28 November 2018

Mike Young
Director of Resource Assessments
Department of Planning and Environment
Sydney NSW 2000

Dear Mr Young,

Boco Rock Wind Farm Stage Two – Section 4.55 Modification

Boco Rock Stage Two Pty Ltd (the Proponent) is submitting this letter to the NSW Department of Planning and Environment (the Department) formally requesting a modification to the approved Boco Rock Wind Farm (Application 09_0103; the Project) under section 4.55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), to accommodate a second stage of the development.

This application for modification (the Modification) involves changes to Yandra cluster only, which would comprise Stage Two of the Project. The purpose of the Modification is to contemporise the allowances and parameters of Stage Two of the Project in order to construct fewer but larger wind turbine generators (WTGs), whilst maintaining to minimise impacts and maximise the efficiency of the Project design.

In general, the proposed amendments involve:

- A reduction in the number of WTGs within Yandra cluster from 32 to up to 20;
- An increase in the size and capacity of WTGs consistent with current technology;
- Addition of a temporary construction compound within Yandra cluster; and,
- Proposed administrative changes to the Project consent.

The proposed modifications are summarised in the accompanying sections of this letter and associated appendices.

Yours sincerely,

Edward Mounsey
Chief Operating Officer
CWP Renewables Pty Ltd

Boco Rock Wind Farm Stage Two

Application for Modification

Environmental Assessment

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Contents

1. Introduction

Boco Rock Wind Farm (the Project) is an operating wind farm located approximately 6 km south west of Nimmitabel and 30 km north of Bombala in NSW within the Snowy Monaro Regional Council. The Project Approval was issued on 9 August 2010 permitting up to 122 wind turbine generators (WTGs) (Major Project Application 09_0103). Stage One of the Project commenced construction in 2013 and became operational in 2015, consisting of 67 WTGs. The remaining 55 approved WTGs in the Boco and Yandra clusters are yet to be constructed (see Figure 1).

In March 2018 amendments to the *Environmental Planning and Assessment Act 1979* (EP&A Act) took effect which removed the ability for Part 3A Project approvals to be modified under Section 75W of that Act. As a result of these amendments, the Project was declared a State Significant Development (SSD) NSW Department of Planning and Environment (the Department) under clause 6 of Schedule 2 to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017*. The declaration of the Project as an SSD does not change the Project Approval conditions.

Significant improvements in WTG technology have occurred since the original Project Approval was received in August 2010. WTG technology has evolved towards longer blade lengths and taller towers to increase generation efficiency and therefore electrical production. The increase in electricity production results in a lower levelized cost of energy and assists the NSW Government meet the objectives of the NSW Renewable Energy Action Plan (2013) and the NSW 2021 Plan with a target of reaching 20% renewable energy by 2020.

This application for modification (the Modification) has been prepared under Section 4.55 of the EP&A Act because it is considered that the proposed changes to WTG dimensions in only one cluster of the wind farm, within the same infrastructure footprint, meet the "*substantially the same development as authorised by the consent*" test.

2. Proposed Modification

Boco Rock Stage Two Pty Ltd (the Proponent) seeks approval for changes to Yandra cluster only. The purpose of the Modification is to accommodate larger but fewer WTGs to drive down the levelized cost of energy and minimise impacts on the surrounding community and environmental values. No changes to the operational Project or the Boco Cluster are proposed in this Modification.

The Project Approval currently permits two alternate layouts within Yandra cluster (see Figure 2):

1. Layout Option 1: 32 WTG locations
2. Layout Option 2: 27 WTG locations

In order to provide certainty to stakeholders, this Modification seeks only to address Layout Option 1. Layout Option 2 would no longer form part of Yandra cluster. All analysis and discussion in this Modification hereafter refers to the approved Layout Option 1 within Yandra cluster only.

Yandra cluster is proposed to be modified as follows and as shown in Figure 3:

- Removal of two approved WTG locations, reducing the available WTG locations from 32 to 30 within Yandra cluster.

- Construction, operation and decommissioning of up to 20 WTGs within these 30 locations (to be selected during detailed design).
- Increase in WTG tip height of up to 200 m.
- Increase in WTG rotor diameter within the revised tip height.
- Addition of a temporary construction compound within Yandra cluster.

This application for Modification has been prepared giving due consideration to the existing Project Approval and the NSW Wind Energy Guidelines (DPE 2016a).

Figure 1: Project Overview

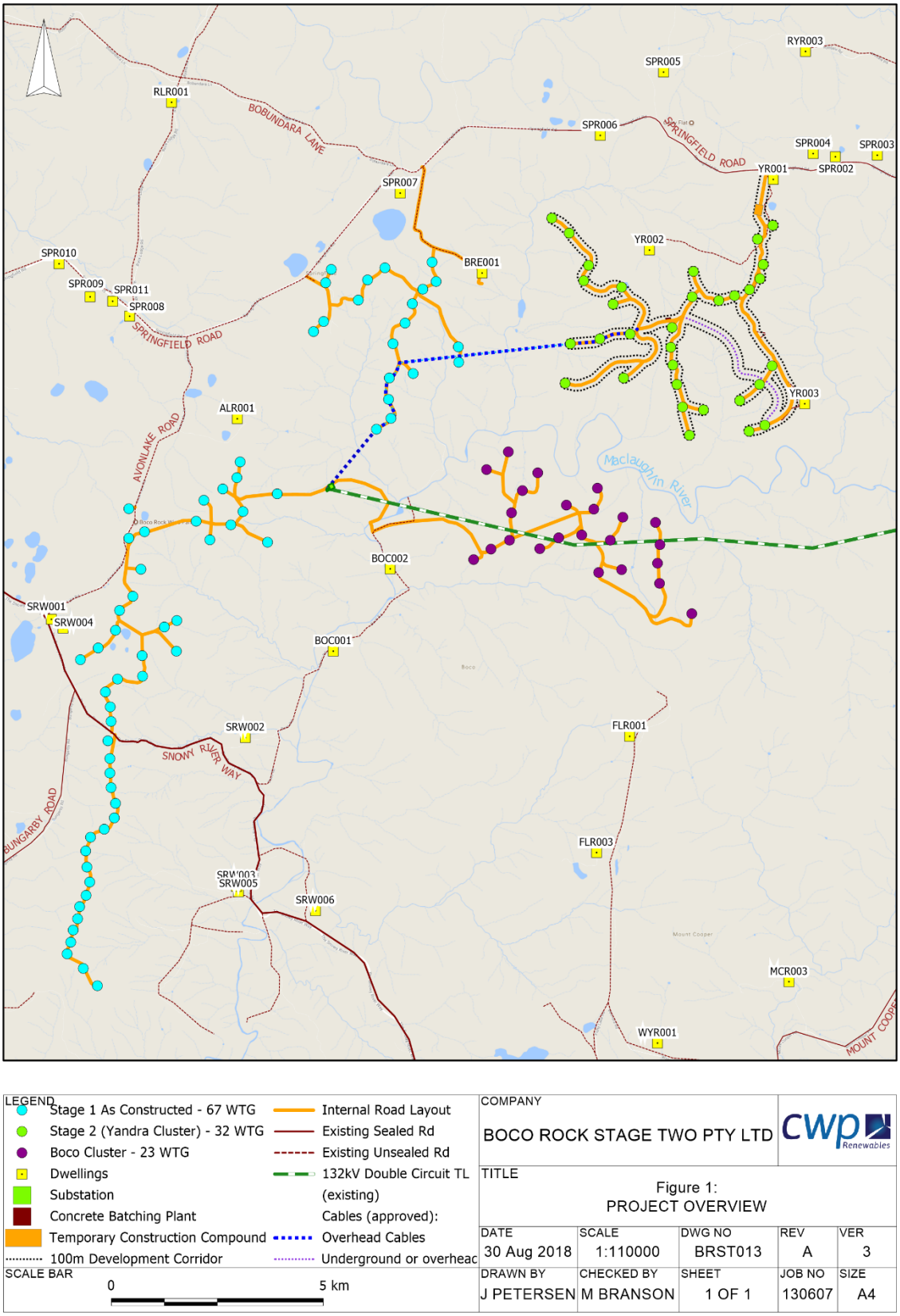
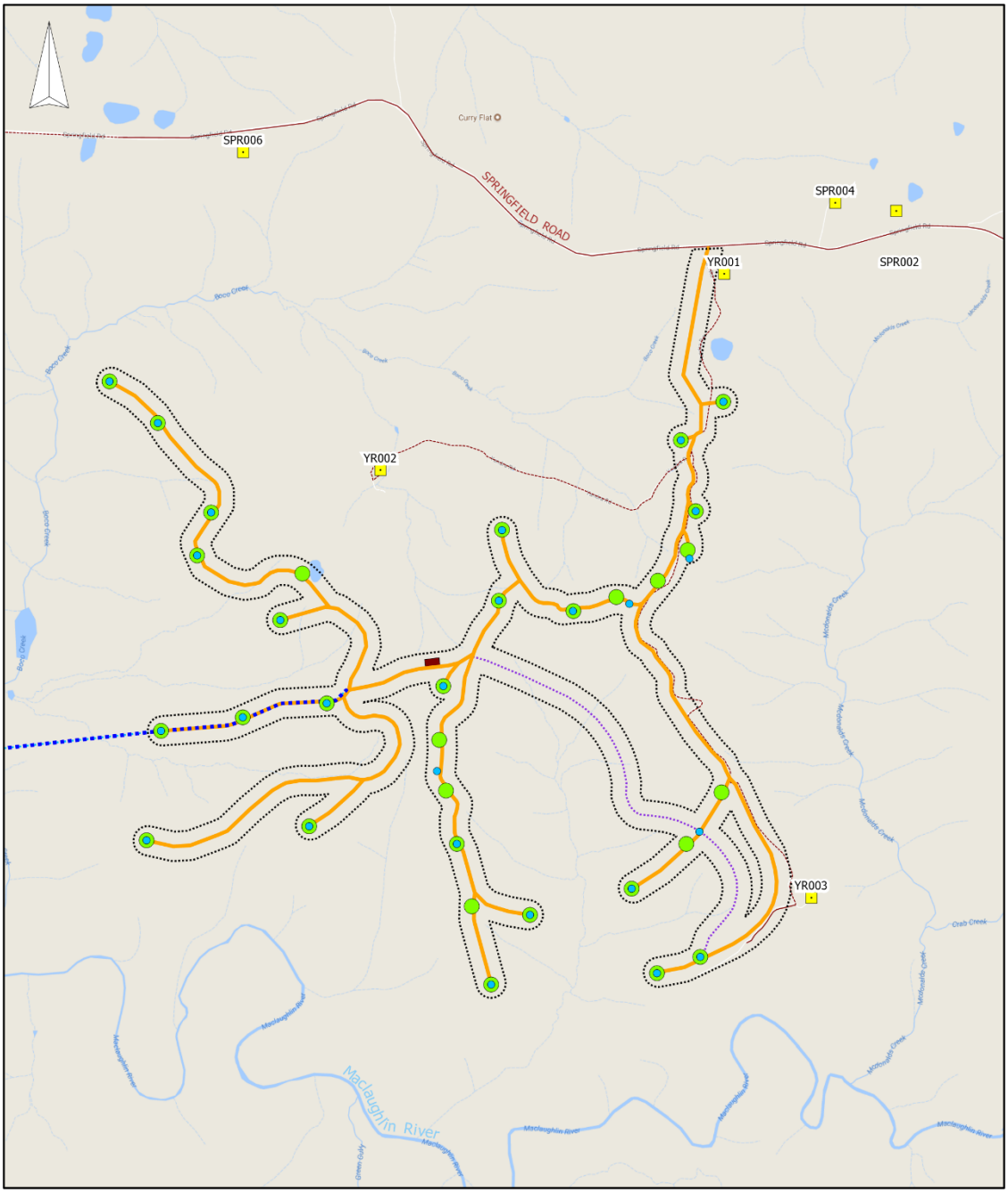


Figure 2: Yandra cluster as Approved

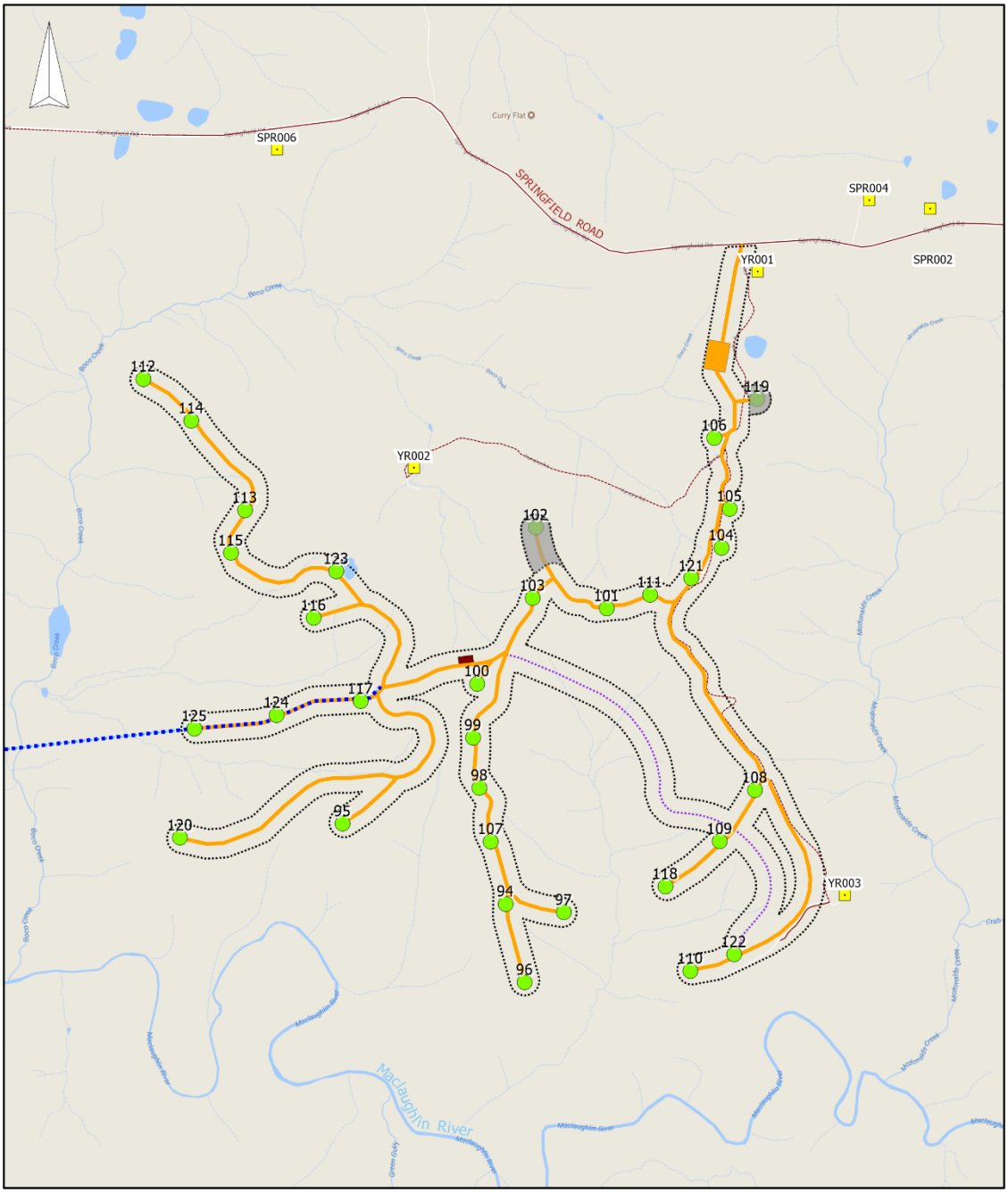


LEGEND			
Layout Option 1:	100m Development Corridor	COMPANY	BOCO ROCK STAGE TWO PTY LTD
32 WTG Locations	Cables (approved):		
Layout Option 2:	Underground or overhead	TITLE	Figure 2: YANDRA CLUSTER AS APPROVED
27 WTG Locations	Overhead Cables		
Dwelling	Exisitng Roads:		
Internal Road Layout	Sealed		
Concrete Batch Plant	Unsealed		

SCALE BAR	DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
0 1 km	J PETERSEN	M BRANSON	1 OF 1	130607	A4

DATE	SCALE	DWG NO	REV	VER
30 Aug 2018	1:45000	BRST014	A	3

Figure 3: Proposed Modification of Yandra cluster



LEGEND		COMPANY	
30 WTG Locations	Internal Road Layout	BOCO ROCK STAGE TWO PTY LTD	cwp Renewables
Dwelling	Exisitng Roads:	TITLE	
100m Development Corridor	Sealed	Figure 3: PROPOSED MODIFICATION OF YANDRA CLUSTER	
WTG locations removed	Unsealed		
Temp Construction Compound	Cables (approved):		
Concrete Batch Plant	Overhead Cables		
	Underground or overhead		

SCALE BAR	DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
0 1 km	J PETERSEN	M BRANSON	1 OF 1	130607	A4

DATE	SCALE	DWG NO	REV	VER
30 Aug 2018	1:45000	BRST015	A	3

2.1 Land Tenure

The modified Project will be spread over five of the original properties of the Project site with details of land tenure provided in Table 1. It is noted that there are additional lots within the Project Area than were originally proposed due to the closing of Crown Roads after the Project Approval and the subsequent creation of new freehold lots.

Table 1: Land Tenure

Landowner	Lot	DP
Freehold 1	190	756818
	2	801347
	157	756818
	191	756818
	158	756818
	205	756818
	159	756818
	1	1176409
Freehold 2	10	456658
	8	456658
	7	456658
	1	1175331
	1	1106166
	10	456658
Freehold 3	2	14852
Freehold 4	252	756818
Freehold 5	1	210967
	5	456651
	253	756818
	4	456651

2.2 Wind Turbine Generator Locations

Table 2 provides the WTG centre-point coordinates for the approved 32 locations in Yandra cluster Layout 1 and identifies the two WTG locations which would be removed by the Modification. The remaining 30 WTG locations are not proposed to be relocated beyond the permitted 100 m micro-siting allowance.

Table 2: WTG centre-point coordinates

WTG ID	Easting	Northing
Yandra cluster		
94	696989	5951367
95	695888	5951937
96	697108	5950831
97	697385	5951300
98	696829	5952159
99	696793	5952502
100	696828	5952868
101	697727	5953359
102*	697254	5953921
103	697222	5953441
104	698520	5953754
105	698582	5954018
106	698490	5954502
107	696897	5951793
108	698712	5952101
109	698463	5951758

WTG ID	Easting	Northing
Yandra cluster		
110	698243	5950882
111	698025	5953446
112	694594	5954992
113	695268	5954084
114	694917	5954701
115	695166	5953796
116	695722	5953341
117	696029	5952768
118	698084	5951461
119*	698787	5954759
120	694775	5951867
121	698310	5953551
122	698542	5950987
123	695883	5953654
124	695453	5952686
125	694890	5952608

***** *Identifies an approved WTG location which is proposed to be removed by this Modification.*

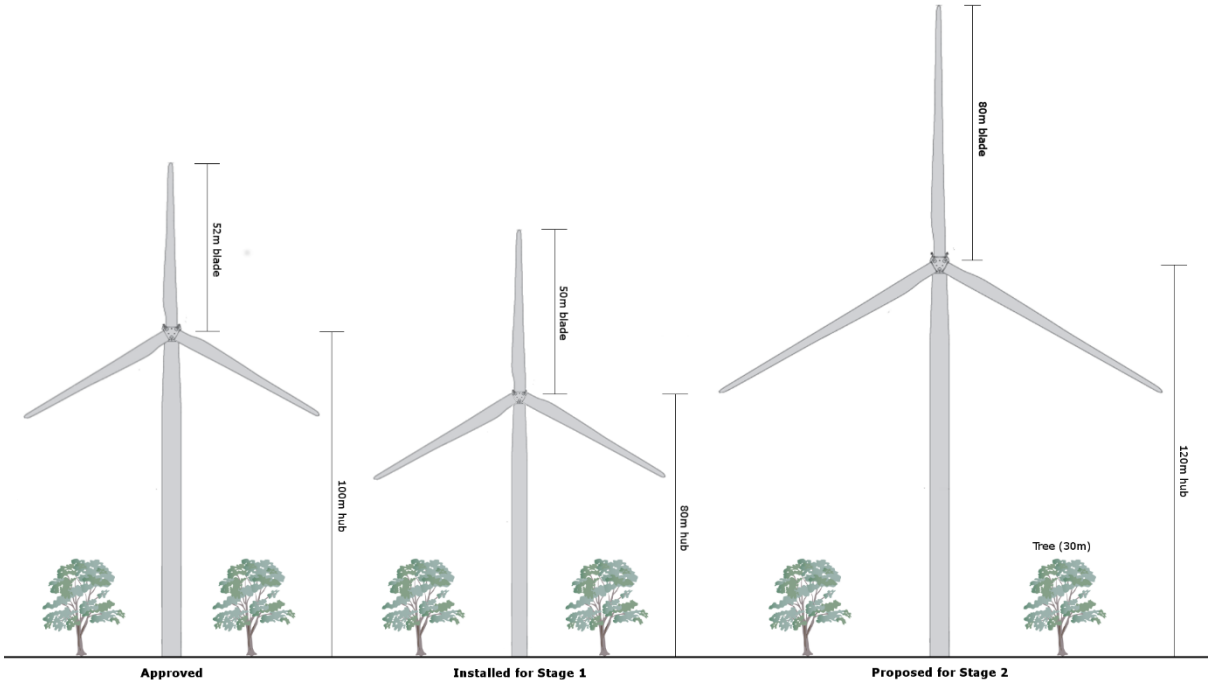
2.3 Wind Turbine Generator Dimensions

The Project Approval permits a wind farm with a total capacity of 270 megawatts (MW) and associated infrastructure, including up to 122 WTGs with a maximum capacity of 3.3 MW and a maximum tip height of 152 m.

