site to establish the line-of-sight paths. In order to ensure that no obstruction to transmission paths occurs, calculations of the 2nd Fresnel zone of the point-to point communications links in proximity to the proposed wind farm were undertaken. It is suggested that beyond the 2nd Fresnel zone, the power of a scattered signal from a structure such as a wind turbine would be small enough such that it would not result in significant interference at the receiver.

[25] Lawrence Derrick & Associates Bannister Wind Farm – Investigation of possible impacts on broadcasting and Radio communication Services September 2003

Coppabella Hills Precinct

Five point-to-point communications links were identified as crossing the Coppabella Hills precinct. In order to determine whether a radio link could be affected by the wind turbines, an 'exclusion zone' was defined, beyond which the level of interference is unlikely to disrupt the radio link, based on the concept of the Fresnel zone, as previously described.

As a result of the exclusion zones established in planning the wind farm, there is the possibility that impacts could occur to existing point-to-point links, in particular link 27571 operated by Harden Shire Council. The Proponent has engaged with council to discuss these potential impacts and possible mitigation strategies. Both council and the Proponent are confident that any potential impacts would be able to be mitigated using the following techniques:

- Modifications to or relocation of the existing antennae;
- Installation of a directional antennae to reroute the existing signal;
- Installation of an amplifier to boost the signal; and/or
- Utilisation of onsite optical cable to reroute the original signal.

Marilba Hills Precinct

Seven point-to-point communications links were identified as crossing the Marilba Hills precinct. When considering the exclusion zones established in planning the wind farm, there are two links identified that could potentially be impacted. The Rural Fire Service and the Department of Environment and Climate Change have been consulted regarding the potential impacts and both parties are confident that a mitigation solution will be possible using the following methods:

- Relocation of the existing antennae;
- Installation of a directional antennae to reroute the existing signal;
- Utilisation of onsite optical cable to reroute the original signal.

Aircraft navigation systems

The closest airports to the Yass Valley Wind Farm are Canberra and Goulburn. There is one radar installation in the vicinity of Canberra airport, namely Mt Majura. A secondary radar installation is located at Mt Bobbara to the North of the Coppabella Hills and Marilba Hills Precincts.

EPURON has consulted with the Civil Aviation Safety Authority (CASA), Airservices Australia and the Department of Defence in relation to the proposal.

Due to the height of the proposed turbines (>110m), the Civil Aviation Safety Authority previously recommended that obstacle lighting be provided as per Section 5.5 of Advisory Circular 139-18(0) - *Obstacle Marking and Lighting of Wind Farms.* However, the Advisory Circular was withdrawn in September 2008 and at the time of writing a recommendation was not available from CASA in relation to Obstacle Marking and Lighting of Wind Farms not in the vicinity of an aerodrome.

EPURON wrote to Airservices Australia (AA) in relation to the wind farm proposal on 15-7-08. In their response dated 16-12-08, AA suggested that there may be "navigational aid issues" associated with the proposal. Specific details regarding particular installations affected were not provided.

EPURON met with Airservices Australia on 1 April, 2009 to discuss the scope of work required for a detailed analysis. Airservices Australia indicated at the meeting that they would not be able to conduct an

internal assessment of the impacts to their navigational aids due to resourcing constraints. Accordingly, it was proposed that EPURON agree on a scope of work acceptable to Airservices Australia so that EPURON could engage a suitable consultant to investigate and prepare a report to assist Airservices Australia in their assessment of the proposal.

EPURON will continue to work closely with AA to mitigate issues discovered with the Mt Bobbara (SSR) and Mt Majura (PSR / SSR) that can be reasonably attributable to the proposed wind farm.

A review of the proposal was undertaken by the Department of Defence. No objection to the proposal was made.

Following a review of the communication services near the proposed wind farm, potential interference and consultation with the service providers, it is considered that the wind farm would have minimal effect on telecommunications services. Mitigation strategies are proposed to ensure any impacts can be managed and mitigated. These are stated below.

7.8.3 Impact Assessment - construction and decommissioning phases

No telecommunications impacts are anticipated during the construction and decommissioning phases of the wind farm development. However, some measures are best instituted during this stage. These include:

Television and radio broadcast services

- Use of primarily non-metallic turbine blades
- Use, wherever practical, of equipment complying with the Electromagnetic Emission Standard, AS/NZS 4251.2:1999

7.8.4 Impact assessment – operation

It is considered that potential impacts would be confined to the *operational phase* of the wind farm, as discussed previously in this section.

Television and radio broadcast services

At the commencement of operation, the Proponent would offer to undertake a monitoring program of houses within 5km of the wind farm to determine any loss in television signal strength, if requested by the owners.

In the event that television interference (TVI) is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference would be investigated by the Proponent.

Should investigations determine that the cause of the interference can be reasonably attributable to the wind farm; the Proponent would put in place mitigation measures at each of the affected receivers in consultation and agreement with the landowners.

Specific mitigation measures available include:

- Modification to or replacement of receiving antenna
- Provision of a land line between the effected receiver and an antenna located in an area of favourable reception
- Improvement of the existing antenna system
- Installation of a digital set top box

- In the event that interference cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna at the Proponents cost

Mobile phone services

Recommendations from telecommunications companies have been incorporated into the planning of the project.

- Mobile phone services in the area are not expected to be impacted by the wind farm or its operation

Radio communications services

Mobile radio and other radio communication services in the area are not expected to be impacted by the wind farm or its operation. Conflicts between point-to-point radio systems and the wind turbines are expected to be avoided using a range of mitigation strategies which include:

- Modifications to or relocation of the existing antennae
- Installation of a directional antennae and/or
- Installation of an amplifier to boost the signal

Aircraft Navigation Systems

The closest airports to the proposed wind farm site are Canberra and Goulburn. There is one radar installation in the vicinity of Canberra airport, namely Mt Majura. A secondary radar installation is located at Mt Bobbara.

EPURON will continue to work with Airservices Australia to mitigate any issues with navigational aids. EPURON will consider any relevant recommendations made by CASA in relation to obstacle lighting should these become available.

7.8.5 Mitigation Measures

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
32	Deterioration of signal strength	No deterioration of signal strength	The Proponent would locate wind turbines to avoid existing microwave link paths that cross each precinct, or liaise with the owners of such links to relocate services to avoid potential impacts from turbines.	Pre construction		x	x
33	Deterioration of signal strength	No deterioration of signal strength	The Proponent would undertake a detailed investigation to develop appropriate mitigation measures associated with potential impacts to navigational aids from the Coppabella Hills and Marilba Hills Precincts. The Proponent would liaise with Airservices Australia to ensure all mitigation measures are acceptable.	Pre-construction and operation		x	x
34	Deterioration of signal strength	No deterioration of signal strength	Ensure adequate television reception is maintained for neighbouring residences as follows: • Undertake a monitoring program of houses within 5km of the wind farm site to determine any loss in television signal strength if requested by the owners. • In the event that after construction television interference (TVI) is experienced by existing receivers within 5km of the site, investigate the source and nature of the interference. • Where investigations determine that the interference is cause by the wind farm, establish appropriate mitigation measures at each of the affected receivers in consultation and agreement with the landowners. Specific mitigation measures may include: • Modification to, or replacement of receiving antenna	Operation		x	x

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
			• Provision of a land line between the effected receiver and an antenna located in an area of favourable reception • Improvement of the existing antenna system • Installation of a digital set top box or • In the event that interference cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna at the Proponents cost				

7.9 ELECTROMAGNETIC FIELDS (EMFS)

7.9.1 Assessment

Background

Electromagnetic fields (EMF) (having both electric and magnetic components) are generated by operational electrical equipment, including transmission lines, substations and wind turbines. Transmission lines and electrical devices, including substations and wind turbines, generate 50 Hz electric and magnetic fields within their vicinity.

Electromagnetic fields can have acute and chronic health impacts. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) have produced fact sheets which state that studies to date have consistently shown that there is no evidence that prolonged exposure to weak *electric* fields (such as those found in the home or in most workplaces), results in adverse human health effects. Whether chronic exposure to weak *magnetic* fields is equally harmless remains an open question. While there is no evidence that these fields cause immediate, permanent harm, laboratory studies on animals and cell cultures have shown that weak magnetic fields can have effects on several biological processes (hormone and enzyme levels, the rate of movement of some chemicals through living tissue). The fact sheets state that while most studies have produced inconclusive results or no increased cancer incidence in laboratory animals following exposure to EMFs, a few studies have indicated an increased incidence (ARPANSA web page updated 2007).

The Australian Radiation Protection and Nuclear Safety Agency (APANSA) was formed in 1998 as a Federal Government agency charged with the responsibility of protecting the health and safety of people and the environment, from the harmful effects of ionising and non-ionising radiation. ARPANSA is currently developing guidelines on exposure limits to EMFs but in the meantime they still refer to the National Health and Medical Research Council Interim Guidelines. The National Health and Medical Research Council Interim Guidelines on Limits of Exposure to 50/60 Hz Electric and Magnetic Fields recommended limit for 24 hour exposure is 1000mG for magnetic fields and 5kV/m for continuous public exposure to electrical fields. They note that research suggests that health effects are associated with prolonged exposure; measurements at one point in time do not accurately reflect prolonged exposure levels.

Electric fields can be reduced both by shielding and with distance from operating electrical equipment. Magnetic fields are reduced more effectively with distance.

7.9.2 Impact assessment – construction and decommissioning phases

Potential for EMF impacts occurs only during the operational phase of the wind farm when electrical infrastructure is capable of generating electromagnetic fields. The electromagnetic fields produced by the wind farm infrastructure would vary at different locations onsite, as discussed below. No impact mitigation is considered to be required for the construction and decommissioning phases.

7.9.3 Impact assessment – operation

Transmission lines

Underground and overhead transmission lines connecting turbines to the substations at each precinct would be 33 kV. At the substation within each precinct, the voltage would be stepped up to 132 kV and fed into the existing TransGrid transmission network.