The Modification seeks to increase the size and capacity of WTGs consistent with current industry standards and technology. The Proponent seeks approval for a WTG tip height of up to 200 m (48 m greater than the approval) including an increased rotor diameter, as shown in Figure 4. It is anticipated that WTGs will have a nameplate capacity of 4 MW or greater, as WTG technology continues to advance rapidly. The Modification seeks to clarify the error in the Schedule 1 of the Project Approval which references a 33 MW limit on individual WTGs, and requests that the limit on generating capacity of individual WTGs be removed.

The Stage Two WTG specifications will be determined following a competitive tender process, which will involve detailed modelling to determine the most cost effective and energy efficient design for the selected WTG. For this reason, the Modification seeks flexibility to select up to 20 WTG locations to be constructed from the 30 locations identified in Table 2 and Figure 3, following approval of the Modification. The selected WTGs will be constructed within the micro-siting allowance of 100m from the approved WTG locations.

Figure 4: Proposed Modification to WTG dimensions



2.4 Ancillary Infrastructure

All ancillary infrastructure will remain within the approved Development Corridor and will be constructed within the 100 m micro-siting allowance permitted under the Project Approval. Condition 6.2(c) of the Project Approval allows the Construction Environmental Management Plan (CEMP) to identify and address alternate locations for temporary construction sites, should they need to relocate from the locations shown on the plans in this Modification. Table 3 identifies the Project components and a provides a comparison between the parameters of the approved Project and the proposed Modification for Yandra cluster. The only additional project component is a temporary construction compound within Yandra cluster which was not previously included in the approved Project plans.

Table 3: Parameters for Project Components in Yandra cluster only

Permanent Infrastructure	Project Approval	Modification	Comparison
WTGs	Up to 32	Up to 20[1]	Reduced by 12
Tower height	c. 101.5 m	c. 130 m	Increase of 28.5 m
Rotor diameter	c. 104 m	c.160 m	Increase of 56 m
Tip height	Up to 152 m	Up to 200 m	Increase of 48 m
Hardstands (individual WTG)	50 m x 25 m	60 m x 35 m	Increase of 850 m
Hardstands (total)	4 ha	4.2 ha	Increase of 0.2 ha
Footings (individual WTG)	14 m x 14 m 0.5 ha	24 m diameter 0.9 ha	Increase of 0.4 ha
Footings (total)	0.72 ha	0.90 ha	Increase of 0.18 ha
Road length	21.2 km.	20.7 km	Reduced by 0.5 km
Road width (excludes cut and fill)	12 m	6 m	Reduced by 50 %
Road area (excludes cut and fill)	25.5 ha	12.4 ha	Reduced by 13.1 ha
Overhead electrical reticulation and control cables	9.26 km	9.26 km	No change

Temporary Infrastructure	Project Approval	Modification	Comparison
Concrete batch plant	0.5 ha	0.5 ha	No change
Construction compound (additional)[2]	N/A	150 x 200 m	Increase of 3 ha

[1] *Up to 20 WTG locations will be selected from the 30 remaining approved WTG sites in Yandra cluster.*

[2] *The construction compound will consist of a fenced off area for temporary site offices and the storage/lay-down of tools, vehicles, equipment, construction materials, WTG components.*

The Project was approved on the basis of the Preferred Project Report[1] which included access roads of 6 m permanent width, plus a 6 m wide disturbance, plus additional cut and fill. These calculations formed the basis of the impact assessment and the Biodiversity offset which has been established to meet the needs of Stage One and all subsequent stages of the Project (Refer to Appendix C).

Our experience constructing Stage One and Sapphire Wind Farm shows that a permanent road width of approximately 6 m, plus temporary cut and fill is adequate for Project construction. Some areas of difficult terrain or sharp turns may require a broader road base but this will be limited at Yandra cluster because of the gentle terrain, and would be more than accounted for by the conservative assessment in Section 4.3.

It is proposed that the final design of Yandra cluster, to be determined within the micro-siting limits once the final 20 WTGs have been selected, be constructed within the revised vegetation impact calculations in Section 4.3, as guided by the conditions of approval. Avoidance of impacts will be undertaken wherever possible in accordance with condition 2.3. This approach will ensure that the Project is delivered in accordance with the commitments already made within the Project Approval and the biodiversity offsets will continue to provide a net gain for biodiversity.

3. Community Consultation

During the development of the Stage Two Modification, the Proponent has been engaged with the local community and Council to share information about the proposal, hear community feedback and amend the proposal to address concerns.

Consultation has been undertaken using the following means:

- Face to face meetings with all landowners within 4 km of Yandra cluster, as well as other key neighbours and community members
- Meetings with Snowy Monaro Regional Council General Manager and Planning Department
- Presentation to Snowy Monaro Regional Council at a public general meeting
- Community Consultative Committee meetings
- Newsletter distribution
- Letter box drop throughout the entire Nimmitabel post code
- Advertising in the local Newspaper
- Community Open Day held at Nimmitabel Community Centre
- Direct communication with local community groups

At the commencement of the Modification, direct contact was made with all landowners within 4 km of a proposed WTG in Yandra cluster. Information was shared in relation to the proposal including potential project impacts, and meetings were arranged to hear the neighbours' concerns in an attempt to address any issues. The main concerns raised related to construction traffic, road condition and visual impacts. Conversations were held with neighbours to address concerns raised and to develop mitigations such as vegetative screening. Neighbour Agreements have been offered to all residences

[1] *Boco Rock Wind Farm Preferred Project Report and Response to Submissions* prepared by Wind Prospect CWP Pty Ltd (now CWP Renewables) and dated May 2010

within 4 km of the project and have been entered into with most residents. There is one Neighbour Agreement still under discussion at a property with an expired Development Approval (SPR002) within 4 km of Yandra cluster.

The Proponent met with Snowy Monaro Regional Council (SMRC) early in the development of the Modification to explain the proposal and understand any concerns which Council may have about the development. The Proponent met with the Group Manager of Development and the Manager of Development on 28 June 2018 and with the General Manager on 19 July 2018. A presentation was also given to Council and to a large public gallery on 19 July 2018 at Berridale Community Hall, including a slide presentation explaining the proposed Modification and how it relates to the existing approval. Matters raised by Council and SMRC staff include management of construction impacts on Council roads, traffic impacts to local residences and the contributions to the Community Enhancement Fund. Each of these matters are considered to be adequately provisioned for within the existing Project Approval and no changes are proposed to these conditions within this Modification.

Two newsletters detailing project information and contact details have been prepared and distributed to the local community through direct letter box drops, at Nimmitabel Post Office, SMRC office in Cooma, Nimmitabel Community Centre and via the Nimmitabel Advancement Group.

The Boco Rock Wind Farm Community Consultative Committee (CCC) was contacted on 12 July 2018 to notify the committee about the proposal and to request a meeting with the group. An extraordinary CCC meeting was held on 13 August 2018 at Nimmitabel Community Centre to discuss the Modification, and a presentation was given by the Proponent. A follow up presentation of the findings from the technical studies contained in this Modification was provided to the CCC at the scheduled meeting on 12 November 2018. Minutes of each meeting will be made publicly available.

Community and business groups in the Nimmitabel area have been directly contacted by the Proponent and provided with information about the proposed Modification, including: Nimmitabel Advancement Group, Lions Club and Nimmitabel Chamber of Commerce. The business community has expressed genuine interest in the Modification and has expressed support for any future construction and operations contracts which would generate employment and income for the region.

A Community Open Day was held at Nimmitabel Community Centre on 27 August, 2018. An interactive display was provided including posters showing the proposed Modification, images of the potential impacts including photo montages and noise contour modelling. The open day was advertised in the Monaro Post over two weeks leading up to the open day, and a flyer advertising the open day was delivered to all residences within the Nimmitabel post code in the week prior, using the service provided by Australia Post. The open day was also advertised by word of mouth and attended by the Nimmitabel Advancement Group and local Lions Club. Approximately 30 members of the community attended the open day to receive information and speak with CWP Renewables staff. The general sentiment was one of support for the project and the potential for new employment opportunities and income.

Some members of the community have expressed concern over the proposal including the size of the WTGs that are proposed to be installed. These concerns have typically been raised by members of the community who expressed concerns in relation to the original proposal. The Proponent has made efforts to understand those concerns, address them where possible and offer mitigations such as

landscape screening where appropriate. The primary design mitigation, which is aimed at minimising impacts to the community, is the commitment to reduce the number of WTGs proposed in Yandra cluster from 32 to 20. Nonetheless some residents remain concerned about the potential impact of the project on the landscape values of the region and the views from their residences.

Despite this, the community consultation undertaken demonstrated strong support for the project, a general support for renewable energy to make use of the regions strong wind profile, and interest from members of the Nimmitabel community seeking opportunities for employment and economic flow-on effects for the region.

4. Impact Assessment

A preliminary risk assessment was undertaken across all technical aspects of the development to ensure that the proposed Modification would be technically feasible. The risk assessment was used to inform the project design as well as the commissioning of technical studies to evaluate potential impacts of the proposal. A summary of the risk assessment is provided in Table 4 and further discussion of each technical area is provided in Sections 4.1 to 4.7. The technical studies that informed the impact assessment are provided as appendices to this Modification.

Table 4: Modification Technical Feasibility Assessment

Technical Assessment	Key element(s) of the Modification	Consideration of change in impact	Summary of findings / recommendations
Landscape and Visual	Increased WTG dimensions Reduced WTG numbers	Proposed impacts have been considered by landscape and visual impact consultants Green Bean Design. A comprehensive modification assessment is provided in Appendix A.	The Visual Impact Assessment (VIA) recognises that whilst the proposed increase in WTG height would be discernible from surrounding view locations and, in a small number of locations, increase the number of WTGs visible, the increase in height will not give rise to a significant increase in the magnitude of visual effect. The reduction in WTG numbers within Yandra cluster has reduced overall visibility and improved legibility of WTGs within the Cluster. It is noted that Neighbour Agreements have been offered by the Proponent to all residences within 4 km of the proposed Stage Two Modification to address and mitigate the visual impacts. As a result, all existing dwellings within 4km of Yandra cluster are involved in the Project.
Noise	WTG model sound power profile	Proposed impacts have been considered by noise consultants SLR Consulting. A comprehensive modification assessment is provided in Appendix B.	Noise from the proposed Modification for Boco Rock Wind Farm Stage Two development has been predicted and assessed against the relevant noise limits, including a cumulative assessment of the Stage One noise emissions. WTG noise has been predicted to comply with the Project Approval at all receptors. It is anticipated that post-construction noise levels will be monitored to evaluate whether the wind farm is compliant, as per the planning conditions set for the project.
Biodiversity	Increased rotor swept area (RSA) per WTG Reduction in permanent infrastructure	Proposed impacts to bird and bat strike have been considered by ecology consultants Brett Lane & Associates. A comprehensive study is included as Appendix D.	The Modification has been designed to ensure that on-ground impacts are reduced, and above-ground impacts are minimized. This has been achieved by reducing the number of WTGs to be installed and removing project infrastructure to accommodate the increased size of WTGs and associated foundations and hardstands. The only additional component is a temporary construction compound adjacent to the project access road, which will be accommodated for by the removal of access roads in the final project design to be constructed.

Technical Assessment	Key element(s) of the Modification	Consideration of change in impact	Summary of findings / recommendations
	Addition of temporary construction compound		The proposed changes to the size and number of WTGs to be installed will create a larger RSA per WTG and increase the total Project RSA by approximately 8 %. In relation to Yandra cluster, the changes would shift the RSA higher than the current Project Approval, removing collision risk from those species which are known to fly at or around canopy height, but with a corresponding increase in risk for those few species that fly at heights over Yandra cluster.
Cultural Heritage	Reduction in permanent infrastructure Addition of temporary construction compound	Proposed impacts have been considered by archaeological consultants NSW Archaeology. Summary advice is provided in Appendix E.	The approved Project site was originally assessed by NSW Archaeology Pty Ltd in 2009. An updated report by NSW Archaeology Pty Ltd indicates that the proposed impact areas within Yandra cluster are all assessed to be of low archaeological potential and sensitivity. Impacts to seven Aboriginal object locales present on the Modification site are permissible, and impact mitigation is not required. Two historic sites are present one of which should be avoided if feasible. The mapping, and tables listing recommendations for all sites, in the 2009 report are all still applicable to the Modification.
Aviation	Increased WTG height	Proposed impacts have been considered by aviation consultants Landrum and Brown. A comprehensive assessment is provided in Appendix F.	There are not expected to be any impacts to aviation, however the WTGs would be classified as Tall Structures and formal notification to CASA and Department of Defence is required. The Aviation Impact Assessment is to be provided to CASA and other aviation authorities during the exhibition phase for consideration with regard to the required notification procedures and the need for any aviation hazard lighting required.
Traffic and Transport	Increased WTG dimensions Reduced Development Footprint	Proposed impacts have been considered by transport consultants Samsa Consulting. A comprehensive modification assessment is provided in Appendix G.	It is considered that the proposed Modification consisting of up to 20 WTGs within Yandra cluster would not create any significant adverse impacts with respect to issues such as road capacity, site access and road safety. Consistent with the previous assessment, a single site access point to Yandra cluster is proposed off the public road network serving all the WTG locations for the Modification. It is expected that WTG components will be delivered to either the Port of Eden or Port Kembla, depending on the size and specifications of the WTGs selected. A detailed route assessment for the transport of the larger WTG components along the possible routes is required to determine which port is suitable. The management of traffic and heavy vehicle movements during construction would be appropriately covered by a Traffic Management Plan. Transport related management strategies from the approved Project remain relevant and are

Technical Assessment	Key element(s) of the Modification	Consideration of change in impact	Summary of findings / recommendations
			proposed to be maintained as part of this Modification. The Project will work closely with local councils and the relevant roads authorities to avoid, minimise and manage road impacts during construction.
Communications	Increased WTG dimensions and height Reduced Development Footprint	Proposed impacts have been considered and addressed in the project layout.	A dataset and GIS analysis was used to determine whether any revised WTG locations would impact the communications links. A corridor was created around the comms links to ensure the 2nd Fresnell zone, or zone of electromagnetic interference, remained unaffected. Additionally, a buffer of 80m (approximately half a rotor diameter) added to accommodate for potential blade impacts from operating WTGs. A map showing the 2nd Fresnell zones is shown in relation to the proposed Modification in Section 4.7 and no WTGs were found to pose a threat of interference. It was determined that a formal technical assessment for communications impacts was not required.

4.1 Visual Impact Assessment

The Proponent recognises that seeking a larger rotor and higher blade tip height can potentially increase associated visual impacts. As such, the reduction in the total number of proposed WTG locations from 32 to 20 has been integral to the Proponent's approach to offset some of these potential impacts. In developing this Modification, consideration was given to the NSW Wind Energy Framework and, in particular, the Wind Energy: Visual Assessment Bulletin (DPE 2016b). In developing the revised layout, the visual magnitude tool was assessed using a 200 m tip height. In accordance with Figures 2 and 5 of DPE (2016b), detailed consideration was given to all residences within 2.7 km of a WTG and mitigation measures were considered for all residences within 4 km.

To address potential visual impacts, a commitment has been made to install no more than 20 WTGs within Yandra cluster, and to remove two of the approved WTG locations nearest to dwellings on Springfield Road, increasing the setback distances from neighbouring residences. All landowners within 4 km of a proposed WTG were contacted directly and mitigation options were discussed. Neighbour Agreements have subsequently been entered into. As a result, all existing dwellings within 4 km of Yandra cluster are involved in the Project. However, there is one property with an expired Development Approval (SPR002) within 2.7 km of a proposed turbine location and a Neighbour Agreement has been offered in the event that a dwelling is subsequently approved and built. Table 5 identifies how the changes to the project influence impacts on SPR002, noting the increase in setback distance and reduction in WTGs visible.

Table 5: Modification response to community concerns

	Approved Layout		Modified Layout	
Residence	**Distance from Approved Layout**	**WTGs potentially visible**	**Distance from Modified Layout**	**WTGs potentially visible**
SPR002[1]	1.8	32	2.1	20

[1]*Not a dwelling. A Council approved Development Application was once in place but has since lapsed.*

A Visual Impact Assessment (VIA) was undertaken by Green Bean Design and is attached as Appendix A. The report includes a Zone of Visual Influence (ZVI) assessment, wireframe analysis, photomontages of the proposed Modification and an analysis of how the proposed Modification would impact visual receptors as compared to the approved Project. It is noted that an assessment of night lighting has not been undertaken in the VIA because it is as yet unclear whether CASA will require aviation hazard lighting to be installed if the Modification is approved. If CASA request aviation hazard lighting, an Obstacle Lighting Plan will be prepared to determine the nature and extent of lighting so that visual impacts can then be assessed.

A series of ZVI maps are included in the VIA and Figure 5 below provides a comparison of the visual influence of the proposed Modification against the approved Project. It is noted that this is a "worst case" ZVI assessment which compares the 32 approved WTGs at 152 m in height against all 30 available WTG locations at 200 m in tip height, noting again that this Modification seeks to limit the installation of 20 WTGs within the 30 available sites. Figure 5 shows that the proposed increase in WTG height to up to 200 m is unlikely to result in any significant change to the extent of WTG visibility.

An indicative layout was developed to evaluate the change in numbers of WTGs visible for the surrounding dwellings. The Indicative layout selected the 20 WTGs which would cause the most similar impacts to the "worst case" using the outermost WTG locations as well as those which are at greatest elevation, creating a highly conservative assessment. Figure 6 shows the number of WTGs visible within the viewshed of Yandra cluster using the approved Project (32 WTGs of 152 m in height). Figure 7 uses the same colour scale to demonstrate the reduction in number of WTGs visible across the viewshed for the proposed Modification (20 WTGs of 200 m in height).

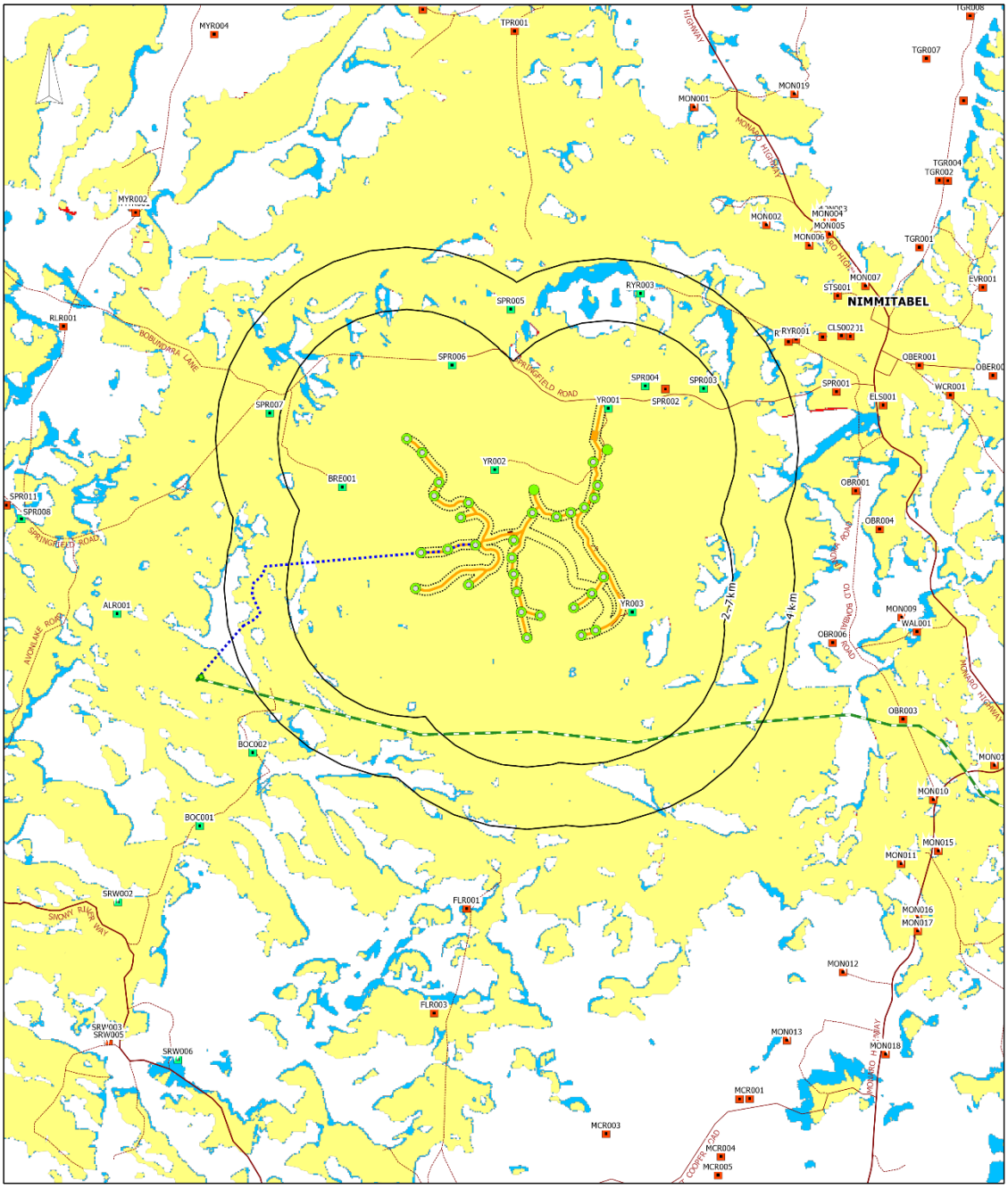
Two photomontages were prepared using the images from the 2010 Environmental Assessment. Photomontage A and F were selected as they are the closest locations to Yandra cluster and provide the most visible indication of the proposed changes. Figures 8 and 9 provide a comparative montage of the approved project and the absolute worst case of all 30 WTG locations at a tip height of 200m from the two locations. The VIA determined that, within the parameters of normal human vision, the proposed Modification is not considered to give rise to an increased level of visual magnitude which is significantly above that determined for the approved Yandra cluster WTGs. The proposed Stage Two Modification would result in an overall low-level change in visibility and a largely unchanged visual impact rating across the landscape when compared to the approved Project.