The magnetic fields associated with a transmission line at any moment in time depend on a range of factors, including the amount of power flowing in the line and the distance of the measurement point from the conductors. Typical levels of magnetic field under a 132 kV high-voltage transmission line range from 5 - 50 mG at a distance of 30 metres from the centre of the easement. The strength of the field falls away rapidly with increased distance. High-voltage lines can produce magnetic fields of up to 80 mG. These figures are far less than the 1,000 mG limit recommended for 24-hour exposure (National Health and Medical Research Council Interim Guidelines on Limits of Exposure to 50/60 Hz electric and magnetic fields).

Electric fields from power lines diminish rapidly with distance from the source. Their levels are extremely low, with levels of 0.07V/m and 0.01V/m recorded at 30m and 60m from a 115kV power line (Hafemeister, 1996), and are significantly less than the 5kV/m (5000V/m) NHMRC interim guideline for continuous exposure. At the voltage (33kV) proposed in this project, the effects are negligible.

In a 33 kV transmission line, the load may be 'unbalanced' (greater at one end than the other) and located closer to the ground than in a 132 kV line and, as such, receivers may be exposed to larger EMFs than the higher voltage lines (pers. comm. Mr Colin Hackney, Country Energy 2006). Where practical, 33 kV lines would be underground, maximising the shielding effect to minimise EMF exposure.

Where practical, 33kV lines would be underground, maximising the shielding effect to minimise EMF exposure. Cables used in the 33kV onsite reticulation cabling will contain three core conductors in trefoil (three lobed) arrangements to cancel out the effects of magnetic fields from adjacent conductors.

Any off-site electricity lines will be located and designed in accordance with the Principals of Prudent Avoidance which essentially means taking appropriate precautions at modest cost without undue inconvenience to avert possible risk. Therefore electricity cables will be located away from residences, where practical, to minimise magnetic fields from any off-site transmission lines.

Substation

The United Kingdom National Grid Company has conducted a survey of suburban substations to determine the level of EMFs produced. Measurements were taken at 0.5 m above ground level within 1m of enclosures. The results revealed mean magnetic flux densities of approximately 19 mG, halving at an average distance of 1.3 m and becoming indistinguishable from the background due to other domestic sources within 5 m (HPA 2004).

Fencing around the substation and the location of the substation and control buildings would ensure that the EMF exposure to receivers including the public, property owners and workers are well below the 1,000 mG levels determined for public health.

Wind Turbines

A report investigated the expected magnetic field for 1,650 kW proposed wind turbines for Windrush Energy in 2004 (Iravani *et al.* 2004). The study was based on research and measurements of an existing wind turbine. The measured flux density at the door of the existing turbine was 0.4 mG and the typical value around the wind turbine was 0.04 mG. The acceptable frequency is 833 mG. The results determined that no measurable magnetic field would be expected at a distance of eight metres from the 1,650 kW wind turbine.

The report concluded:

> *It is our strong belief that the magnetic fields produced by the generation and export of electricity from the Windrush wind turbine does not pose a threat to public health.*

The areas proposed for the installation of wind farm infrastructure would have limited public access. Access to these areas by the general public would be restricted, with periodic access by appropriately trained and qualified maintenance staff only. Property owners accessing the sites would have no reason to spend extended periods near the infrastructure, which is not located near frequent use areas such as sheds, yards and residences. Should property owners require access to control buildings or other wind farm infrastructure, they would be accompanied by an appropriately trained and qualified maintenance staff member.

Wind farms present an opportunity for tourist and educational use. Although it does not form part of this Proposal, there is a potential for the Yass Valley Wind Farm to be used in the future as a renewable energy educational facility. Again, extended exposure is not anticipated from tours, however, appropriate safeguards could be put into place prior to the operation of any tours to ensure the opportunity for human exposure to EMFs is minimised and within recommended guidelines.

7.9.4 Mitigation Measures

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
35	Radiation exposure from EMFs	Minimise exposure	Adhere to standard industry approaches and policies with respect to EMF through maintenance of adequate easements around transmission lines.	Operation	OEMP	x	x
36	Radiation exposure from EMFs	Minimise exposure	The turbines, control building, substation and transmission lines would be located as far as practical from residences, farm sheds, and yards in order to reduce the potential for both chronic and acute exposure.	Operation	OEMP	x	x

7.10 TRAFFIC AND TRANSPORT

7.10.1 Approach

The Traffic Impact Study was prepared by Bega Duo Designs (December 2008) assessing potential traffic implications that may result from the Proposal. This study was completed in accordance with the *Guide to Traffic Generating Developments* as recommended by the RTA. The study assessed potential impacts of the proposed development and provided recommendations for minimising potential traffic impacts associated with the Proposal. The traffic impact study is primarily focused on the construction phase of the Proposal as it is considered that the construction phase would generate the greatest volume of traffic. A full copy of the Traffic Impact Study is presented in Appendix 6.

The methodology adopted by Bega Duo Designs included:

- General project information was obtained from the Proponent and **ngh**environmental
- Further information and feedback was received from key stakeholders at the Yass Valley Wind Farm Planning Focus Meeting, held on site on the 14th & 15th of October, 2008
- Existing mapping was used to identify features during inspections of each precinct
- Planning documentation for other wind farm Proposals was reviewed
- Roads were inspected, inventories prepared and photographs taken. Road junction and intersections were inspected and photographed
- Approximate traffic count information was obtained from observations at all precincts during November 2008. Roads & Traffic Authority data was used to establish the existing traffic volumes (vehicles per day) on the main roads.
- Consultation with representatives from **ngh**environmental, Epuron, Roads & Traffic Authority, Harden and Yass Valley Councils was undertaken
- Information on road conditions was obtained from property owners and interested residents at the Open House Community Consultation Day on 10th of December 2008
- Methods of wind turbine construction and programming of the works were investigated to estimate the proposed vehicle trips[26]

7.10.2 Results

Access

The roads in the vicinity of the Proposal area are generally classified as follows:

- National Highways - Hume Highway which is owned and maintained by the Roads & Traffic Authority

[26] In accordance with the Guide to Traffic Generating Developments, a 'trip' is defined as a one-way vehicle movement from one point to another, excluding the return journey. The general method of measuring traffic volume is 'vehicles per day'. This is the total of all trips made in either direction per day.

- State Roads – Burley Griffin Way which is maintained by Yass Valley Council under contract to the Roads & Traffic Authority
- Regional Roads – Burrinjuck Road which is part funded by a grant agreement administered by the Roads & Traffic Authority
- Local Roads – All other roads which are owned by the Council (either Harden or Yass Valley).

Each precinct is located between 20 and 50 kilometres west of Yass, a major country town and service centre. The Hume Highway provides a safe road connection with up to 110km/h travel speed. The village of Binalong provides some services and is within 10 kilometres of the northern extremity of the Marilba Hills and Coppabella Hills precincts.

Access requirements for the proposed wind farm can be separated into the following categories:

- Standard road vehicles from 2 wheel drive cars to B-Double trucks. These vehicles are required to access each precinct usually as far as the depot or storage compound. They represent the largest proportion of vehicles. It is anticipated that light vehicles would be the primary source of transport within the construction area of each precinct.
- 4 wheel drive vehicles which may be required for most transport to the turbine locations and would provide ongoing maintenance.
- Specialist vehicles may include off-road construction vehicles, for example vehicles with nonstandard axle combinations. These may include tracked vehicles and reconfigured trailers used to tow components into position. This type of vehicle would not generally be able to be used on sealed local roads.
- Over-dimensional vehicles transporting turbine components and oversize construction machinery. These vehicles would generally be wider and longer but weights of loads would not be excessive (generally up to 70 tonnes carried over 7 axles) and they would be able to cross most drainage structures without damage.
- Over-mass and over-dimensional vehicles transporting electrical transformers of up to 200 tonnes. These vehicles would possibly require the strengthening of bridges and drainage structures because of the close spacing of axles. Only a small number of these vehicles are anticipated during construction.

Coppabella Precinct

The major access points being considered for the Coppabella Hills Precinct are from Whitefields Road to the south of the precinct. Whitefields Road connects with the Hume Highway, 38 kilometres from Yass. The western end of Whitefields Road connects with the Hume Highway via Coppabella and Berramangra Roads. Additional access points may be available from Coppabella Road for low volumes of 4 wheel drive or specialist vehicles. The five turbines at the western end of the precinct would likely be accessed from Berramangra Road which junctions with the Hume Highway, 47.3 kilometres from Yass.

Marilba Precinct

Access points under consideration for the eastern section of the Marilba precinct are from the Hume Highway, via the truck rest areas on each side of Conroys Gap, 20.9 kilometres from Yass. Access to the majority of turbines would be from the Marilba Station access road, 23.0 and 25.2 kilometres from Yass. An access to the northern section from Illalong Road at 1.6 kilometres from Burley Griffin Way is being considered. An access off Burley Griffin Way at 3.5 kilometres from the Hume Highway could provide access to the eastern section of the precinct and the proposed connection to the 132kV transmission line.

Existing Traffic Volumes

Volumes obtained from RTA counts are average, annual, daily traffic counts and have been adjusted to represent numbers of vehicles. The volumes were based on counts collected in 2006. The figures include vehicle numbers in both directions and can be adjusted if required, assuming that the peak hour represents 10% of the annual average daily traffic volumes (AADT). Precise volumes are not considered to be critical in the examination of traffic impacts and therefore the 2006 volumes have been adopted.

Observations on most of the minor roads, undertaken as part of the field assessment, revealed hourly counts approaching zero. The traffic on these roads is generated primarily by the occupied properties. The numbers adopted below have been adjusted based on the number of properties multiplied by traffic generation rates for dwellings given in the RTA Guide to Traffic Generating Developments.

The traffic volumes on Paynes Road at Bogo Quarry are dependant on the production rate of a particular day and can reach up to 20 vehicles per hour. For the purposes of this report, this maximum rate is assumed over a 7 hour day.

The accuracy of the adopted traffic counts on the minor roads is not significant in the assessment of traffic impacts while the volumes remain low. Impacts on these roads are considered based on observed defects in each road.

Table 7-13: Traffic Volumes (AADTs)[27] for Roads in the Study Area.