To evaluate residence-specific impacts, wireframes were prepared for all non-involved residences within 4 km of Yandra cluster and provided to the landowner for consideration. This process was also undertaken for some sensitive receptors to around 8 km from the project. Wireframe diagrams do not account for screening provided by vegetation and are therefore very conservative in calculating WTG visibility. Whilst the Modification would be visible (in whole or in part) from some residential dwellings within 4 km of WTG locations, overall visibility would be partially restricted from many areas due to tree cover and/or the influence of surrounding landforms.

In an effort to address the visual impacts in accordance with the DPE (2016b) Guidelines, Neighbour Agreements have been offered by the Proponent to all residences within 4 km of the proposed Modification. One previously approved dwelling exists within 4 km of Yandra cluster (SPR002). Mitigation measures in the form of landscaping have also been offered to some sensitive receptors to around 8 km from Yandra cluster. Landscape mitigations remain available to residences assessed as high or moderate impact in accordance with approval condition 2.23.

In summary, the VIA recognises that whilst the proposed increase in WTG height would be discernible from surrounding view locations and, in a small number of locations, increase the number of WTGs visible (including views toward partial sections of WTG structures, rather than whole WTGs), the increase in height will not give rise to a significant increase in the magnitude of visual effect. The proposed removal of at least 12 approved WTGs within Yandra cluster has reduced overall visibility and improved views towards WTGs within the Cluster.

Figure 5: Comparative ZVI Map



LEGEND					
30WTG Locations 200m	Involved dwelling	COMPANY	BOCO ROCK STAGE TWO PTY LTD		cwp Renewables
32WTG Approved layout 152m	Non-involved Dwelling				
Approved layout visible	Concrete Batch Plant				
30WTG Modified layout visible	Substation				
Both Layouts Visible	Existing Sealed Rd	TITLE	Figure 5: 32WTG 152m Approved Layout vs 30WTG 200m Layout		
No turbines visible	Existing Unsealed Rd				
100m Development Corridor	Overhead Cables				
Temporary construction compound	132kV Double Circuit line (existing)				
	Indicative internal roads				

SCALE BAR	DATE	SCALE	DWG NO	REV	VER
0 5 km	06 Nov 18	1:78000	BRST022	C	1
	DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
	J PETERSEN	M BRANSON	1 OF 1	130607	A3

Figure 6: ZVI mapping of approved Yandra cluster

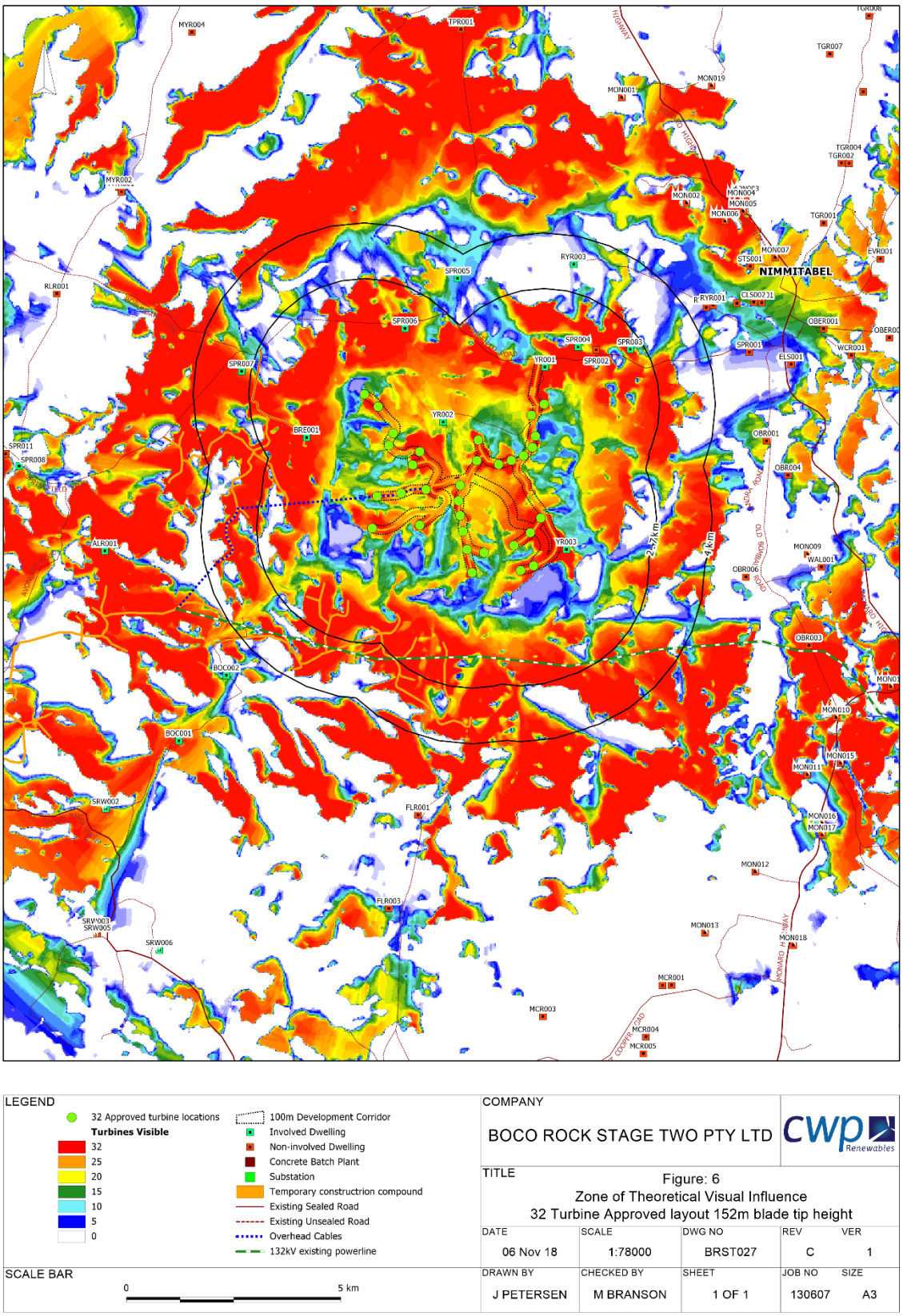


Figure 7: ZVI mapping of proposed modification to Yandra cluster

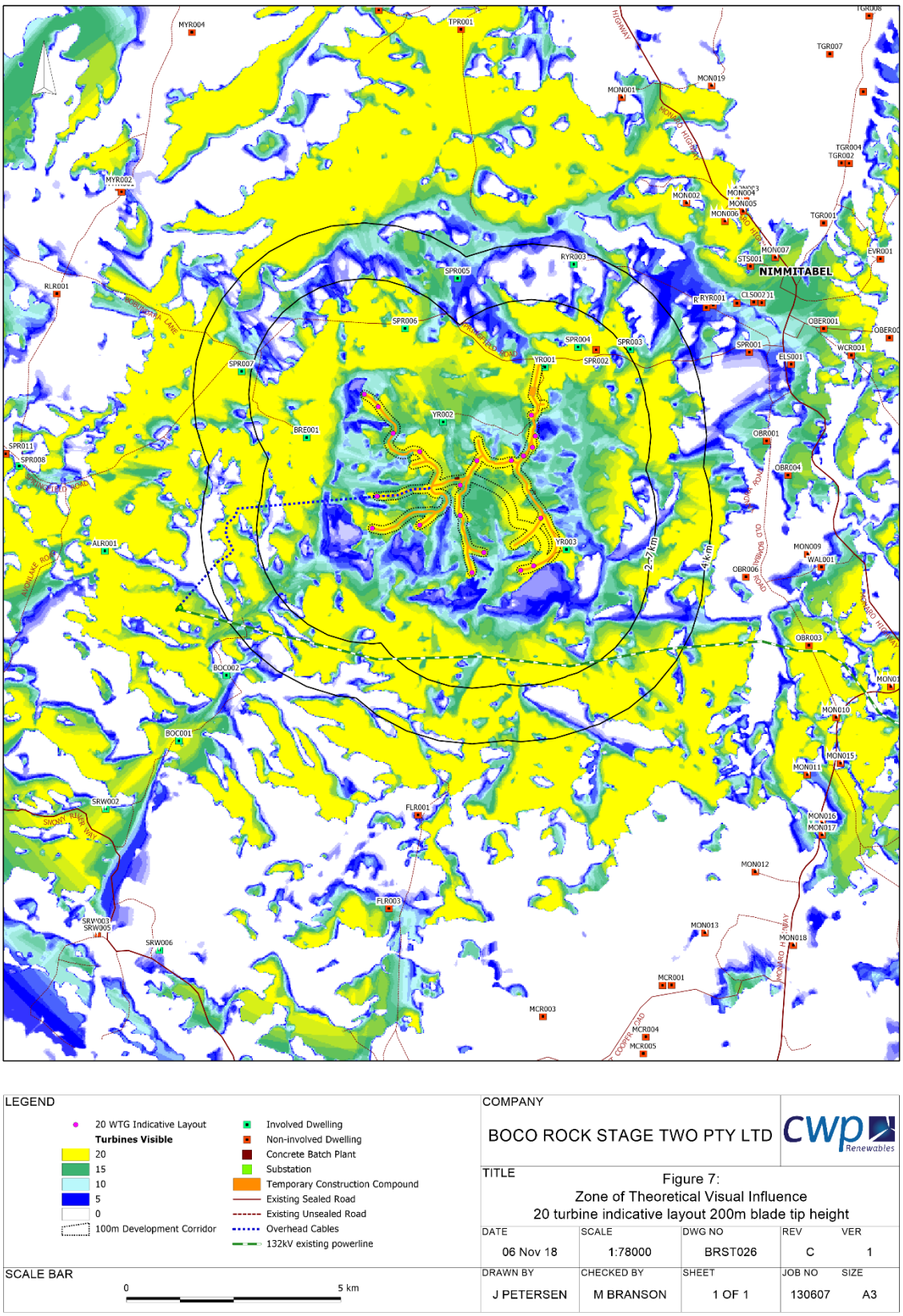
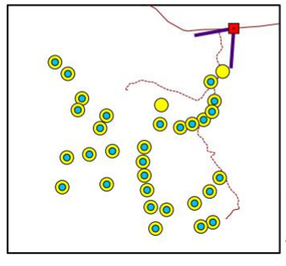


Figure 8: Photo Montage A – Springfield Road



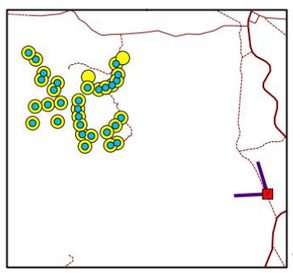
BOCO ROCK WIND FARM: PM A SPRINGFIELD ROAD

Grid reference:	699064E 5955836N	View direction:	221.9°
Viewpoint elevation:	1079 m AHD	Included angle:	75.8°
Camera height:	1.7 m	Distance to nearest turbine:	1.1 km
Turbine blade tip height:	152m & 200m	Viewing distance:	300 mm

Figure 9: Photo Montage F – Old Bombala Road

32 TURBINE VIEW (152m TIP HEIGHT)

30 TURBINE VIEW (200m TIP HEIGHT)



BOCO ROCK WIND FARM: PM F OLD BOMBALA ROAD

Grid reference:	705236E 5948718N
Viewpoint elevation:	1041 m AHD
Camera height:	1.7 m
Turbine blade tip height:	152m & 200m

View direction:	305°
Included angle:	75.8°
Distance to nearest turbine:	7.1 km
Viewing distance:	300 mm

Table 6: Approval Conditions: Visual Amenity

Ref	Condition	Proposed Amendments
2.23	**Turbines** Within six months of the commissioning of the project, the Proponent shall prepare and submit a Visual Impact Verification Report for the Director General's approval, confirming the visual impacts of the wind turbines at each non-associated receptor identified in the Environmental Assessment to be moderately or highly impacted. The Report shall consider the final model and layout of turbines for the project as well as any site specific mitigating factors at the receptor. The Report shall identify all reasonable and feasible screen planting options available at each receptor for which impacts have been verified to be moderate to high including demonstrating that these measures have been determined in consultation with affected receptors. The Proponent shall ensure that the identified screen plantings are implemented within a time frame agreed to with the landowner, however no later than within 18 months of the approval of the Visual Impact Verification Report by the Director-General. Unless otherwise agreed to by the Director-General, the Proponent shall monitor and maintain the health of the plantings until such time that the plantings have been verified by an independent and suitably qualified expert (whose appointment has been agreed to by the Director-General) as being well established and in good health. Any plantings which are unsuccessful during that time shall be replaced by the Proponent at no cost to the landowner.	Nil.
2.24	Wind turbine generators shall be painted matt off-white/grey. The blades shall be finished with a surface treatment that minimises any potential for glare or reflection. No advertising, signs or logos shall be mounted on the turbines, except where required for safety purposes. A corporate logo may be placed on the turbines provided it is not distinguishable by the naked eye from any publicly accessible location or from any non-associated receptors.	Nil.
2.25	The Proponent shall ensure that shadow flicker arising from the operation of the project shall not exceed 30 hours/annum at any non-associated receptor.	Nil.
2.27	**Night Lighting** With the exception of aviation hazard lighting implemented in accordance with the requirements of this condition, no external lighting other than low intensity security night lighting is permitted on site unless otherwise agreed or directed by the Director-General. Prior to the commencement of construction, the Proponent shall consult with the Civil Aviation Safety Authority on the need for aviation hazard lighting in relation to the wind turbines and implement such lighting only where it is specifically required by the Civil Aviation Safety Authority. In this case, aviation hazard light shall be implemented in a manner that minimises visual intrusion to surrounding non associated receptors as far as reasonable and feasible. The potential for any intrusion from night lighting shall be considered as part of the Visual Impact Verification Report required to be prepared under condition 2.23.	Nil.

4.2 Noise Impact Assessment

A detailed Noise Impact Assessment has been prepared by SLR Consulting Pty Ltd (SLR) which is included as Appendix B. Noise monitoring was previously conducted by SLR in 2009 as part of the original Environmental Assessment and background noise regression curves were established. The 2018 noise assessment was undertaken using two WTG models currently entering the Australian market, as shown in Table 7. Although only 20 WTGs are to be installed, 30 available WTG locations were assessed to provide a conservative, worst-case assessment. The assessment also considered the cumulative noise impact by including the existing 67 WTGs installed in Stage One.

Table 7: WTG models considered in the Noise Impact Assessment

WTG Model	Vestas V150 – 4.2 MW	GE 158 – 5.3 MW
Rotor diameter	150 m	158 m
Hub height	125 m	125 m
Standard Mode Sound Power Level, LWA ref 8 m/s	104.9 dBA	106 dBA

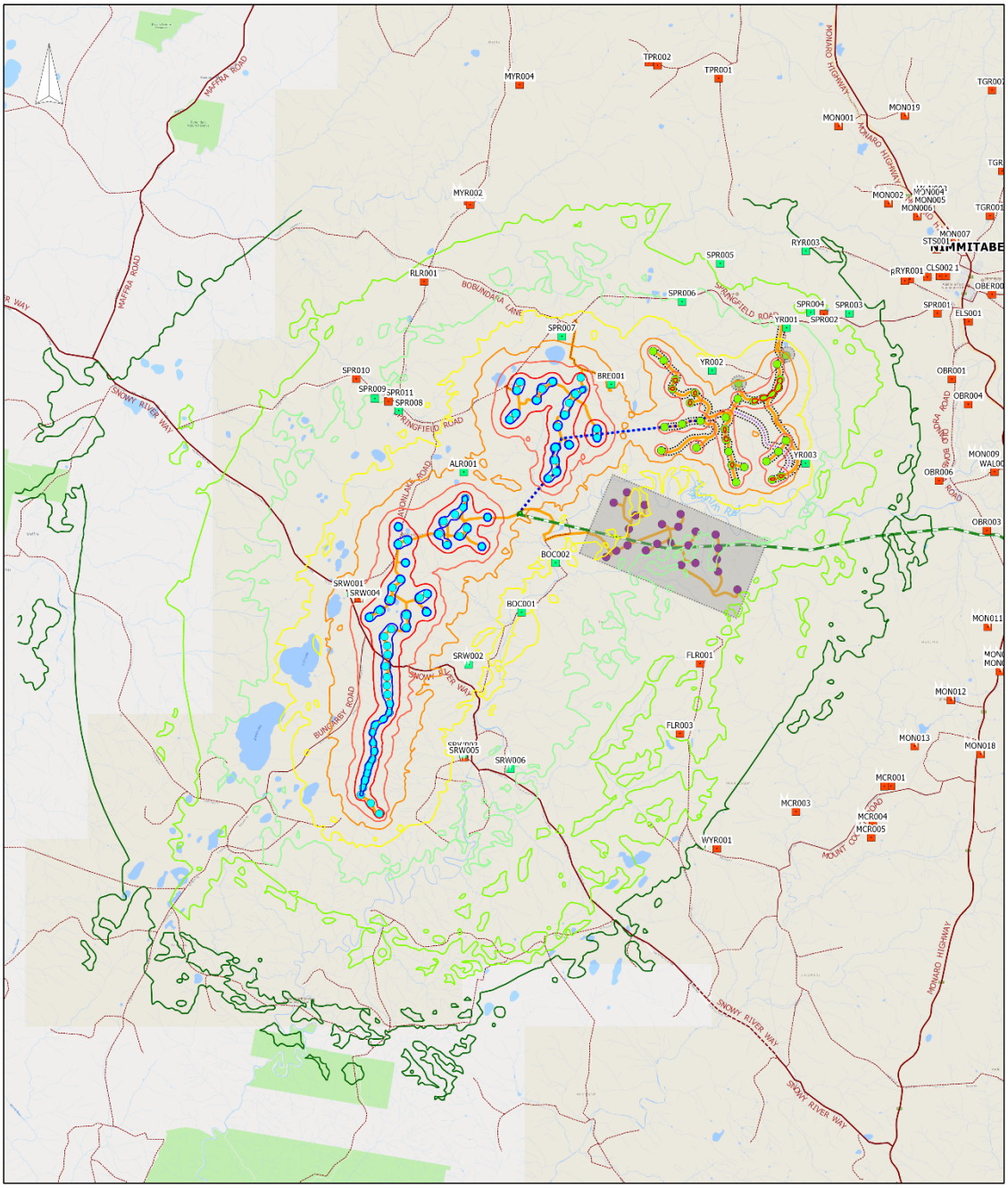
All properties surrounding the proposed site have an ambient background noise environment that is determined by predominantly natural sources which are largely wind influenced. An assessment of the acceptability of wind farm noise levels at all assessment receivers using the required noise limit set in SA EPA (2009) Guidelines has been completed. Dwellings further than these receptors are deemed to comply if dwellings closer to WTGs comply with the SA EPA (2009) noise limit.