Road	AADT (vehicles per day)	Information source
Hume Highway at Bowning	7223	Obtained from RTA records
Burley Griffin Way Stn 94.085	1661	Obtained from RTA records
Illalong Road	70	Adjusted from counts taken
Berramangra Road	Less than 50	Adjusted from counts taken
Garry Owen Road	Less than 50	Adjusted from counts taken
Paynes Road to Bogo Quarry	Less than 200	Adjusted from quarry production rates
Cumbamurra, Coppabella, Coppa Ck, Waterview & Whitefields Road	Less than 30	Adjusted from counts taken and discussions with landholders

7.10.3 Impact Assessment - construction and decommissioning phases

Over-mass and over-dimensional vehicles

The larger vehicles would occupy most of the width of the roadway at many locations thereby requiring traffic control procedures to ensure safe passage for local road users. For nearby property owners, there is likely to be an increase in traffic noise and dust nuisance in addition to the need to control stock from

[27] AADTs represent the total traffic volume in both directions (they also equate to the number of trips)

straying on the roads which are not fenced. Dust generated on unsealed roads could impact visibility and result in the loss of pavement materials. Gravel road surfaces would deteriorate and potholes would form under the increased traffic loads, particularly during wet weather when water ponds or drains across a road. Structural damage may occur to some of the culverts, concrete causeway crossings, stock grids and traffic islands. The location of trees and other roadside objects have the potential to obstruct the passage of long wide loads and high loads. Lack of roadside delineation in some locations may impact traffic safety during periods of poor visibility. Some intersections have inadequate pavement width to safely accommodate the turning manoeuvres of the over-size vehicles.

It is considered that these impacts would be temporary, as the equipment haulage is not a continuous program. Most of the heavy haulage would be in the form of convoys and would be managed through a number of specific mitigation measures developed and implemented in conjunction with both RTA and Yass Valley and Harden Councils. These measures usually include escort vehicles.

Decisions on the final routes for these vehicles would be the subject of negotiations between the haulage contractor and the road authorities.

Traffic impacts at specific locations

Hume Highway

Additional traffic would be turning to and from the Hume Highway at seven locations between Burley Griffin Way and Westbourne Road (18.3 to 50.2 kilometres west of Yass).

The junctions at Burley Griffin Way, Paynes Road, Burrinjuck Road, Illalong Road and Berramangra Road are of a high standard and the relatively small increase in traffic volumes is unlikely to have any significant impacts on safety for turning traffic.

The junctions with Burley Griffin Way and Burrinjuck Road have advance signposting allowing traffic departing from the Highway to select the appropriate lane and decelerate smoothly in preparation for the turn. This facility is not available on the other junctions and drivers who are unfamiliar with the locality are often required to make sudden manoeuvres at high speed when they approach their departure point at a minor junction.

Hume Highway rest areas at Conroys Gap

The existing access track from the rest area on the northern side departs from the deceleration lane at a point where travel speeds have not sufficiently reduced to permit safe access. The existing access on the southern side does not have sufficient setback from the rest area formation and turning radii are insufficient for large vehicles. The rest areas do not permit safe turning for return travel.

Illalong Road

Increased vehicle movements particularly by heavy vehicles would increase the potential of vehicle conflicts.

Yass Valley Council has imposed a weight restriction of ten tonnes on the full length of Illalong road as the pavement is considered to be of insufficient strength to withstand large volumes of heavy traffic.

A timber bridge at 3.3 kilometres from Burley Griffin Way is currently under repair. The width between kerbs is 4.8 metres. This bridge and the concrete bridges at 6.09 and 10.27 kilometres may be of insufficient strength and width for use by heavy vehicles.

Marilba access roads

The increased volumes of traffic at these junctions may result in vehicle conflicts in the 'throat' of the junction, between vehicles departing and entering at peak periods.

Whitefields Road

The increased volumes of traffic at the junction with Hume Highway may result in vehicle conflicts in the 'throat' of the junction between vehicles departing and entering at peak periods.

Whitefields Road has insufficient width for most of its length to operate as a two lane access road carrying construction traffic. Trees overhang the road at many locations which would restrict high loads. The proximity of many trees to the roadside could restrict the passage of long wide loads.

The road reserve is not fenced for stock control and properties are separated by gates at six locations along the 10 kilometre length.

Coppabella Road (Southern section from Whitefields Road to Berramangra Road).

The 2.6 kilometre section of Coppabella Road from Whitefields Road to Berramangra Road is of insufficient width for part of a major access route and is not fenced.

Berramangra Road

Berramangra Road has inadequate delineation of the alignment and insufficient warning of the poorly aligned sections and roadside hazards. The available width of bitumen is reduced at some locations by roadside vegetation.

The junction with Coppabella Road has insufficient sight distance to the north along Berramangra Road.

An old concrete bridge at 3.6 kilometres has an available width of 5.5 meters between kerbs.

The junction with Hillview Road has inadequate turning radius to the north. The Westbourne Road Junction requires larger turning radii for safe turning by larger vehicles.

Berramangra Road beyond 9.3 kilometres from Hume Highway has a low standard of alignment which reduces safe travel speed on some sections to 40 to 50 kilometres per hour.

Impacts on Minor Roads

There is the potential to impact Westbourne Road, Coppa Creek Road, Cumbarmurra Road, Garry Owen Road and Coppabella Road (Northern Section). Although it is not anticipated that these minor roads would become primary access routes, it is probable that some of these routes would experience a small increase in traffic volumes. A relatively small increase in traffic volumes would require improvements to ensure the safety of road users particularly in relation to conflicts between vehicles and stock.