The assessment figures contained in Figure 10 and Figure 11 depict the predicted WTG noise level curves including the worst case Stage Two layout for the Vestas and GE WTGs respectively. All involved and non-involved receiver locations are predicted to comply with their respective criteria.

The Proponent has discussed the possible noise implications of the Project with the involved residents on whose property the WTGs would be located, and has entered into agreements with those parties. Neighbour Agreements have been offered to all landowners with residences within 4 km of a WTG for Stage Two. Only one previously approved dwelling (SPR002) remains non-involved within 4 km and a Neighbour Agreement remains under consideration. These agreements constitute a noise agreement which satisfies the requirements of each of Condition 2.18, the NSW Wind Energy: Noise Assessment Bulletin (DPE 2016c) and the SA EPA 2009 Guidelines. The agreements acknowledge that any noise from the WTGs which may be experienced by the landowner at the residence must be within the parameters set out in the World Health Organisation (WHO 1999) Guidelines.

SLR found that all receiver locations are predicted to comply with their respective criteria from the Project Approval as shown in Table 8. Nonetheless, if undue WTG noise impacts are identified during operations due to temperature inversion, atmospheric stability or other reasons, then an 'adaptive management' approach could be implemented to mitigate or remove the impact.

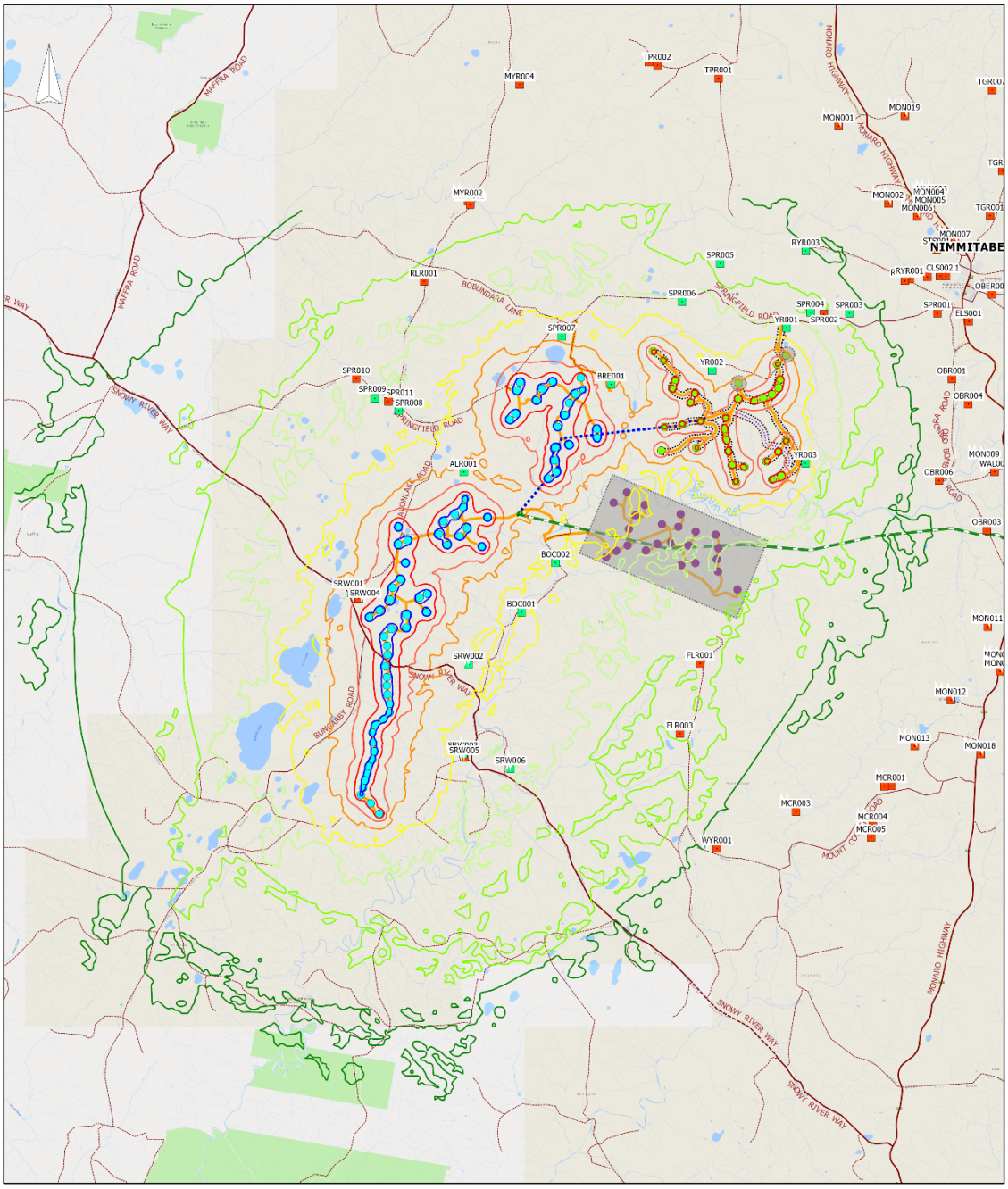
Figure 10: Noise Contours using Stage One and the worst-case Vestas V150 layout.



LEGEND			COMPANY	
Noise Contours dBA	Stage 1 As Constructed - 67 WTG	Internal Road Layout	BOCO ROCK STAGE TWO PTY LTD	cwp Renewables
20	Stage 2 (Yandra Cluster) - 32 WTG	Existing Sealed Rd		
25	Boco Cluster - 23 WTG	Existing Unsealed Rd		
30	Involved Dwelling	132kV Double Circuit TL (existing)		
35	Non-involved Dwelling	Cables (approved):		
40	Substation	Overhead Cables		
45	Concrete Batching Plant	Underground or overhead		
50	100m Development Corridor			
55	Not part of Stage 2			

SCALE BAR	TITLE				
0 5 km	Figure 10: Noise Contours Stage 1 - 67 x GE 1.6MW & 1.7MW Stage 2 - 30 x Vestas V150 4.2MW				
	DATE	SCALE	DWG NO	REV	VER
	06 Nov 2018	1:150000	BRST024	C	1
	DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
	J PETERSEN	M BRANSON	1 OF 1	130607	A3

Figure 11: Noise Contours using Stage One and the worst-case GE 158 layout.



LEGEND			COMPANY		
Noise contour dBA	Stage 1 As Constructed - 67 WTG	Internal Road Layout	BOCO ROCK STAGE TWO PTY LTD		cwp Renewables
25	Stage 2 (Yandra Cluster) - 32 WTG	Existing Sealed Rd	TITLE	Figure 11: Noise Contours Stage 1 - 67 x GE 1.6MW & 1.7MW Stage 2 - 30 x GE 158 5.3MW	
30	Boco Cluster - 23 WTG	Existing Unsealed Rd			
35	Involved dwelling	132kV Double Circuit TL (existing)	DATE	SCALE	DWG NO / REV / VER
40	Non-involved dwelling	Cables (approved):	06 Nov 2018	1:150000	BRST024 / C / 1
45	Substation	Overhead Cables			
50	Concrete Batching Plant	Underground or overhead			
55	100m Development Corridor				
	Not part of Stage 2				
SCALE BAR	0 5 km		DRAWN BY	CHECKED BY	SHEET / JOB NO / SIZE
			J PETERSEN	M BRANSON	1 OF 1 / 130607 / A3

Table 8: Approval Conditions: Operational Noise Criteria

Ref	Condition	Proposed amendments
2.17	The Proponent shall design, operate and maintain the project to ensure that the equivalent noise level (LAeq (10-minute)) from the wind turbine component of the project does not exceed the following limits at any existing sensitive receptor: a) 35 dB(A); or b) the existing background noise level (LA90 (10-minute)) correlated to the integer wind speed at the turbine hub height at the wind farm site by more than 5 dB(A), whichever is the greater, for each integer wind speed (measured at 10m height) from cut-in to rated power of the wind turbine generator. For the purpose of assessment of noise contributions specified under conditions 2.17: a) 5 dB(A) shall be applied to measured noise levels where tonality is present. The presence of tonality shall be determined using the methodology detailed in Wind Turbine Generator Systems- Part 11: Acoustic Noise Measurement Techniques IEC 61400-11:2002 or its latest edition; and b) noise from the project shall be measured at the most affected point within the residential boundary, or at the most affected point within 20 metres of the dwelling, where the dwelling is more than 20 metres from the boundary.	Nil.
2.18	Notwithstanding conditions 2.17 of this approval, the noise limits specified under conditions 2.17 do not apply to any sensitive receptor where a noise agreement is in place between the Proponent and the respective landowner(s) in relation to noise impacts and/or noise limits. Where a noise agreement has been entered into, the noise agreements shall satisfy the requirements of Guidelines for Community Noise (WHO, 1999) and Section 2.3 of Wind Farms: Environmental Noise Guidelines (South Australian Environmental Protection Agency, 2003).	Amend to reference DPE (2016) Noise Assessment Bulletin.
2.19	At least 6 months prior to the commencement of commissioning of the wind turbines, the Proponent shall prepare and submit a Detailed Design Noise Report (Wind Turbines) for the Director-General's approval. The Detailed Design Noise Report (Wind Turbines) shall predict noise levels at each of the receptor locations identified in condition 2.17 consistent with the procedures presented in Wind Farms - Environmental Noise Guidelines (South Australian Environmental Protection Agency, 2003) considering the final turbine model and layout of the project and worst case operating and meteorological factors to demonstrate that noise levels associated with the final design would be no greater that than the noise limits identified in condition 2.17 at surrounding sensitive receptors.	Nil.

4.3 Biodiversity Impact Assessment

The ecological study undertaken by Eco Logical Australia Pty Ltd (ELA) in 2009 included evaluation of all permanent and temporary impacts on biodiversity which was reported within the Environmental Assessment. During exhibition, consultation with the Department of Environment Climate Change and Water (now the Office of Environment and Heritage (OEH)) was undertaken and it was agreed (and identified in the Response to Submissions) that as a conservative measure all impacts would be considered permanent when determining the required biodiversity offsets for the Project.

Two biodiversity offset sites have been established and secured in perpetuity using a BioBanking Agreement under the *Threatened Species Conservation Act 1995*. The two offset sites total over 1,100 ha of which over 80 % is considered to be Natural Temperate Grassland of high conservation value, constituting the largest area of protected Natural Temperate Grassland in NSW. The offsets meet the requirements for both Stage One and all subsequent stages of the approved project and no further offsets are required to offset impacts within the thresholds of temporary and permanent impacts identified in the Preferred Project Report (Refer to letter from OEH in Appendix C).

4.3.1 *On-ground Impacts*

An approach of avoidance has been adopted to minimise the on-ground impacts to biodiversity during construction. The Modification is designed to ensure that on-ground impacts to biodiversity are less than the approved limits despite the increase in WTG, hardstand and footing dimensions. This has been achieved by reducing the number of WTGs to be installed, reducing the required road width from 12 m to 6 m and removing unnecessary roads, hardstands and footings. The only additional component is a temporary construction compound adjacent to the project access road. Table 9 identifies the proposed changes to on-ground disturbance for the Modification. Components which are not listed remain unchanged from the approved Project.

Table 9: Proposed changes to on-ground components

Project Infrastructure (Yandra only)	Project Approval	Modification	Comparison
WTGs (Yandra)	Up to 32	Up to 20	Reduced by 12
Hardstands (total area)	4 ha	4.2 ha	Increase of 0.20 ha
Footings (total area)	0.72 ha	0.9 ha	Increase of 0.18 ha
Access road length[1]	21.2 km	20.7 km	Reduced by 0.5 km
Access road width (excludes cut and fill)[2]	12 m	6 m	Reduced by 50 %
Access road area (excludes cut and fill)[3]	25.5 ha	12.3 ha	Reduced by 13.2 ha
Temporary construction compound	N/A	150 x 200 m	Increase of 3.00 ha

[1] Reduction in access road length accounts only for the two WTGs which have been removed from the plans. It does not account for any additional reductions in access roads when the final 20 WTG sites are selected.

[2] The original road width calculated in the EA was based on a permanent road of 6m plus a temporary 6 m disturbance, plus cut and fill. Based on experience it is now considered adequate to construct a 6m wide road plus cut and fill.

[3] This calculation is based on the premise of notes 1 and 2 above.

4.3.2 ***Above-ground Impacts***

The Modification proposes an increase in rotor diameter which increases the rotor swept area (RSA) for WTGs within Yandra cluster. The increased rotor size is mitigated by the reduced number of WTGs but will increase the RSA for the Project when combined with the operational Stage One and the approved, but not constructed, Boco cluster.

The Project Approval permits up to 122 WTGs of 104 m diameter and therefore a total RSA of 1,036,374 m^2. Stage One comprises 67 operational WTGs of 100 m diameter with a combined RSA of 526,217 m^2 which is less than was originally assessed. Although the Boco and Yandra clusters are not constructed, the Project approval permits rotor diameters of 104 m which would provide RSA totals of 195,385 and 271,836 m^2 respectively. Table 10 provides the RSA calculations for the Project.

Table 10: Rotor swept area calculations for the Project

	Project Approval	**Stage One (as built)**	**Boco cluster (approved)**	**Yandra cluster (approved)**	**Yandra cluster (proposed)**	**Revised Project Maximums**
WTGs	122	67	23	32	20	110
Rotor diameter (m)	104 m	100 m	104 m	104 m	160 m	160 m
RSA (m^2 / WTG)	8,495	7,854	8,495	8,495	20,106	20,106
RSA (m^2 total)	1,036,374	526,217	195,385	271,836	402,124	1,123,725

The proposed Modification to install up to 20 WTGs in Yandra cluster with an approximate rotor diameter of 160 m would create a Stage Two RSA of 402,124 m^2, which is a 130,288 m^2 increase compared to the approved Yandra cluster. The proposed Modification would create a project-wide RSA of up to 1,123,725 m^2, based on the revised total of 110 WTGs being installed. This RSA is approximately 8 % greater than the RSA assessed and approved for the entire Project.

A comprehensive Bird and Bat Impact Study has been conducted by Brett Lane & Associates Pty Ltd (BLA) which is included as Appendix D. The study considers the original ecological assessment (ELA 2009), the approved Bird and Bat Adaptive Management Plan (BBAMP) and the BBAMP monitoring which has been undertaken by NGH Environmental from 2015 annually to 2018 and is on-going (NGH 2016, 2017b, 2018a, 2018b). The study assesses the impacts of the increased RSA size as well as the change in risk profile resulting from the proposed rotor height which influences the collision risk potential for each species depending upon their flight habits and ecology.

4.3.3 ***Impact Assessment***

This section evaluates the potential impacts of the proposed Modification on biodiversity and biodiversity values as defined under the *Biodiversity Conservation Act 2016* (BC Act) as well as additional biodiversity values prescribed in the *Biodiversity Conservation Regulation 2017* (BC Regulation).

The BC Act defines biodiversity values in section 1.5 (2):

a) *vegetation integrity—being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state,*
b) *habitat suitability—being the degree to which the habitat needs of threatened species are present at a particular site,*
c) *biodiversity values, or biodiversity-related values, prescribed by the regulations.*

Additional biodiversity values are prescribed under section 1.4 of the BC Regulation for the purposes of the BC Act:

a) *threatened species abundance—being the occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site,*
b) *vegetation abundance—being the occurrence and abundance of vegetation at a particular site,*
c) *habitat connectivity—being the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range,*
d) *threatened species movement—being the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle,*
e) *flight path integrity—being the degree to which the flight paths of protected animals over a particular site are free from interference,*
f) *water sustainability—being the degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site.*

The following sections provide an assessment of the proposed change in impacts between the approved Project and the proposed Modification on the biodiversity values described in the BC Act and BC Regulation.

4.3.3.1 Vegetation Integrity

Section 1.5 (2) (a) of the BC Act defines vegetation integrity as: *being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state.* Since the Project Approval, there has been no change in land use and the area continues to be used for agricultural purposes. Two vegetation communities are present in varying condition: Ribbon Gum (*Eucalyptus viminalis*) Snow Gum Open Forest (*Eucalyptus pauciflora*) and Derived Grassland (see Figure 12). The forest community occurs primarily on the basalt soils on the ridges and gullies surrounding the Maclaughlin River, whereas the Derived Grassland occurs on those once-forested areas which have historically been disturbed by agricultural activities and are now more characteristic of a grassland community (ELA 2009). There are no changes proposed to the approved infrastructure in the Natural Temperate Grassland to the west of Yandra cluster.

Table 11 identifies the vegetation clearance for Yandra cluster under the approved Project, and the proposed Modification. Despite the increased WTG footing and hardstand dimensions, and the addition of the temporary construction compound, impacts to vegetation abundance and integrity will be reduced for all vegetation types. Importantly, the calculations in Table 11 are based on a worst-case assessment involving all of the 30 WTG locations available and are therefore highly conservative.

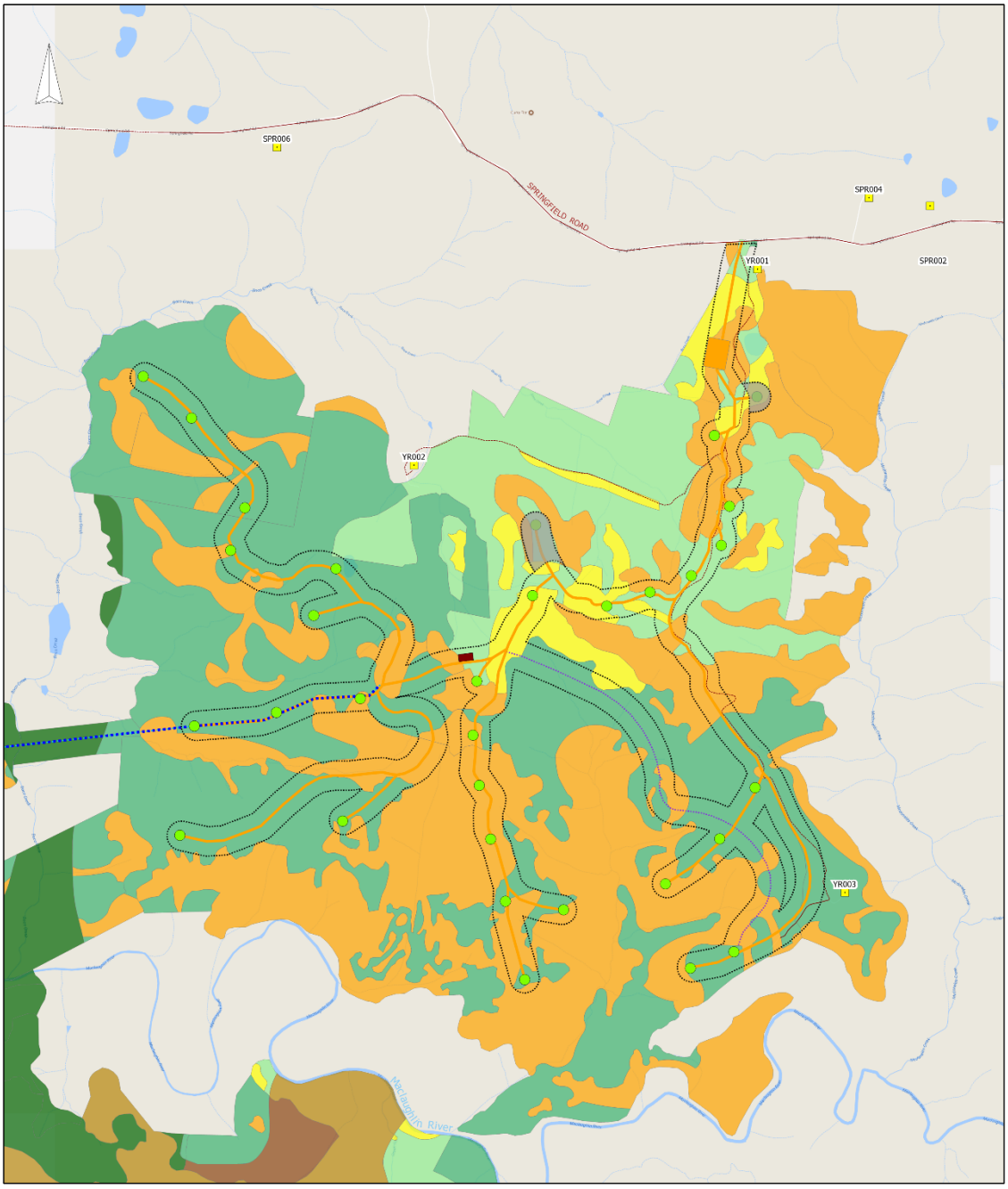
The approved Project would involve clearing and/or modifying approximately 65.99 ha of native vegetation including Ribbon Gum Snow Gum Open Forest and Derived Grassland. This includes the permanent clearance of vegetation for construction, as well as temporary earthworks which would be rehabilitated at the end of construction in accordance with an approved CEMP. The approved Project would affect the composition, structure and function of vegetation in Yandra cluster, but would not alter the surrounding landscape from a near natural state. The Project Approval requires an offset to compensate for impacts to vegetation extent and integrity, which has been established and is being managed to address the impacts of the entire approved Project (Refer to Appendix C). The offset site is improving the vegetation integrity of the surrounding landscape as it is compensating, in a large part, for impacts which are approved but have not yet occurred.

The proposed Modification for Stage Two would see a reduction in impact to all vegetation types within Yandra cluster, with only 53.54 ha of native vegetation potentially impacted. Compared to the approved Project, the Modification would improve the surrounding landscape by avoiding of 12.45 ha of vegetation, including 4.33 ha of Snow Gum Ribbon Gum Open Forest and 8.12 ha of Derived Grassland. The proposed changes would result in a direct net gain in composition, structure and function of vegetation in Yandra cluster as the approved impacts have already been offset. Accordingly, the proposed Modification is expected to deliver a net gain for vegetation integrity as defined under Section 1.5 of the BC Act.

Table 11: Vegetation impact comparison

	Derived Grassland (Low)	**Derived Grassland (Mod-Good)**	**Ribbon Gum-Snow Gum Open Forest (Low)**	**Ribbon Gum-Snow Gum Open Forest (Mod-Good)**	**Total (ha)**
Approved layout (32 WTGs)					
Roads (12 m)	3.03	12.32	2.71	7.89	**25.96**
Cut/fill	4.30	16.98	3.06	10.72	**35.05**
Footings (14m diameter)	0.08	0.24	0.05	0.12	**0.49**
Concrete batch plant	0.44	0.06	0.00	0.00	**0.50**
Hardstands (25 x 50 m)	0.75	2.07	0.29	0.89	**4.00**
Total (ha)	**8.60**	**31.67**	**6.10**	**19.62**	**65.99**
Modification worst-case layout (30 WTGs)					
Roads (6 m)	1.27	6.02	1.22	3.66	**12.16**
Cut/fill	3.05	16.19	2.12	9.24	**30.60**
Footings (24m diameter)	0.18	0.71	0.09	0.38	**1.35**
Concrete batch plant	0.44	0.06	0	0	**0.50**
Hardstands (35 x 60 m)	0.96	3.28	0.27	1.42	**5.93**
Construction compound	0	0	0.13	2.87	**3.00**
Total (ha)	**5.90**	**26.25**	**3.83**	**17.56**	**53.54**
Balance of change	**Reduced by 2.7 ha**	**Reduced by 5.42 ha**	**Reduced by 2.27 ha**	**Reduced by 2.06 ha**	**Reduced by 12.45 ha**

Figure 12: Vegetation Mapping of Yandra cluster



4.3.3.2 Habitat Suitability

Section 1.5 (2) (b) of the BC Act defines habitat suitability as being: *the degree to which the habitat needs of threatened species are present at a particular site.* The ELA (2009) report evaluated impacts to habitat suitability for threatened species using the vegetation communities mapped at the Project site. Areas of Ribbon Gum Snow Gum Open Forest within the study area are considered suitable habitat for a variety of fauna including birds, owls, bats, arboreal mammals, reptiles and in areas where dams are present, amphibians. The majority of the trees within the study area support hollows and Yandra in particular provides suitable habitat for hollow-dependant species. A Squirrel Glider (*Petaurus norfolcensis*) was recorded within Yandra cluster during spotlighting surveys (ELA 2009).

Grassland areas occur primarily on the Springfield, Sherwins and Boco clusters. Depending on grazing intensity, many of these areas support large Poa tussocks which provide sheltering habitat for a variety of reptile species. The rocky outcrops present on the ridge tops and mid slopes also provide habitat for reptile species including the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) and Little Whip Snake (*Suta flagellum*) which have been recorded at a number of locations across the Project study area (ELA 2009). Yandra Cluster contains Derived Grassland as shown in Figure 12. The ELA (2009) report identifies low quality Grassland Earless Dragon habitat, as well as habitat for the Pink-tailed Worm Lizard (*Aprasia parapulchella*) and the Striped Legless Lizard (*Delma impar*) in Yandra cluster corresponding with the extent of the Derived Grassland (Mod-Good) community (See Figure 12). Table 11 identifies that the proposed Modification would avoid impacts to 5.42 ha of habitat for these species compared to the approved impacts which have already been offset. Little Whip Snake habitat is considered to correspond with all vegetation types across the Project site, of which 12.45 ha will be avoided by the proposed Modification.

Habitat for a variety of threatened flora species is also present across the study area, however, no threatened flora were recorded across the study area during systematic surveys of areas (ELA 2009). Due to the proposed changes to Yandra cluster resulting in a reduction in impact for all vegetation types, as shown in Table 11, habitat suitability for threatened flora and terrestrial fauna (including threatened mammals, low-flying threatened woodland birds and threatened bats) is expected to see a net gain of 12.45 ha compared to the impacts which have already been assessed, approved and offset. Accordingly, the proposed Modification is expected to generate a net gain in habitat suitability, as defined under Section 1.5 of the BC Act, for terrestrial species within the Project site.

The Bird and Bat Impact Study (Appendix D) evaluated impacts under the *Biodiversity Conservation Regulation 2017* to evaluate how the proposed Modification would impact bird and bat species known or likely to occur in the study area, and whether there would be any significant impact as a result of the proposed Modification. The proposed changes to Yandra cluster would remove the risk of collision for birds flying below 40 m. Between 40 m and 100 m, there would be a decrease in RSA and a corresponding reduced risk of bird collision due to the increased rotor height. In contrast, above 100 m the collision risk would increase for birds flying at height.

The cumulative effects on habitat suitability were assessed for the wind farm as a whole, based on the WTG dimensions of the proposed Yandra cluster, the approved Boco cluster and the operational Stage One cluster (refer to Table 10). The Bird and Bat Impact Study found that the proposed Modification would lead to a corresponding change in collision risk for birds and bats that fly within each RSA height band, as described below:

- Between 30-40 m the cumulative area of the RSA in this height band will be decreased by 27 % with a reduction in risk to birds and bats. This is an area where a higher level of bird and bat activity is recorded compared to higher heights where birds and bats may fly;
- Between 40-100 m cumulatively there will be a decrease in RSA across the wind farm between 1 % and 16 % as compared to the approved WTG dimensions. This is an area where higher flying species of birds and a few species of bats are recorded; and
- Over 100 m in height the risk to birds and bats will incrementally increase, albeit with fewer WTGs. There are few flights at these heights, however if they do occur, they are typically high-flying bat species and higher-flying birds, e.g. raptors and the White-throated Needletail.

The proposed change to cumulative RSA below 100 m height would improve the habitat suitability of the site for lower-flying species. In contrast, the Modification would increase the risk of collision (and therefore reduce habitat suitability) for species typically recorded flying above 100 m.

BL&A (2018) found that the proposed Modification would decrease risk to species flying below 100 m as the total extent of the RSA below 100 m would decrease. In Yandra cluster, the minimum RSA has been lifted from 30 m to 40 m and the number of WTGs reduced from 32 to 20. The Modification will increase the risk of collision for those few species typically recorded flying over 100 m including Wedge-tailed Eagles (WTE), other high-flying raptors and White-throated Needletails (WTNT). Overall, the risk to the WTE and WTNT from collision with WTGs was considered to be low given the low number of birds utilising the site, the low frequency with which these flights occur and the non-threatened status of these species in mainland Australia.

Most birds recorded by ELA (2009) and the subsequent BBAMP monitoring were common, widespread species of partly wooded agricultural landscapes in south-eastern Australia. No species listed as rare or threatened under the EPBC Act have been recorded. Of the BC Act listed species recorded or considered likely to occur, none have a significantly increased risk of collision with the modified WTGs in Stage Two (Refer to Appendix D).

Two threatened bat species have been recorded on site: Eastern Bentwing Bat (EBB) and Eastern False Pipistrelle. To date, there have been four mortalities of EBB, all occurring during the first year of monitoring (2015), with no further mortalities identified between 2016 and 2018. On-going monitoring of the species at the wind farm as part of bird and bat monitoring has concluded that it is unlikely that a significant proportion of the population is utilising, or migrating through, the wind farm site (NGH 2017c). NGH have also undertaken a risk analysis of the EBB at BRWF (Section 2.1.5, NGH 2017c), which concluded that on-going operation of the wind farm is unlikely to significantly affect the species. The Eastern False Pipistrelle has also been recorded on site, although no mortalities have been recorded. BLA (2018) found that because it tends to fly lower in open country it is unlikely that habitat suitability for this species would be affected.

BLA (2018) have determined that the Modification is likely to improve the habitat suitability of the Project site for both EBB and Eastern False Pipistrelle due to the reduction in habitat removal, increase in lower tip height, reduction in RSA below 100 m and the species' tendency to forage near the ground in open environments. In particular, an increase in the minimum tip height from 30 to 40 m is expected to reduce the interaction between rotors and these bat species in the Project area. As a significant

population of EBB is unlikely to be utilising or migrating through the site (NGH 2017c), this change in risk is not expected to lead to a significant change in impact on the species' population.

The assessment of impacts on habitat suitability has been assessed for each threatened bird and bat species considered likely to occur or known to occur in the Project area in accordance with the definition in Section 1.5 (2) of the BC Act. Impacts to non-threatened native species are considered in Appendix D and discussed when considering Flight Path Integrity under the BC Regulation.

4.3.3.3 Threatened Species Abundance

Section 1.4 of the BC Regulation defines threatened species abundance as being: *the occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site.* This topic is addressed to some extent in the sections 4.3.3.1 and 4.3.3.2 above, including a quantitative analysis of impacts in Table 10 and Table 11.

The proposed Modification is expected to deliver a net gain in vegetation integrity and habitat suitability for terrestrial species as discussed in detail in the sections above and demonstrated in Table 11. This is due to a reduction in the impacts to native vegetation, including threatened species habitat, as a result of changes in the Project design. Approximately 12.45 ha of vegetation would be avoided by the proposed Modification including habitat for threatened flora and fauna described in Section 4.3.3.2. Accordingly, the proposed Modification is expected to deliver a net gain in potential habitat influencing the occurrence and abundance of terrestrial threatened species and ecological communities, or their habitat at the Project site, compared to the approved Project.

The Bird and Bat Impact Study (Appendix D) assessed potential operational impacts to threatened bird and bat species as a result of rotor collision, based on the species recorded on site during the original ecological study (ELA 2009) and in the subsequent BBAMP monitoring and reports (NGH 2016, 2017a, 2017b, 2017c, 2018a, 2018b). A discussion of the potential impacts of the proposed Modification is provided in detail above in section 4.3.3.2 and in Appendix D. BL&A (2018) found that, despite the modest 8 % increase in RSA for the Project, the overall impacts to threatened species and consequently their abundance as a result of the modification will not increase. This is primarily due to the change in rotor height and the resulting alteration of RSA distribution, and the fact that there are few threatened bird and bat species regularly recorded in the area (Appendix D).

In particular, an increase in the minimum tip height from 30 to 40 m is expected to reduce the interaction between rotors and threatened woodland bird and bat species in the Project area. The overall reduction in RSA below 100 m will further mitigate the 8 % increase in total RSA as most threatened species are considered to predominantly fly below this height.

4.3.3.4 Vegetation Abundance

Section 1.4 of the BC Regulation defines vegetation abundance as: *being the occurrence and abundance of vegetation at a particular site*. A quantitative assessment of vegetation impacts of the proposed Modification is provided in Table 11. The Project has established and is managing two offset sites which adequately offset all Project impacts approved in 2010 as demonstrated in Appendix C. Therefore, the proposed Modification would lead to a net gain in vegetation abundance as a result of the avoidance measures adopted in this Modification. The total avoidance measures equate to a gain

of 12.45 ha of vegetation including 4.33 ha of Ribbon Gum-Snow Gum Open Forest and 8.12 ha of Derived Grassland.

4.3.3.5 Habitat Connectivity

Section 1.4 of the BC Regulation defines habitat connectivity as: *being the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range*. The proposed Modification is unlikely to have any influence on habitat connectivity for threatened flora and terrestrial fauna species due to the linear nature of the development and the net gain in vegetation integrity, abundance and habitat suitability at the Project site demonstrated above.

An assessment of potential impacts to habitat connectivity for each threatened avian species with the potential to occur at the Project site was undertaken by BLA (2018; refer to Appendix D Section 3.3). The assessment found that no threatened species which are considered likely to occur, or known to occur, are expected to experience a significant reduction in habitat connectivity because of the Modification, which would inhibit the movement of those species across their range. The Project occurs in the Monaro region which is largely comprised of sparse open habitats and the Modification is not anticipated to significantly alter the habitat connectivity for species, despite the increase in overall RSA. The reduction in the number of WTGs will provide fewer physical barriers and decrease any "barrier effect" which could contribute to decreased aerial connectivity between habitats. This is largely due to fewer, larger WTGs presenting fewer obstacles to birds and bats flying between habitats. Additionally, the RSA in Yandra cluster will be raised in height, improving habitat connectivity for those avian species flying around canopy height up to 40 m, with a marginal decrease in RSA up to 100 m in height compared to the approved Project.

4.3.3.6 Threatened Species Movement

Section 1.4 of the BC Regulation defines threatened species movement as: *being the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle*. The proposed changes to on-ground impacts and the subsequent net gain in vegetation integrity, extent and habitat suitability has been demonstrated in the sections above. The proposed Modification is not expected to result in any increase in impacts to the movement of threatened flora and terrestrial fauna species which may be required to maintain the species' lifecycle, when compared to the approved Project.

The Bird and Bat Impact Study (Appendix D) assessed whether the proposed Modification would result in changes to movements of threatened avian species considered likely or known to occur at the Project site (refer to Appendix D Section 3.3). The study found that there is likely to be less risk to threatened species movement for species that fly below 100 m. There will be an increase in risk to species that may fly above 100 m, but the analysis did not identify any substantial increase in risk as the space between the WTGs is considered sufficient to permit species to move about the area. The reduced number of WTGs from 32 to 20 will decrease the potential for a barrier effect in Yandra cluster which could inhibit threatened species movement.

Overall the Modification is not expected to impact negatively on threatened species of birds and bats insofar as the movement over the site would contribute to the species life-cycle, compared to the

approved Project, particularly as few species of threatened birds and bats regularly use the site (as outlined above).

4.3.3.7 Flight Path Integrity

Section 1.4 of the BC Regulation defines flight path integrity as: *being the degree to which the flight paths of protected animals over a particular site are free from interference.* ELA (2009) assessed flight characteristics of birds in the original EA and identified that the Project is situated in a broad open landscape on the Monaro plains and that flight pathways are less influenced by canopy density and vegetation structure than in areas with more prominent habitat features. The Bird and Bat Impact Study in Appendix D evaluates the potential impacts of the proposed Modification on native bird and bat species which are considered likely or known to occur at the Project site, and considers the relative risk of impacts to flight path integrity.

Section 4.3.2 above provides an analysis of the above-ground impacts and RSA considerations which is directly relevant to an assessment of flight path integrity. Subsequently, Section 4.3.3.2 evaluates the impacts of the proposed Modification on habitat suitability for threatened bird and bat species by considering the potential for flight interference and rotor strike impacts, which corresponds directly to flight path integrity. None of these species have been identified as being regular seasonal migrants with well-defined flight paths which are typical for migratory shorebirds. Nor does the Project Area include significant habitat features such as karst or wetlands which would act as attractants for large groups of regular migratory birds and bats to the area.

When considering flight path integrity for both birds and bats, it is noted that there will be no loss in connectivity of habitats compared with the currently approved Project. The Modification involves removal of Project components and an increase in WTG dimensions, but no alterations to layout.

Furthermore, reduced impacts on vegetation and habitat will enhance habitat connectivity at the local scale. The proposed Modification would have fewer WTGs forming potential barriers to flight paths and would remove RSA from the area between 30-40 m above ground height. Additionally, the reduced RSA of the wind farm below 100 m will reduce impacts on flight path integrity for most birds and bats. However, the increased RSA above 100 m will increase potential impacts to flight path integrity for high flying species. BL&A did not identify any threatened avian species for which flight path integrity was expected to be significantly impacted by the proposed Modification either because of the species' flight habits, habitat traits or because they are rare or infrequent visitors to the Project site.

Of the non-threatened species considered at risk of rotor strike, Wedge-tailed Eagles, other high-flying raptors and White-throated Needletails are considered to be most at risk due to their high-flying foraging habit. Overall, despite the modest 8 % increase in the Project RSA, the risk to these species from collision with WTGs is considered to be low given the low number of birds utilising the site, the spacing of the WTGs providing sufficient space to prevent a barrier to flight paths and the low frequency with which these birds are recorded in the Project area (refer to Appendix D).

Two widespread and common bat species are considered to be at risk as they are known to forage at RSA height: White-striped Freetail Bat and Gould's Wattled Bat. It is likely that an increase to RSA area and height through the Modification may increase collision risk and negatively impact flight path

integrity for these two high flying species. However, BL&A (2018) concluded that the proposed 8 % increase in RSA was unlikely to be of significance for these species considering that they are widespread and common across Australia (refer to Appendix D).

4.3.3.8 Water Sustainability

Section 1.4 of the BC Regulation defines water sustainability as: *being the degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site.* The proposed Modification does not involve any alteration to water bodies or water sources, nor does it involve changes to the approved transmission line creek crossing between Yandra cluster and the substation. It is expected that water consumption for construction of up to 20 WTGs would be approximately equivalent to that which was originally assessed for the 32 WTGs in Yandra cluster. Water for construction of the Project would be procured from licenced water sources under the appropriate licencing instrument to ensure that any impacts to water source are within approved limits and managed according to the NSW Office of Water requirements.

The proposed Modification is not expected to increase any impacts to hydrological processes that may sustain threatened species or ecological communities in and around Yandra cluster compared to the approved Project. The Implementation of appropriate sediment and erosion control management measures as part of the Project CEMP will ensure that impacts to water quality are minimised in accordance with the existing approval. Accordingly, the proposed Modification is not anticipated to have any impacts on water sustainability as defined under the BC Regulation.

4.3.4 ***Summary of Biodiversity Impacts***

In summary the assessment identified the following:

- the Modification would deliver a net gain for vegetation integrity, habitat suitability as defined under the BC Act, by avoiding approximately 12.45 ha of Ribbon Gum Snow Gum Open Forest and Derived Grassland which has already been offset;
- the proposed Modification would reduce the RSA of the Project below 100 m in height and increase the RSA above 100 m in height, creating a net improvement for low flying species and a corresponding increase for those few species flying at heights above Yandra cluster;
- there are not predicted to be any significant impacts to biodiversity values as defined under the BC Act or BC Regulation for on-ground or above ground impacts when compared to the approved Project; and
- the impacts of the entire approved Project have already been offset with the establishment and ongoing management of two offset sites nearby (refer to Appendix C).

Accordingly, a biodiversity development assessment report has not been prepared for this Modification.

Prior to the commencement of operation of any WTGs within Stage Two, the Project BBAMP would be revised and updated to the satisfaction of the Secretary to address the Modification. The BBAMP would address the requirements of the Biodiversity Assessment Methodology (section 9.4.2.3), specifically including:

- measures to monitor predicted impacts

- thresholds for species mortality, based on relevant literature, which will trigger adaptive management actions
- measures to monitor predicted indirect impacts and nominate corresponding thresholds, based on relevant literature, which will trigger adaptive management actions
- any other measures proposed to mitigate potential impacts.

The BBAMP would be informed by the three years of monitoring results which have been collected from Stage One to date and tailor the future monitoring to address the key bird and bat risks of the Modified Project. Implementation of the BBAMP would enable the Project to adaptively respond to bird and bat fatalities and actively manage the site to ensure that biodiversity objectives are met.