The road reserves are fenced on Westbourne Road and Garry Owen Road and therefore can support small increases in traffic without the level of improvement required on the other minor roads.

Isolated curves and crests on looser gravel surfaces could result in drivers losing control. Several drainage structures may need upgrading to ensure continued access in wet weather.

Several mitigation measures have been developed to manage traffic impacts during the construction phase; key areas are highlighted in Table 7-14 and full measures are detailed in Section 7.10.5 .These centre around the development of a Traffic Management Plan (TMP) in consultation with roads authorities and affected members of the community, to finalise the routes and ensure that safety and protection of assets is managed effectively.

7.10.4 Impact assessment – operation

Once operational, the wind farm would be managed and operated by several crews of technicians, likely to be based at Yass. The precincts would be accessed regularly for operational and maintenance activities. It is estimated that the operational phase would generate up to 8 trips per day into the Coppabella Precinct from Whitefields Road. It is assumed that there would be at least four permanent access points into the Marilba Precinct, generating approximately 4 trips per day from the access points at Conroys Gap and Marilba Station.

It is considered that the operational wind farm may generate tourist traffic on the roads surrounding each precinct. The proposed wind farm may generate interest as a visual feature in the locality however, it is considered that this would not significantly increase the number of tourists visiting Yass and therefore the increase in traffic volumes and subsequent impacts are likely to be low. Each precinct is in relative close proximity to the Hume Highway. This highway is a dual carriage way main road that would be able to facilitate the potential increase in traffic.

No specific mitigation measures are considered warranted to manage operational traffic impacts.

Table 7-14: Summary of the type and extent of key safeguards required to reduce traffic impacts

Key safeguards	Hume Highway	Burley Griffin Way	Illalong Road	Marilba Access Road	Paynes Road	Whitefield's Road	Coppabella Road	Berramangra Road	Westbourne Road	Coppa Creek Road	Cumbamurra Road	Garry Owen Road
Reconstruction and/or realignment to provide 6m wide pavement	-	-	-	-	-	Up to 9.8 km of reconstruction (to the junction of site)	2.6 km of reconstruction on the southern section only	-	-	-	-	-
Improve turning radii and advance signposting on junctions [28]	5 junctions	1 junction	2 junctions	(see Hume Highway)	-	(see Hume Highway)	-	2 junctions	(see Berramangra Road)	-	-	-
Check bridges and pavement condition on sealed roads in consultation with road authorities	-	-	3 bridges & 11 km of pavement	-	-	-	-	1 bridge & 8.5 km of pavement	-	-	-	1 bridge
Maintain road shoulders on sealed roads	-	-	-	-	-	-	-	13.8 km of sealed pavement	-	-	-	0.81km of sealed pavement
Provide warning signs and guideposts	-	-	-	-	-	9.8 km length	3.12 km length in the northern section	13.8 km length	5.0 km length	-	-	9.7km length
Liaise with roads authority and land holders on improvements required	2 junctions at Conroys Gap Rest Areas	-	11 km length	2.2 km length	1.34 km length		10.33 km length	13.8 km length	5.0 km length	2.3 km length	7.5 km length	9.7km length

[28] The road indicated is the more major road of the junction

7.10.5 Mitigation measures

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
37	Safety and asset protection	Minimise Risk	The Proponent would develop and implement a Traffic Management Plan (TMP) in consultation with roads authorities to facilitate appropriate management of potential traffic impacts. The TMP would include provisions for: • Scheduling of deliveries and managing timing of transport • Limiting the number of trips per day • Undertaking community consultation before and during all haulage activities • Designing and implementing temporary modifications to intersections, roadside furniture, stock grids and gates • Managing the haulage process, including the erection of warning and/or advisory speed signage prior to isolated curves, crests, narrow bridges and change of road conditions • Designation of a speed limit would be placed on all of the roads that would be used primarily by construction traffic • Preparation of a Transport Code of Conduct to be made available to all contractors and staff • Identification of a procedure to monitor the traffic impacts during construction and work methods modified (where required) to reduce the impacts • Provide a contact phone number to enable any issues or concerns to be rapidly identified and addressed through appropriate procedures • Reinstatement of pre-existing conditions after temporary	Construction	CEMP	x	x

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
			modifications to the roads and pavement along the route.				
38	Safety and Asset protection	Minimise Risk	The Proponent would use a licensed haulage contractor with experience in transporting similar loads, responsible for obtaining all required approvals and permits from the RTA and Councils and for complying with conditions specified in those approvals.	Construction	CEMP	x	x
39	Safety and Asset protection	Minimise Risk	The Proponent would prepare road dilapidation reports covering pavement and drainage structures in consultation with roads authorities for the route prior to the commencement of construction and after construction is complete. The Proponent would repair any damage resulting from the construction traffic (except that resulting from normal wear and tear) as required during and after completion of construction at the Proponent's cost or, alternately, negotiate an alternative for road damage with the relevant roads authority.	Construction	CEMP	x	x
40	Safety and Asset protection	Minimise Risk	Route specific mitigation measures, as detailed Section 5.2 of the Traffic Impact Study, would be adopted where significant increases in use are anticipated as a consequence of the proposal.	Construction	CEMP	x	x

7.11 FIRE AND BUSHFIRE IMPACTS

7.11.1 Existing environment

The development envelope of both Coppabella Hills and Marilba Hills Precincts is predominately pasture. Remnant patches of Box Gum Woodlands (both precincts), Box Gum Woodland Derived Grassland (Marilba Hills), Broad-leaved Peppermint Dry Grass Forest (Marilba Hills), Long leaved-box Dry Grass Forest (Marilba Hills) and Long-leaved Box / Red Stringybark Dry Grass Forest (Coppabella Hills) also occur.

Factors mitigating fire risks within the precincts include the sparse and fragmented nature of woodland and forest remnants flanking the development envelope at Coppabella Hills and Marilba Hills and the continued grazing regimes, which acts to reduce fuel loads. However grass fires can spread rapidly and threaten life and property.

The bushfire danger period for both the Yass Valley and Harden Shire Local Government Area (LGA) is generally between 1st October and 31st March, but can vary subject to local conditions. Summer conditions in these LGAs can be dry and hot with high wind speeds. Existing ignition sources include farm machinery and vehicles, hay storage, vehicles stopping in long grass on road verges, cigarette butts thrown from car windows (both precincts border the Hume Highway) and lightening strikes. The elevated position of the sites may increase the frequency of lightning strike. The steep topography and absence of built areas or natural fire breaks such as large water bodies may assist the rate of spread of wildfires. Furthermore, steep topography currently impedes access to all areas of the precincts.

The NSW Fire Brigade defines hazardous materials as 'anything that, when produced, stored, moved, used or otherwise dealt with without adequate safeguards to prevent it from escaping, may cause injury or death or damage to life, property or the environment'. The fuels and lubricants required to construct and operate the wind farm constitute hazardous materials under this definition.

The NSW Fire Brigade has the authority to attend, combat and render safe any land-based or inland waterway spillage of hazardous materials within the State. All fire stations are equipped with trained personnel and resources for dealing with hazmat incidents. The Hazardous Materials Response Unit has a 24 hour phone contact (Tel: 02 9742 7155). Intermediate hazardous materials response is delivered by 20 strategically located units; each unit is equipped with detection equipment and has the capability to access chemical databases with information on chemical, biological, radiological and toxic industrial chemical substances. The closest NSW Intermediate Hazardous Materials Response Unit is located at Goulburn Fire Station 157 – 161 Burke St. Goulburn. The travel time to the site would be 1.5 hours (approximately 100km).

7.11.2 Impact assessment - construction and decommissioning phases

Issues relevant to the Proposal and bushfire impacts include:

- Activities such as hot welding in fire danger periods;
- Potential for infrastructure to start or influence a fire; and
- Access to the site and fire fighting strategies onsite.

These issues are discussed below.

Flammable materials and ignition sources brought onto the site, such as fuels, would increase the risk of fire during the construction period. Correct handling and storage procedures would mitigate against the

risk of ignition. Appropriate fire fighting equipment would be held at each precinct when the fire danger is very high to extreme, and a minimum of one person on site would be trained in its use.

The Rural Fire Service would be consulted in regard to the adequacy of bushfire prevention procedures to be implemented on site during construction, operation and decommissioning. These procedures would in particular cover hot-work procedures and response measures to control any incident.

Planning for Bushfire Protection (2006) guidelines present methods for determining building standards according to the assessed category of bush fire attack (considering APZ distances, topography and vegetation). The Proponent would assess the likely categories of bush fire attack according to PBP methodology and, where appropriate, aim to ensure building standards comply with A*S 3959-1999 Construction of buildings in bushfire-prone areas* standards for the appropriate level of bushfire attack. The Proponent would also consider other aspects of building design to protect buildings from radiation and ember attack and ensure that buildings comply with the fire provisions of the Building Code of Australia.

7.11.3 Impact assessment - operation

Ignition sources

Ignition sources are similar for each precinct, being dependant on the infrastructure to be installed.

Being electrical equipment and containing petrochemicals, there is potential for the wind turbines, substations, control buildings and transmission lines to start or influence the spread of fire. For the wind turbines themselves, the risk of fire can be associated with malfunctioning turbine bearings, inadequate crankcase lubrication, cable damage during rotation, electrical shorting or arcing occurring in transmission and distribution facilities (AusWEA 2001).

Zilkha Renewable Energy (2002) reports that records from a leading insurer show that fires due to equipment failure are very rare in modern wind turbine designs. In 15 years and with over 12,000 insured turbines, the insurer has had only one case of third party damage from fire caused by a turbine. Turbines automatically shut down if ambient temperatures exceed the safe operating range, or if components overheat.

There remains however, a possibility that electrical failure could produce a fire within a turbine tower. In the event of a turbine igniting within any precinct, the generally low fuel levels in surrounding pasture and fragmented woodland at the Coppabella Hills and Marilba Hills precincts would reduce the chance and intensity of wildfire.

The ready visibility of the turbines and local presence of RFS equipment and personnel would and assist detection, response time and control. In addition, shut down mechanisms are installed in the wind turbines, and remote alarming and maintenance procedures would also be used to minimise risks.