Table 12: Approval Conditions: Flora and Fauna Impacts

Ref	Condition	Proposed amendments
2.1	*Unless otherwise agreed to by the Director-General, prior to the commencement of construction of the project, the Proponent shall in consultation with the DECCW and DEWHA secure a biodiversity offset package comprising a minimum of 750 hectares of Natural Template Grasslands, which provides suitable habitat for the Grassland Earless Dragon, Stripped Legless Lizard and Little Whip Snake in perpetuity through BioBanking mechanisms to the satisfaction of the Director-General. Unless otherwise agreed to by the Director-General in consultation with DECCW and DEWHA, the biodiversity offset package shall include: at least 150 hectares of confirmed habitat for the Grassland Earless Dragon and the Stripped Legless Lizard and at least 300 hectares of confirmed habitat for the Little Whip Snake.*	*Nil.*
2.2	*The Proponent shall ensure that all that reasonable and feasible effort is made to locate wind turbines at least 30 metres from adjacent hollow-bearing trees which have the potential to provide roost or nesting habitat for bird and bat species identified to be at risk of rotor collision during turbine operation.*	*Nil.*
2.3	*The Proponent shall ensure that all reasonable and feasible effort is made to avoid native vegetation disturbance (including clearing of hollow bearing trees) during micro-siting and construction of the project so as to reduce the extent of vegetation disturbance required for the project as far as possible from the maximum worst of 174.3 hectares identified in the Preferred Project Report.*	*Nil.*
2.5	*The Proponent shall ensure that any water extracted from the on-site farm dam for the purposes of construction activities is undertaken in a manner that maintains water volumes at levels suitable for the Blue Billed Duck for the duration of the construction of the project.*	*Nil.*
2.6	*The Proponent shall ensure that the waterway crossing of the McLaughlin River is designed and constructed in consultation with NOW and DII (Fisheries) and consistent with DII (Fisheries) guidelines Policy and Guidelines for Fish Friendly Waterway Crossings (2004) and Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (2004).*	*Nil.*
2.7	*The Proponent shall ensure that any disturbance to watercourses and/or associated riparian vegetation is rehabilitated to a standard equal to or better than the existing condition in consultation with the NOW and DII (Fisheries), within six months of the cessation of construction activities at the relevant area. Any revegetation measures undertaken shall be monitored and maintained consistent with the requirements of condition 2.8.*	*Nil.*
2.8	*The Proponent shall implement a revegetation and rehabilitation program for all areas of the development footprint which are disturbed during the construction of the project however, which are not required for the ongoing operation of the project including temporary construction facility sites and sections of construction access roads. The Proponent shall ensure that all revegetation measures are implemented progressively where possible and in all cases within six months of the cessation of construction activates activities at the relevant area. Unless otherwise agreed to by the Director-General, the Proponent shall monitor and maintain the health of all revegetated areas until such time that the plantings have been verified by an independent and suitably qualified expert (whose appointment has been agreed to by the Director-General) as being well established, in good health and self sustaining.*	*Nil.*

4.4 Heritage Impact Assessment

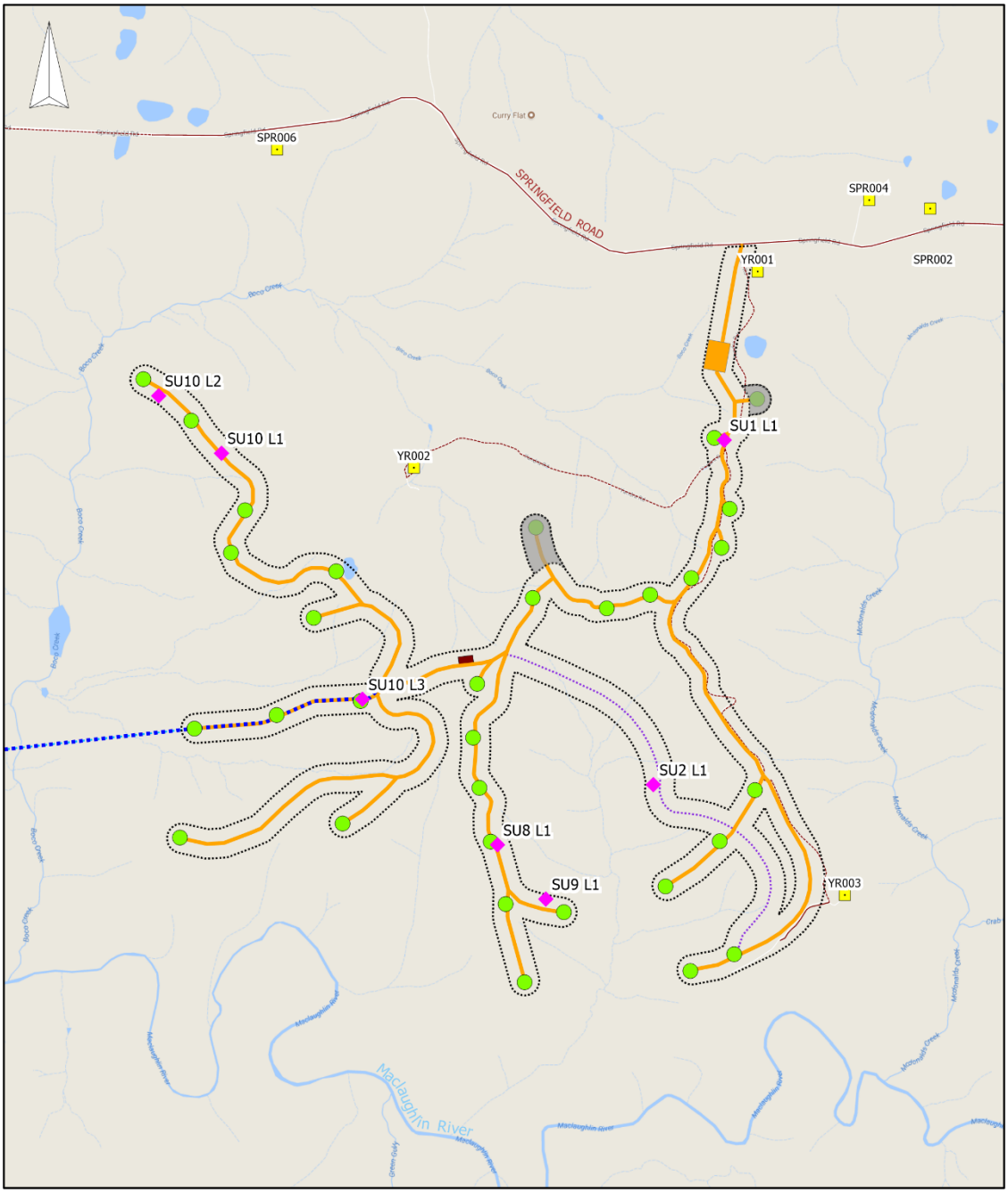
NSW Archaeology Pty Ltd assessed the heritage values of the Project site in 2009 and all areas of the proposed Modification were assessed during the original survey. The Stage Two area was found to be of low archaeological potential and sensitivity. NSW Archaeology Pty Ltd were engaged to evaluate any potential for further impacts to heritage values as a result of the proposed Modification, and their report is included as Appendix E.

Seven Aboriginal object locales are present within the Yandra cluster survey area. They are all assessed to be of low heritage significance and a management strategy of unmitigated impact was originally recommended in the Project Approval and remains valid. That is, impacts are permissible, and impact mitigation is not required. An updated AHIMS site search was undertaken in August 2018 which identified no additional heritage sites in the Stage Two area other than those recorded in 2009. As a result, it is not considered that condition 2.40 is relevant in relation to micro-siting of infrastructure for Yandra cluster.

Recommendations from the Project Approval regarding two historic sites present in Yandra cluster remain valid, one of which should be avoided if feasible. All mapping and recommendations listed from the previous assessment are still applicable to the Modification. Given that there are no changes to the proposed project footprint with the exception of the temporary construction compound, and the entire Modification area has been surveyed (See Figure 13), there are not anticipated to be any impacts to heritage values.

NSW Archaeology Pty Ltd consider that mitigation measures are not required for the Stage Two area. Nonetheless, the Proponent has developed a heritage management policy which will be implemented as part of the Construction Environmental Management Plan to ensure that heritage is adequately managed during construction. A Heritage Management Plan will be prepared by a suitably qualified archaeologist to ensure that any construction impacts, including unexpected finds, are provisioned for during construction and can be managed appropriately throughout the life of the Project. The plan will be prepared in consultation with OEH to ensure compliance with Project Approval conditions 2.41 and 2.42 as shown in Table 13.

Figure 13: Heritage Mapping of Yandra cluster



LEGEND							
Dwelling	Temp Construction Compound	COMPANY	BOCO ROCK STAGE TWO PTY LTD				
Aboriginal object locale:	Internal Road Layout						
Low local scientific significance	Exisitng Roads:	TITLE	Figure 13: Heritage Mapping of Yandra Cluster				
32 WTG Locations	Sealed	DATE	SCALE	DWG NO	REV	VER	
100m Development Corridor	Unsealed	30 Aug 2018	1:45000	BRST015	A	3	
WTG locations removed	Cables (approved):	SCALE BAR	DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
Concrete Batch Plant	Overhead Cables	0 1 km	J PETERSEN	M BRANSON	1 OF 1	130607	A4
	Underground or overhead						

Table 13: Approval Conditions: Heritage Impacts

Ref	Condition	Proposed amendments
2.40	The Proponent shall ensure that registered Aboriginal stakeholders are provided the opportunity to have input into any micro-siting of project components in relation to potential impacts on indigenous heritage and cultural values.	This condition is not considered applicable to Yandra cluster.
2.41	If during the course of construction the Proponent becomes aware of any previously unidentified Aboriginal object(s), all work likely to affect the object(s) shall cease immediately and the DECCW informed in accordance National Parks and Wildlife Act 1974. In addition, registered Aboriginal stakeholders shall be informed of the finds. Works shall not recommence until an appropriate strategy for managing the objects has been determined in consultation with DECCW and the registered Aboriginal stakeholders and written authorisation from DECCW is received by the Proponent.	Nil.
2.42	If during the course of construction the Proponent becomes aware of any unexpected historical relic(s), all work likely to affect the relic(s) shall cease immediately and the Heritage Office notified in accordance with the Heritage Act 1977. Works shall not recommence until the Proponent receives written authorisation from the Heritage Office.	Nil.

4.5 Aviation

Landrum & Brown Worldwide (Australia) Pty Ltd have prepared an Aeronautical Impact Assessment (AIA) for the proposed Modification which is included as Appendix F. The AIA considered all 32 approved WTG locations as possible WTG sites, of which the highest is at an elevation of 1098 m AHD. With the proposed revised WTG height of 200 m, the WTG tip would reach a maximum elevation of 1298 m AHD.

There are no airports or aerodromes within 30 km of Stage Two, the nearest being Cooma and Polo Flat airports which have PANS OPS surfaces which overlie Yandra cluster. Despite the increased elevations proposed for the Stage Two Modification, the clearance between the proposed WTGs and the PANS OPS surfaces is over 100 m.

Landrum and Brown found that the WTGs would not infringe on any Obstacle Lighting Surface, PANS OPS surface, contingency procedures or LSALT surfaces. The project is located outside the clearance zones associated with any aeronautical navigation aids, will not have a significant impact on local flying activities and will provide a significant visual navigation feature in the region.

There are not expected to be any impacts to aviation, however the WTGs would be classified as Tall Structures and formal notification to CASA and Department of Defence is required. The conditions of the consent provide for this in condition 2.34 as outlined in Table 14.

The Aviation Impact Assessment is to be provided to CASA and other aviation authorities during the exhibition phase for consideration in regard to the required notification procedures and the need for any aviation hazard lighting required at the project.

Table 14: Approval Conditions: Aviation Obstacles and Hazards

Ref	Condition	Proposed amendments
2.34	Prior to the commencement of construction and operation, the Proponent shall provide the following information to the Civil Aviation Safety Authority, AirServices Australia, the Aerial Agricultural Association of Australia as well as known privately owned local airfields in the local area: a) "as constructed" coordinates in latitude and longitude of each wind turbine generator; b) final height of each wind turbine generator in Australian Height Datum; and c) elevation at the base of each wind turbine generator in Australian Height Datum.	Nil.

4.6 Traffic and Transport

The Project Approval provides for construction of Yandra cluster using one site entrance from Springfield Road. Stage One of the Project was constructed to the west of Yandra cluster entrance using the same Springfield Road route between 2013 and 2015 without significant traffic or transport impacts. There are no proposed changes to standard heavy vehicle or light construction vehicle access. Similarly, there are not expected to be any constraints along Springfield Road which would prevent the transport of over-dimensional equipment to the site entrance.

However, given the increase in WTG dimensions, some alterations to the over-dimensional transport routes are likely to be required. The primary logistical constraint which differs between the approved Project and the proposed Modification is the WTG blade. Currently the market is trending toward single piece blades with current lengths of up to 73.5 m, however longer blades are expected. Some manufacturers are now developing two-piece blades which would enable longer blade lengths with shorter transported dimensions. Depending on which WTG model is selected for installation at Stage Two, it is expected that WTG components will be delivered to either the Port of Eden or Port Kembla, however alternate ports may be considered depending on port capacity at the time of construction.

A revised traffic and transport assessment by *Samsa Consulting – Transport Planning and Traffic Engineering Consultants* is included as Appendix G. The assessment compares the approved Project against the proposed Modification to evaluate the appropriateness of the changes and identify any key transport and traffic risks associated with wind farm component and equipment haulage.

The approved route from Port of Eden was Edrom Road, Princes Highway, Imlay Road, Monaro Highway (via Bombala town local roads – Maybe Street, Forbes Street, Mahratta Street) and onto Springfield Road. Transport of over-dimensional components from Port Eden was completed successfully during construction of Stage One with blades of up to 48.7 m. The approved route is considered to still be the best route between the Port of Eden and the Project site for component sizes used during Stage One of the Project but would be problematic for the longer 78 m blades that may potentially be used for Stage Two.

An alternate route for over-dimensional components would involve transport from Port Kembla to the Project site. The preferred route is via Princes Highway, Picton Road, Hume Highway, Federal Highway, Majura Parkway, Monaro Highway via Polo Flat Road (bypassing to the east of Cooma) and then continuing along Monaro Highway / Snowy Mountains Highway to Springfield Road via Nimmitabel. Apart from the relatively short section of Polo Flat Road bypassing Cooma to the east, the remainder of the route is along NSW Class 1 over-size over-mass (OSOM) approved roads. The use of Polo Flat Road to bypass the Cooma urban area is considered to be preferable as it is the Monaro Highway heavy vehicle bypass route. There are expected to be some road furniture upgrades along this route, but there are not any constraints that have been identified to prevent transport of the over-dimensional components to the Springfield Road site entrance.

It is proposed that prior to the commencement of construction, a Transport Management Plan (TMP) will be prepared in consultation with the relevant roads authorities. The TMP will include a detailed route assessment to confirm the transport route based on the WTG components selected for construction, and identify the route constraints and any upgrade requirements. This approach is consistent with the requirements of condition 2.28 in the Project Approval. The use of licensed and experienced contractors for transporting wind farm components would ensure a minimisation of

transport impacts. Transport of over-dimensional components would only be undertaken subject to the appropriate RMS permits.

The Proponent will work closely with local councils and the relevant roads authorities to avoid, minimise and manage road impacts during construction, as was undertaken during construction of Stage One. Road dilapidation would be managed and addressed in accordance with conditions 2.28 and 2.29.

With adoption of these measures it is considered that the proposed Modification consisting of up to 20 WTGs within Yandra cluster would likely decrease the transport movements associated with construction of the Project, and would not create any significant adverse impacts with respect to issues such as road capacity, site access and road safety. Transport related management strategies from the approved Project remain relevant and are proposed to be maintained as part of this Modification. It is considered that all affected roads would be able to maintain their level of service during peak construction activities.

It is considered that traffic and road network impacts would be negligible during the operational phase using the existing approval conditions (see Table 15).

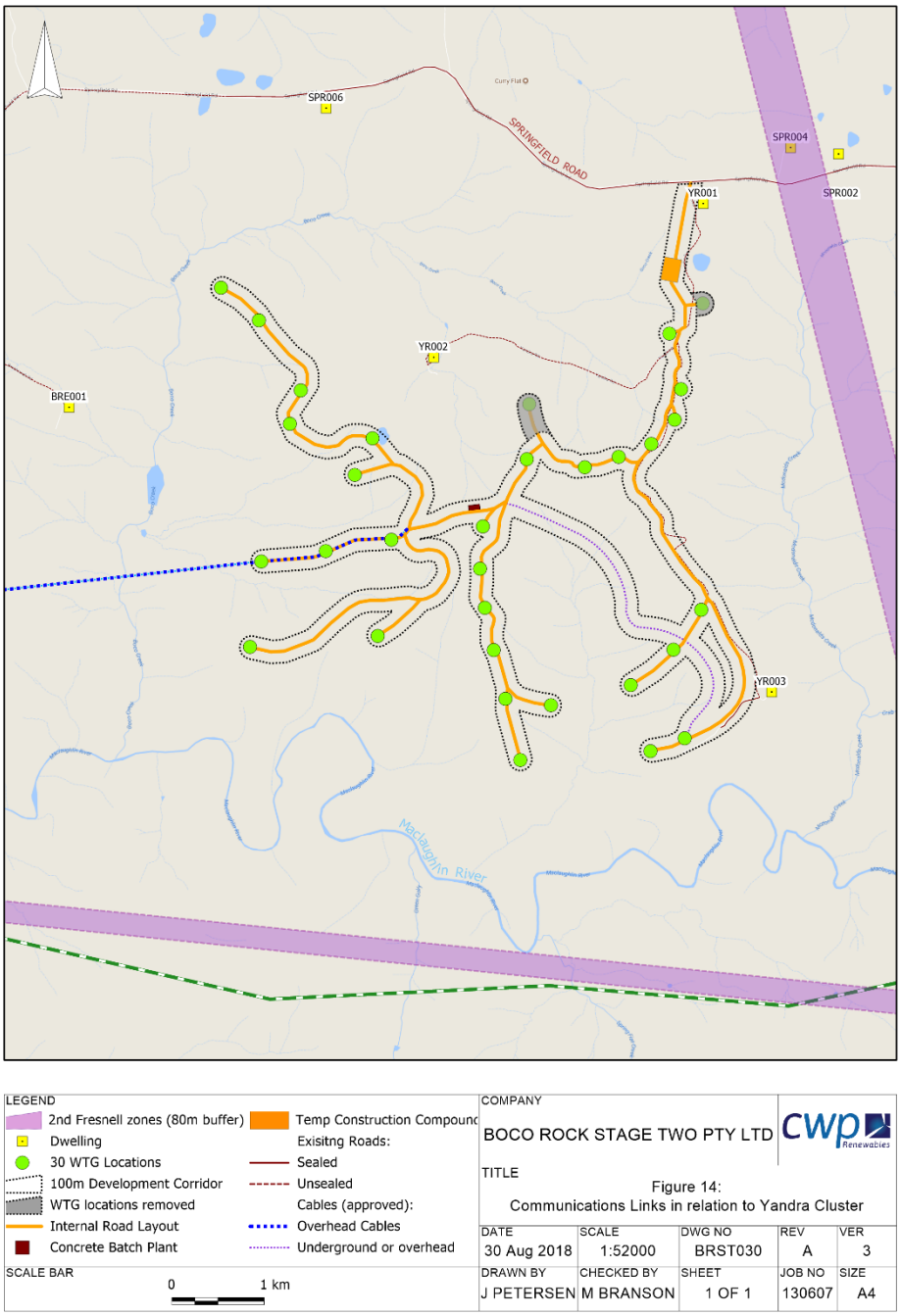
Table 15: Approval Conditions: Traffic and Transport Impacts

Ref	Condition	Proposed amendments
2.28	Prior to the commencement of construction of the project, the Proponent shall commission a suitably qualified expert to assess the condition of all public roads proposed to be traversed by construction traffic associated with the project (including over-mass or over-dimensional vehicles) in consultation with Council and the RTA, and identify any upgrade requirements to accommodate project traffic for the duration of construction (including culvert, bridge and drainage design; intersection treatments; vehicle turning requirements; and site access) considering final traffic volumes. The road dilapidation report shall be submitted to the Director-General prior to the commencement of construction clearly identifying recommendations made by the Council and the RTA and how these have been addressed. The Proponent shall ensure that all upgrade measures identified in the report are implemented to the satisfaction of Council and the RTA, prior to the commencement of construction.	Nil.
2.29	Prior to the commencement of operation of the project, the Proponent shall commission a suitably qualified expert to assess the condition of all public roads traversed by construction traffic associated with the project (including over-mass or over-dimensional vehicles) in consultation with Council and the RTA. Should the pre-operational dilapidation survey report identify any damage to roads attributable to construction traffic associated with the project, the Proponent shall repair the roads consistent with the recommendations of the pre-operational dilapidation survey report, within such time as agreed to with the Council and the RTA. The pre-operation road dilapidation report shall be submitted to the Director-General prior to the commencement of operation, clearly identifying recommendations made by the Council and the RTA and how these have been addressed.	Nil.

4.7 Communications Impacts

A corridor was created around the communication links to ensure the 2nd Fresnell zone, or zone of electromagnetic interference, remained unaffected. Additionally, a buffer of 80 m (approximately half a rotor diameter) added to accommodate for potential blade impacts from operating WTGs. A map showing the 2nd Fresnell zones is shown in relation to the proposed Modification in Figure 14. No WTGs were found to pose a threat of interference to the existing communications links. It was determined that a formal technical assessment for communications impacts was not required.

Figure 14: Communications Links in relation to Yandra cluster



5. Amendments to the Administrative Conditions

Given that over eight years have lapsed since the Project Approval was granted, there have been many changes in legislation, guidelines and departmental responsibilities, as well as advances in WTG technology, environmental management and monitoring and compliance. The Project has also been declared an SSD due to changes in the EP&A Act. Therefore, it is suggested that additional amendments to the consent may be warranted.

The Modification seeks to clarify the error in the Schedule 1 of the Project Approval which references a 33 MW limit on individual WTGs. The Proponent requests that the limit on generating capacity of individual WTGs be removed because it is counterproductive in lowering the levelized cost of energy.

A recent example of further administrative modifications would be the Sapphire Wind Farm consent which received consent from the Department in 2016 for a similar Modification involving an increase in tip height and a corresponding decrease in WTG numbers. The Proponent respectfully requests that the Department consider adopting the changes made to Sapphire Wind Farm approval as part of this Modification to contemporise the Project Approval and improve the efficacy of both construction and operations, as well as compliance monitoring and reporting related to the Project.

References

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South Australia Environmental Protection Authority (SA EPA) 2009, Wind Farms Environmental Noise Guidelines.

World Health Organization (WHO) 1999, Guidelines for Community Noise.

Appendices

Appendix A – Visual Impact Assessment

Appendix B – Noise Impact Assessment

Appendix C – Letter from OEH regarding Biodiversity Offsets

Appendix D – Bird and Bat Impact Study

Appendix E – Heritage Impact Report

Appendix F – Aviation Impact Assessment

Appendix G - Traffic and Transport Impact Assessment

Appendix A – Visual Impact Assessment

Prepared by:
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14 November 2018

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Boco Rock Wind Farm
Stage Two Modification

VISUAL IMPACT ASSESSMENT

Prepared for:

Prepared by:

GREEN BEAN DESIGN
landscape architects

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DOUCMENT CONTROL

Item	Detail
Project Name:	**Boco Rock Wind Farm Stage Two Modification**
Report Title:	**Visual Impact Assessment**
Project Number:	**18-256**
Version Number:	**v3**
Status:	**Final**
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Date:	**14 November 2018**

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Table 1 Glossary

Term	Definition
Cumulative effects	The summation of effects that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions.
Magnitude	A combination of the scale, extent and duration of an effect.
Mitigation	Measures, including any processes, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual effects of a development project.
Residual visual effect	Observable difference between the approved and the proposed Stage Two Modification.
Sensitivity	Susceptibility of a receiver to a specific type of change.
Swept area	Circular area defined by the rotational path of the rotor blades.
Visibility	A relative determination at which the proposal can be discerned and described.
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual Impact Assessment	A process of applied professional and methodical techniques to assess and determine the extent and nature of change to the composition of existing views that may result from a development.
View location	A place or situation from which a proposed development may be visible.
Visual receiver	Individual and/or defined groups of people who have the potential to be impacted.
Visual significance	A measure of visual effect culminating from the degree of magnitude and receiver sensitivity.
Zone of Visual Influence Diagram	A map, usually digitally produced, showing areas of land within which wind turbines are theoretically visible.

Executive summary

Green Bean Design Pty Ltd (GBD) has been commissioned by CWP Renewables on behalf of Boco Rock Stage Two Pty Ltd (the Proponent), to prepare a Visual Impact Assessment (VIA) report for the Boco Rock Wind Farm Stage Two Modification Application (Stage Two Modification). The application is for an amendment of development consent in accordance with Section 4.55 of the Environment Planning and Assessment Act 1979.

The Proponent seeks approval for a Modification to the Yandra Cluster only, which will comprise Stage Two of the Project. The purpose of the Modification is to accommodate larger but fewer wind turbines to drive down the levelized cost of energy and minimise impacts on the surrounding community and environmental values. No changes to the operational Project or the Boco Cluster are proposed in this Modification.

This VIA report has been prepared with regard to the visual assessment process outlined in the New South Wales State Government Wind Energy: Visual Assessment Bulletin December 2016 (DPE Guidelines) as applicable to the modification application.

This VIA included the following tasks:

- Preparation of Zone of Visual Influence (ZVI) Diagrams (**Figures 2**, **3** and **4**)
- Preparation of 1 wireframe diagram and 2 photomontages to illustrate the approved Boco Rock Wind Farm and modified wind turbines. The wireframe diagrams and photomontages are illustrated in **Figures 8** to **10**
- Assessment of 1 non-associated unbuilt dwelling within 4km of the approved Yandra Cluster wind turbines and
- Review of changes to ancillary facilities.

The overall number of wind turbine rotor blades and tips visible from residential dwellings within 4 kilometres (km) of the Stage Two Modification wind turbines would be reduced (with up to 20 turbines to be installed, as opposed to the approved 32 wind turbines) from the approved wind turbine layout. The proposed increase in tower height, as well as overall wind turbine tip height of the Stage Two Modification wind turbines, is unlikely to result in any significant change to the extent of wind turbine visibility. Key differences in the approved and proposed wind turbine modification are illustrated in **Figures 5**, **6** and **7**.

Previously approved ancillary wind farm infrastructure, as well as the proposed additional temporary construction compound, would not result in a significant change in levels of visual impact from surrounding residential dwellings. The generally small-scale ancillary facilities are concealed by topography and existing vegetation screening.

The proposed Stage Two Modification would not introduce elements that are out of character with the approved Boco Rock Wind Farm project, and the potential for the proposed wind turbine modifications to result in any additional significant cumulative visual effects is considered to be low. The proposed Stage Two Modification would result in an overall low-level change in visibility and a largely unchanged visual impact rating in accordance with the approved Boco Rock Wind Farm project.

1 Introduction

The Boco Rock Wind Farm Project Approval (dated 9 August 2010) permits the construction and operation of up to 122 wind turbines to a maximum 152 metre tip height. The 122 approved wind turbines are located within 3 defined Sherwin, Boco and Yandra Clusters wind turbine clusters.

A total of 67 wind turbines in the Boco Rock Wind Farm Stage 1 (Sherwin Cluster) have been operational since 2015.

The Boco Rock Wind Farm Stage Two Modification applies to 32 approved wind turbines within the Yandra Cluster only. The Project Approval permits two alternate layouts within the Yandra Cluster. The alternate approved layouts include:

- Layout Option 1 for 32 wind turbines and
- Layout Option 2 for 27 wind turbines.

The Proponent has confirmed that the Stage Two Modification would address Layout Option 1, and that Layout Option 2 would not form any ongoing part of the Yandra Cluster. The Yandra Cluster would be modified as follows:

- removal of two approved wind turbines locations, reducing the available wind turbines locations from 32 to 30 within Yandra Cluster
- construction, operation and decommissioning of up to 20 wind turbines within these 30 locations.
- increase in wind turbine tip height of up to 200m.
- increase in wind turbine rotor diameter within the revised tip height.
- addition of a temporary construction compound within the Yandra Cluster.

The location of the 20 Yandra Cluster wind turbines for the modification will remain in accordance with the Project Approval wind turbine locations within approved allowances from micro siting.

This VIA has been prepared to compare and assess the potential visual effect of the proposed Stage Two Modification with the visual ratings determined in Boco Rock Wind Farm Landscape and Visual Impact Assessment report (GBD September 2009).

The comparison between the approved Boco Rock Wind Farm and proposed Stage Two Modification has been used to determine if any of the visual ratings applied to residential dwelling locations within and between 2.7km and 4km of the approved wind turbines are subject to an increased level of visual effect as a result of the proposed modification works.

GBD confirm the following information has been provided by the Proponent, or procured by GBD, for consideration and/or incorporation into this VIA:

- location and description of proposed wind turbine modifications
- Zone of Visual Influence (ZVI) diagrams

- wireframe diagram illustrating the approved Boco Rock Wind Farm wind turbines and the proposed wind turbine modifications
- photomontages illustrating the approved Boco Rock Wind Farm wind turbines and the proposed wind turbine modifications
- Boco Rock Wind Farm Landscape and Visual Impact Assessment – Green Bean Design Pty Ltd, September 2009
- Boco Rock Wind Farm, Director General's Environmental Assessment Report, March 2015
- Boco Rock Wind Farm Project Approval Conditions of Consent 9 August 2010 and
- New South Wales Government Wind Energy: Visual Assessment Bulletin December 2016.

2 Report structure

2.1 Report structure

This VIA report been structured into eleven parts as follows:

Table 2 – Report structure

Report section	Description
Section 1 Introduction	Overview of scope of VIA and summary of project information provided to or sourced by GBD in order to undertake the VIA
Section 2 Report structure	This section provides a description of the report structure
Section 3 Methodology	This section sets out the methodology employed in the VIA preparation
Section 4 Approved Boco Rock Wind Farm and proposed modification	This section describes the key differences in wind turbine layout and design criteria between the approved and proposed modification amendments
Section 5 Zone of Visual Influence (ZVI) diagrams	This section identifies the area of land surrounding the wind farm from which wind turbines, or portions of wind turbine structures, may be theoretically visible
Section 6 Assessment of visual effects	This section describes the assessment and determination of residual visual effects between the approved and proposed modification amendments
Section 7 Visual Assessment	This section describes the application of the NSW State Government Wind Energy: Visual Assessment Bulletin December 2016 to the proposed Stage Two Modification
Section 8 Wireframe diagrams and photomontages	This section describes and presents the wireframe diagrams and photomontage prepared for the proposed Stage Two Modification.

Table 2 – Report structure

Report section	Description
Section 9 Review of Conditions of Consent	This section identifies the Project Approval Conditions of Consent relevant to visual amenity and confirms their applicability to the proposed Stage Two Modification.
Section 10 Conclusion	Conclusions are drawn on the overall visual impact of the proposed Stage Two Modification.

3 Methodology

3.1 Introduction

This VIA methodology included the following tasks:

- review of the approved Boco Rock Wind Farm Landscape and Visual Impact Assessment, as well as the proposed Stage Two wind turbine layout
- preparation of ZVI diagrams
- preparation of wireframe diagrams, photomontages and illustrative figures and
- assessment of significance of residual visual effects and changes in visual impacts.

3.2 Project review

A review of the approved Boco Rock Wind Farm project application was carried out to confirm the location of sensitive view locations and the visual impact ratings determined through previous landscape and visual impact assessments. This review also included familiarisation with the NSW Department of Planning and Environment (DPE) Assessment Report and the conditions of Project Approval.

3.3 ZVI diagrams

ZVI Diagrams were prepared to illustrate the theoretical visibility of the approved Boco Rock Wind Farm wind turbines (tip height at 152 metres) and the proposed Stage Two Modification (tip height at 200 metres). The ZVI Diagrams are illustrated in **Figures 2**, **3** and **4**.

3.4 Visual Assessment

The proposed Stage Two Modification VIA has undertaken a further determination of visual effects which extends to residential dwellings located within and between 2.7km and 4km of the approved Yandra Cluster wind turbines. The 4km threshold distance has been established by reference to the DPE Guidelines (Page 19, Figure 5 Visual magnitude thresholds for visual assessment).

This VIA has not addressed the Stage 1 Preliminary Environmental Assessment (pre-lodgement) guidelines as these are not pertinent to the preparation of a wind farm modification.

Similarly, Stage 2 of the Guidelines (Figure 1, Steps in the Visual Assessment), addresses the preparation of a Visual Baseline Study as part of the Environmental Impact Statement, which is also not pertinent to the proposed Stage Two Modification.

This VIA has considered the Visual Assessment Process set out in Appendix 1 of the Guidelines against the proposed Stage Two Modification where considered relevant to this VIA.

3.6 Wireframe diagram and photomontages

A wireframe diagram and photomontages have been prepared from the unconstructed residential dwelling and public view locations surrounding the approved Boco Rock Wind Farm and within proximity to the Yandra Cluster. The wireframe diagram and photomontages illustrate and contrast the approved wind turbines and the proposed Stage Two Stage. The wireframe diagrams and photomontages are illustrated in **Figures 8** to **10**.

4 Approved and proposed Stage Two Modification 'Yandra Cluster' wind turbines

4.1 Approved Yandra Cluster wind turbine design

The approved Yandra Cluster wind turbine design permits construction and operation of up to 32 wind turbines to a maximum tip height of 152 metres. The VIA for the approved wind farm was based on an approximate 101.5 metre hub height and 104 metre rotor blade diameter.

4.2 Proposed Stage Two Yandra Cluster wind turbine modification

The proposed Stage Two Modification Yandra Cluster would include:

- up to 20 wind turbines
- an increase of the blade tip height up to approximately 200 metres.
- a tower height up to approximately 130 metres and
- an increase in rotor diameter up to approximately 160 metres.

Table 3 outlines the differences in the approved Boco Rock Wind Farm 'Yandra Cluster' and proposed Stage Two Yandra Cluster Modification wind turbine design criteria.

Table 3: Approved and proposed Stage Two Modification wind turbine design criteria

	Tower height (assessment)	Rotor diameter (assessment)	Max. tip height	Total number
Approved Yandra Cluster wind turbine	101.5 m	104 m	152 m	32
Proposed Stage Two Modification wind turbine	130 m	160 m	200 m	20
Difference	+28.5	+56 m	+48 m	-12
Percentage difference	28%	+54%	+31.5%	-37.5%

Table 4: Approved Stage Two and proposed modified Stage Two rotor swept area

	Rotor diameter	Swept area
Approved wind turbine	104 m	8,495 m^2
Proposed Stage Two Modification	160 m	20,106 m^2
Difference	+56 m	+11,611m^2
Percentage difference	+54%	+137%

The layout for the approved and Stage Two Modification is illustrated in **Figure 1**.

4.3 Approved Boco Rock Wind Farm and proposed Stage Two Modification wind turbine visibility

The proposed Stage Two Modification would result in an increase to the extent of visibility of wind turbine rotor blades and tips from residential dwellings surrounding the wind farm site. **Table 5** identifies residential dwellings within 4km of a wind turbine and associated changes in wind turbine visibility.

Table 5 Changes in visibility of approved wind turbines and Stage Two Modification

Non-associated residential dwelling within 4km of wind turbines (**Figure 1**)	Distance to closest Yandra Cluster wind turbine (km)	Wind turbines theoretically visible			GBD Visibility Rating[1]
		Approved Yandra Cluster wind turbine (32 turbines)	Proposed Stage Two Yandra Cluster wind turbine (20 turbines)	Difference in wind turbine visibility	
SPR002[2]	2.1	32	20	-12	Not assessed

Notes:

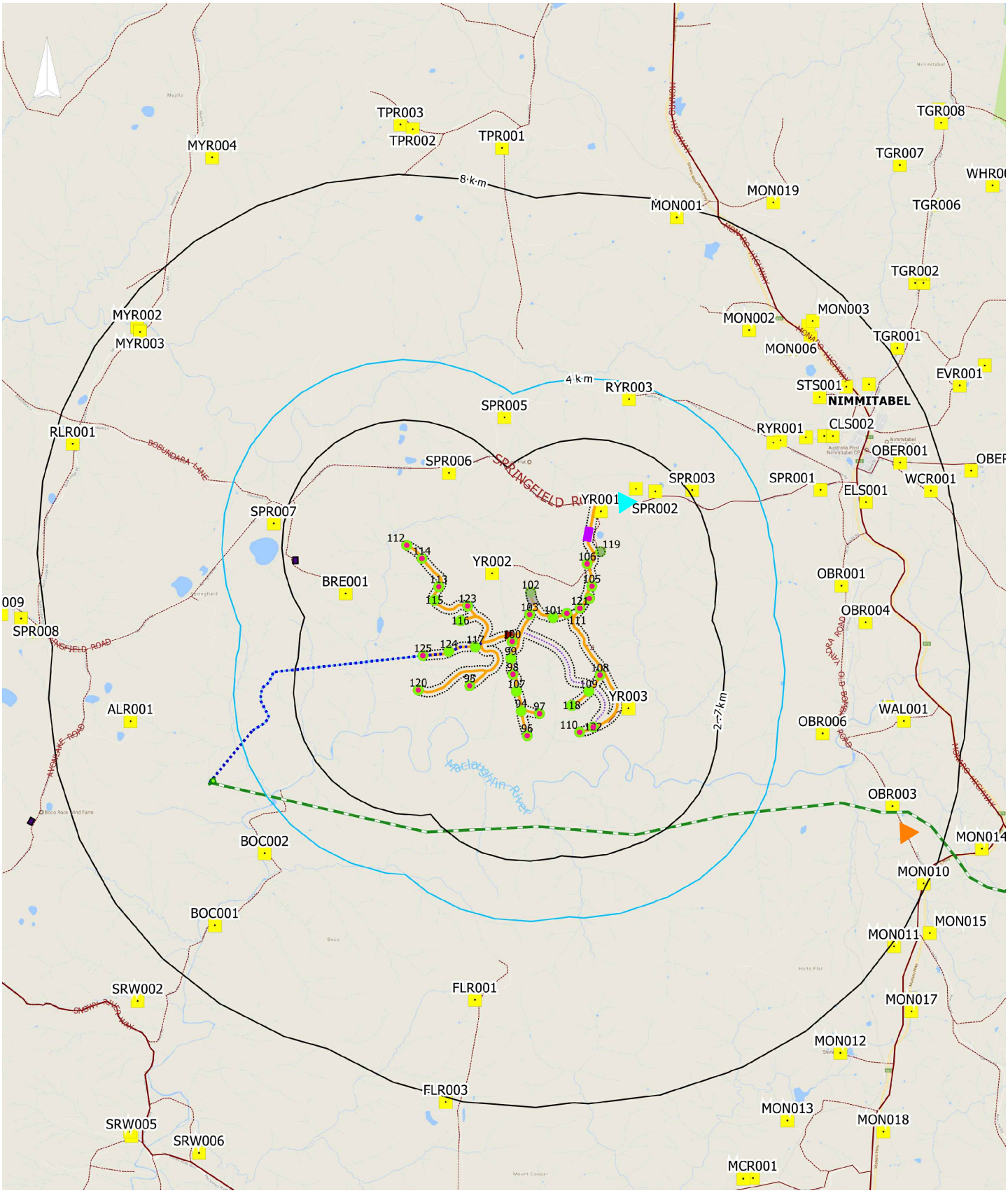
[1] Green Bean Design Pty Ltd, Boco Rock Wind Farm Landscape and Visual Impact Assessment – September 2009.

[2] A dwelling does not exist; however, a Council Development Application was once issued and has since lapsed. Dwelling location confirmed by Proponent in discussion with landowner.

4.4 Magnitude of visual effects

The determination of residual visual effects resulting from the proposed Stage Two Modification would result primarily from observable differences between the approved wind turbines and the proposed Stage Two Modification, including an increase of 48m in maximum tip height and increase in the wind turbine rotor swept area (refer **Figure 5**).

Table 5 indicates that the proposed Stage Two Modification would result in no additional wind turbines being visible at residential dwellings within 4km of the approved wind turbine locations. Views toward additional wind turbine rotors and blade tips are not considered to result in a magnitude of visual effect which is greater than the magnitude of visual effect associated with the approved Stage Two project.



Legend

- Dwelling
- 20WTG Indicative layout
- 30 Wind Turbine Locations
- 100m Development Buffer
- Turbine locations removed
- Internal road layout
- Concrete Batching Plant

Existing roads:

- Sealed Road
- Unsealed Road

Cables (approved):

- Overhead Cables
- Underground or overhead
- Proposed construction compound

- Photomontage 1 location - Old Bombala Road
- Photomontage 2 location - Springfield Road

0km 2km

Figure 1 Approved and Stage Two wind turbine layout for Yandra Cluster

Boco Rock Wind Farm Stage Two Visual Impact Assessment

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5 Zone of Visual Influence Diagrams

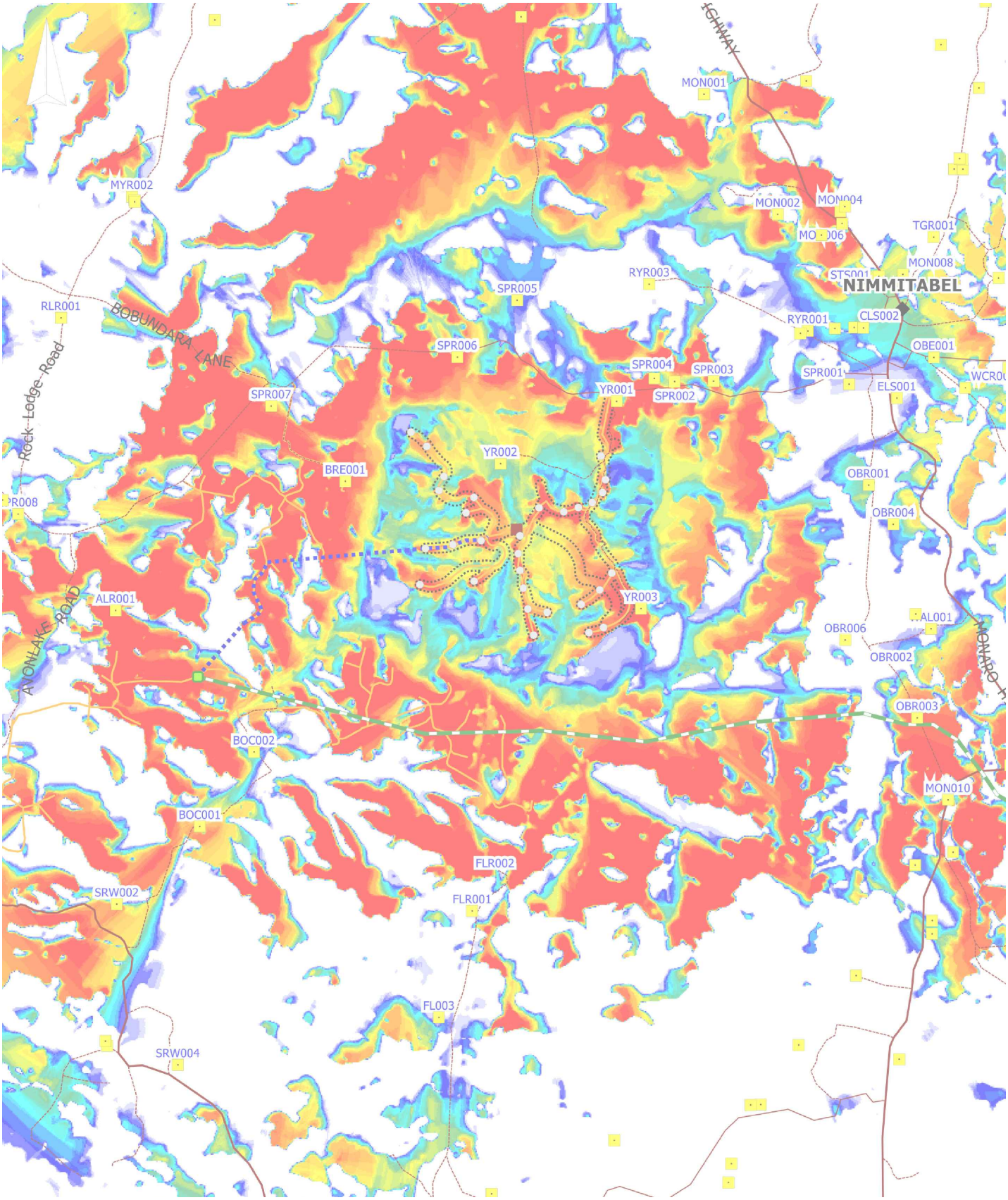
5.1 Introduction

Within the recognised limitations of Zone of Visual Influence (ZVI) diagrams, the overall extent of visibility for the approved Boco Rock Wind Farm and the proposed Stage Two Modification, covers a very similar extent within 4km of the landscape surrounding the approved wind farm.