Lightning conductors are installed in turbines to ground lightning strikes in order to minimise risk of damage to the turbines and risk of ignition of a wildfire. Relatively minor damage to turbines may occur from lightning strike. At the existing Crookwell I site, a direct strike resulted in damage to one of the turbine blades, which was repaired onsite. No wildfire resulted. The risk of turbine ignition is considered to be low, based on the low likelihood of electrical failure or over-heating and a range of factors mitigating the fire hazard.

Electrical transmission lines would be installed to connect the wind farm to the electricity grid system. The lines are underground across most of the precincts and overhead to connect the precincts to the substations. The overhead lines have been routed to avoid trees and forest fragments where possible,

reducing the need for clearing and eliminating ongoing fire risks from tree growth and in the event of a line breakage. Cable routes would be periodically inspected to monitor any regrowth.

The transformers located in the substation facilities would contain transformer oil for the purpose of cooling and insulation. These facilities would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire and would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater). Transformer oil would be changed regularly at appropriate intervals by qualified staff to minimise the potential for fire caused by contaminated oil. The oil would be removed from the site and disposed of appropriately.

The substations would be surrounded by a gravel and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation areas would also be surrounded by a security fence as a safety precaution to prevent trespassers and stock ingress. An asset protection zone would be maintained around the control room and substation buildings, compliant with the RFS *Planning for Bushfire Protection* guidelines. Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities.

Impacts on fire-fighting operations

Wind farms have been found to influence temperature and wind speed around turbines and have the potential to influence bushfire behaviour. A distance of up to 1.25km (SEDA 2002) around each wind turbine is likely to experience warmer night temperatures and faster wind speeds on average, although this attenuates rapidly with distance from the turbine. While the amount of increase is small (approximately 0.7^{o}C increase and approximately 0.6 metres/second increase at ground level; Baidya, *et al.* 2004) these factors may enhance bushfire conditions, slightly increasing the intensity or rate of spread of a bushfire at the site. This minor increase in fire intensity is not considered likely to noticeably affect the rate of spread or controllability of wildfires. In the event of a fire, the turbines would be shut down.

The turbines have the potential to present a hazard to fire fighting helicopters and planes.

The access tracks installed to build and maintain the wind farm would increase the accessibility onsite and would therefore have a positive impact on the response time and ability to fight fires onsite or on neighbouring properties.

The RFS have participated in the environmental assessment process of several wind farms in the region, including in person at Planning Focus Meetings. Representatives of the RFS have stated at these meetings that, due to the hazardous materials stored onsite (hydrocarbons within turbines and the substation), the local RFS would only ever act in a support capacity to the NSW Fire Brigade, in the event of an infrastructure related fire onsite. The RFS and NSW Fire Brigade would be consulted regarding safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure, and also in the event of an external wildfire threatening the wind farm. They have also stated that wind farm infrastructure is not different with regard to bush fire risk than similar large scale infrastructure developments.

7.11.4 Mitigation measures

The discussion above illustrates that bushfire risks are manageable with respect to the Proposal.

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
41	Bushfire risk	Minimise risks	The Proponent would prepare a Bushfire Management Plan as part of the Construction Environmental Management Plan. The Rural Fire Service and NSW Fire Brigade would be consulted in regard to its adequacy to manage bushfire risks during construction, operation and decommissioning. The plan would as a minimum include: • Hot-work procedures, asset protection zones, safety, communication, site access and response protocols in the event of a fire originating in the wind farm infrastructure, or in the event of an external wildfire threatening the wind farm or nearby persons or property • Flammable materials and ignition sources brought onto the site, such as hydrocarbons, would be handled and stored as per manufacturer's instructions. • During the construction phase, appropriate fire fighting equipment would be held onsite when the fire danger is very high to extreme, and a minimum of one person on site would be trained in its use. The equipment and level of training would be determined in consultation with the local RFS • Substations would be bunded with a capacity exceeding the volume of the transformer oil to contain the oil in the event of a major leak or fire. The facilities would be regularly inspected and maintained to ensure leaks do not present a fire hazard, and to ensure the bunded area is clear (including removing any rainwater) • Substations would be surrounded by a gravel and concrete area free of vegetation to prevent the spread of fire from the substation and reduce the impact of bushfire on the structure. The substation area would also be surrounded by a security fence as a safety precaution to	Construction Operation Decommissioning	CEMP and OEMP	x	x

SoC	Impact	Objective	Mitigation tasks	Project phase	Auditing	Coppabella Hills	Marilba Hills
			prevent trespassers and stock ingress • Asset protection zones (APZs), based on the RFS Planning for Bushfire Protection, would be maintained around the control room, sub-station and in electricity transmission easements. Workplace health and safety protocols would be developed to minimise the risk of fire for workers during construction and during maintenance in the control room and amenities • Fire extinguishers would be stored onsite in the control building and within the substation building • Shut down of turbines would commence if components reach critical temperatures or if directed by the RFS in the case of a nearby wildfire being declared (an all hours contact point would be available to the RFS during the bushfire period). Remote alarming and maintenance procedures would also be used to minimise risks • Overhead transmission easements would be periodically inspected to monitor regrowth of encroaching vegetation				