Figure 2 illustrates the theoretical visibility of the approved Boco Rock Wind Farm wind turbines at a 152m tip height, and **Figure 3** illustrates the proposed Stage Two Modification wind turbines at a 200 m tip height.

The overall similarity in theoretical wind turbine visibility shown in **Figures 2** and **3** demonstrates the influence of local topographical features on views toward the approved Boco Rock Wind Farm and proposed Stage Two Modification. The ZVI diagrams also illustrate that the proposed wind turbine modifications would have a very limited increase in visual effects across the Boco Rock Wind Farm viewshed. **Figure 4** illustrates a comparative ZVI to identify areas of similar wind turbine visibility between the approved and Stage Two Modification wind turbine layouts, as well as those areas from which the proposed Stage Two Modification wind turbines would be visible beyond the approved wind turbines.

Whilst the overall extent of wind turbine visibility would be contained by topography for both the approved and the proposed wind turbine modification, the number of wind turbine rotors and tips visible from residential dwelling locations surrounding the Yandra Cluster would be subject to an overall decrease. The wireframe diagrams do not account for screening provided by trees and vegetation and are therefore very conservative in the number of wind turbine blade tip visibility.



Legend

- 30 Approved WTGs
- 30
- 25
- 20
- 15
- 10
- 5
- 0
- 100m dev corridor
- Dwelling
- Concrete batch plant
- Substation
- Sealed road
- Unsealed road
- Overhead Cables
- 132kV

0km 1km

Figure 2 Approved wind turbine layout ZVI (152m tip height)

Boco Rock Wind Farm Stage Two Visual Impact Assessment

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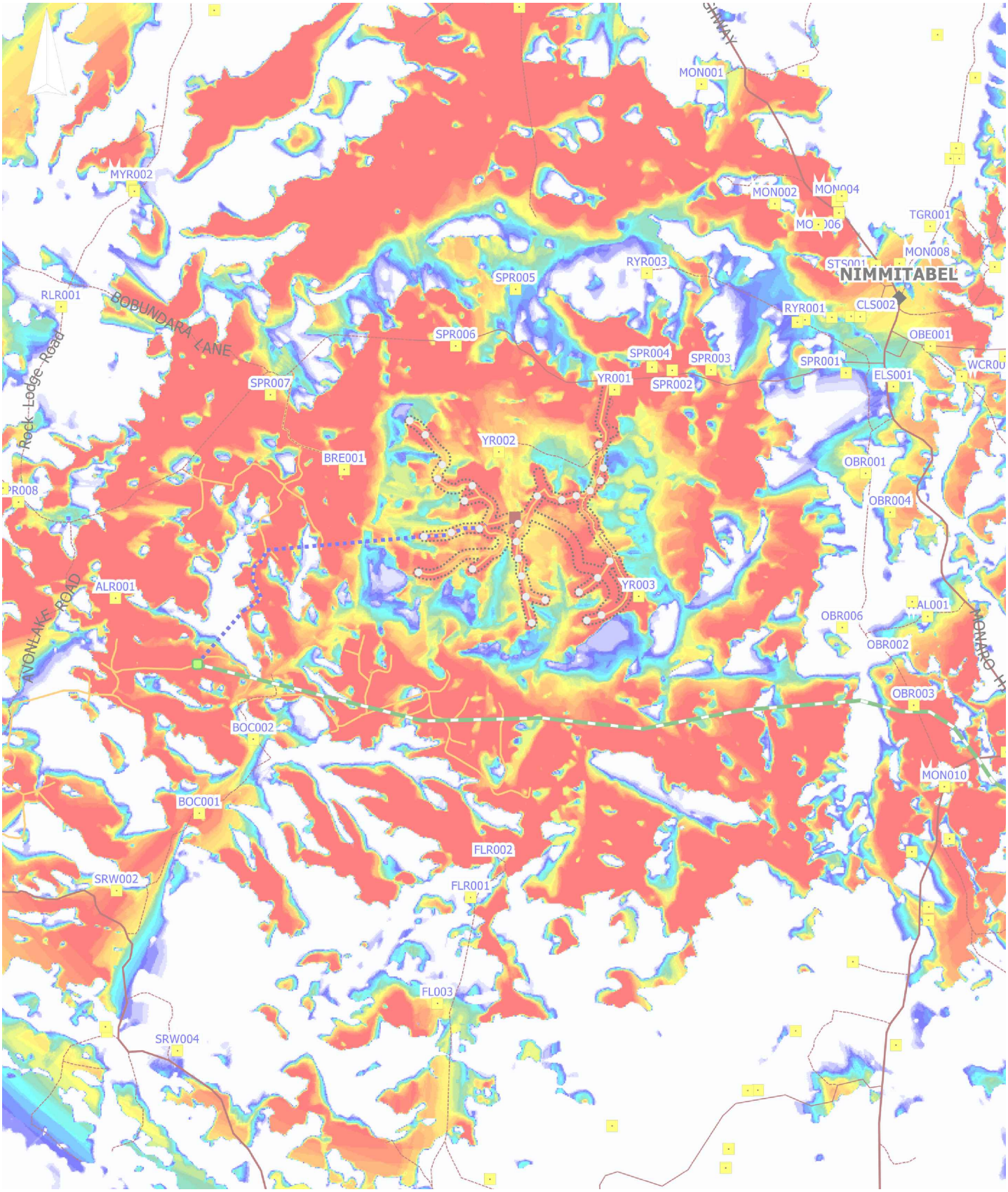

Legend

30 Approved WTGs	100m dev corridor
30	Dwelling
25	Concrete batch plant
20	Substation
15	Sealed road
10	Unsealed road
5	Overhead Cables
0	132kV

0km 2km

Figure 3 Stage 2 Modification wind turbine layout ZVI (200m tip height)

Boco Rock Wind Farm Stage Two Visual Impact Assessment

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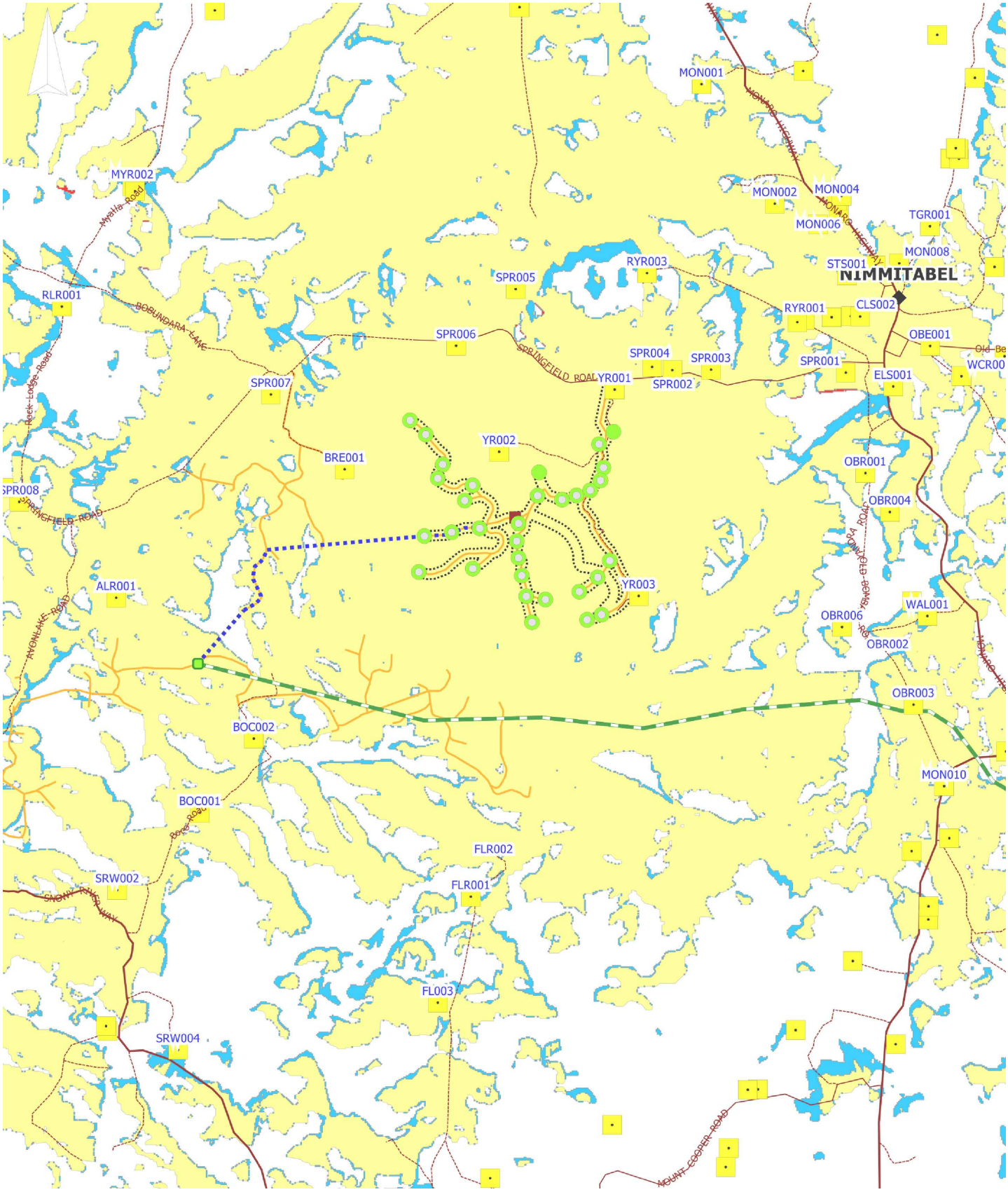

Legend

- 30WTG Locations 200m
- 32WTG Approved layout 152m
- Approved layout visible
- 30WTG Modified layout visible
- Both layouts visible
- No turbines visible
- 100m dev corridor
- Dwelling
- Concrete batch plant
- Substation
- Sealed road
- Unsealed road
- Overhead Cables
- 132kV (existing)

0km 2km

Figure 4 Approved and Stage Two Modification wind turbine layout ZVI comparison

Boco Rock Wind Farm Stage Two Visual Impact Assessment

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6 Assessment of visual effects

6.1 Introduction

This section compares the visual effect of the proposed Stage Two Modification wind turbines to the approved turbines that can be installed under the Project Approval. It is noted that the proposed Stage Two Modification would be consistent with the approved wind turbines with regard to their visual form, design, pattern and colour. This VIA therefore focusses on the change in wind turbine dimensions for the modified wind farm relative to the approved project. **Figures 4, 5** and **6** provide illustration of the change in turbine dimensions and consider the appearance at different distances. **Tables 6** and **7** describe the characterisation of visual effect (magnitude) and for respective receiver locations.

6.2 Perception of changes in Visual magnitude

A comparison of a turbine that is approved with the Development Consent and wind turbine proposed by the modification is illustrated in **Figure 4**. **Figures 5** and **6** consider:

- the representation of the approved and proposed wind turbine in terms of comparative height when viewed from 2.7km and 4km
- the change in vertical view angle for the two turbines at 2.7km and 4km. **Figure 5** illustrates that the proposed wind turbine modification would include an additional and approximate one-degree view angle above the approved 152 metre tip of blade wind turbine from a 2.7km view distance. The additional view angle from a view distance of 4 kilometres would be around two thirds of a degree (41 minutes) increase in view angle.
- the perceived visual scale at 2.7km and 4km. **Figure 6** illustrates the perceived and relative height difference between the approved 152 metre tip height wind turbine and the proposed Stage Two wind turbine modification 200 metre tip height. At a view distance of 4km the approved Stage Two and proposed wind turbine modifications would be perceived at less than half the height of the amended wind turbines when viewed at a distance of 2.7km. The relatively small increase in view angle toward the proposed Stage Two wind turbine modification tip height, at a view distance of 4km (and beyond) is considered unlikely to result in a level of visual magnitude greater than the approved Stage Two wind turbines.

Whilst the proposed Stage Two Modification wind turbines would extend above the approved wind turbine tip height of 152 metres; this VIA has determined, using the methods described in this section, that the overall scale of the proposed Stage Two Modification wind turbines at a 4km (and over) view distance would not result in an order of visual magnitude that is significantly above the visual magnitude of the approved Yandra Cluster wind turbines.

Within the parameters of normal human vision, the proposed Stage Two wind turbines are not considered to give rise to an increased level of visual magnitude which is significantly above that determined for the approved Yandra Cluster wind turbines.

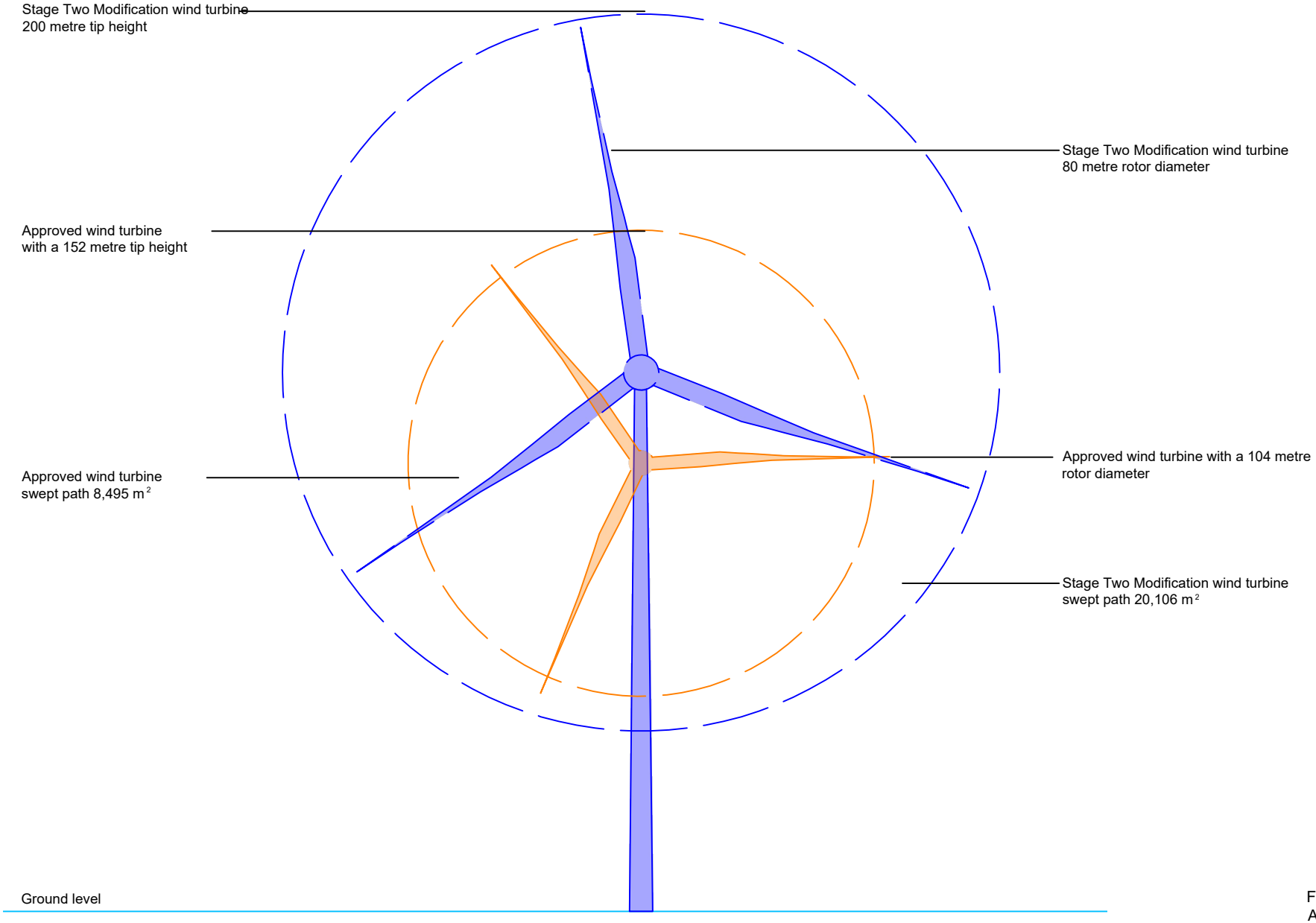

Figure 5
Approved and proposed
Stage Two Modification wind
turbine comparison

Boco Rock Wind Farm Stage Two Modification

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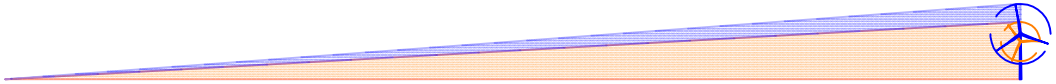
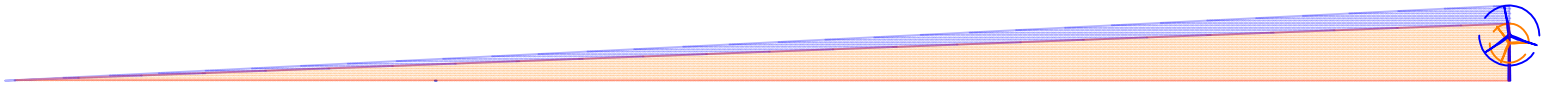
Orange line = view line toward tip height of approved wind turbine (152 metres)

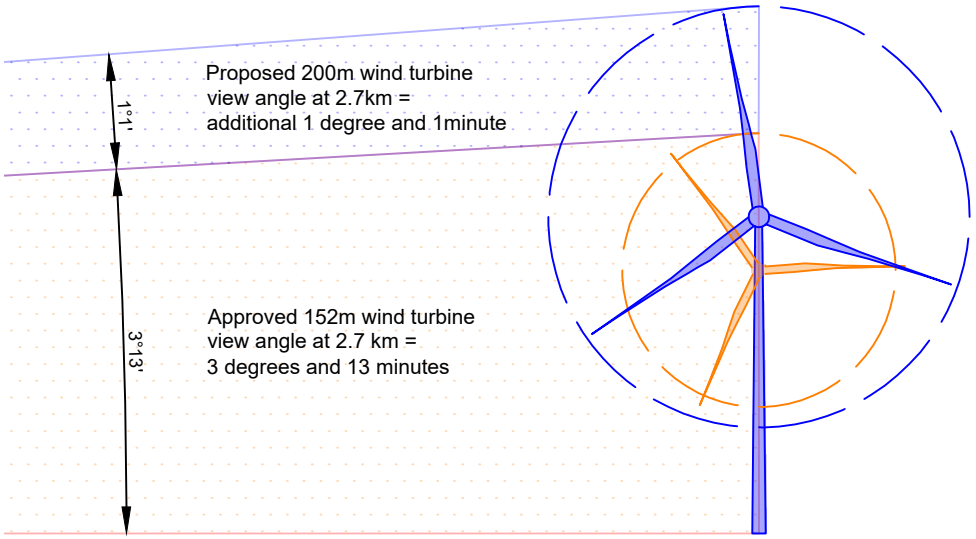
Blue line = view line toward tip height of proposed wind turbine modification (200 metres)



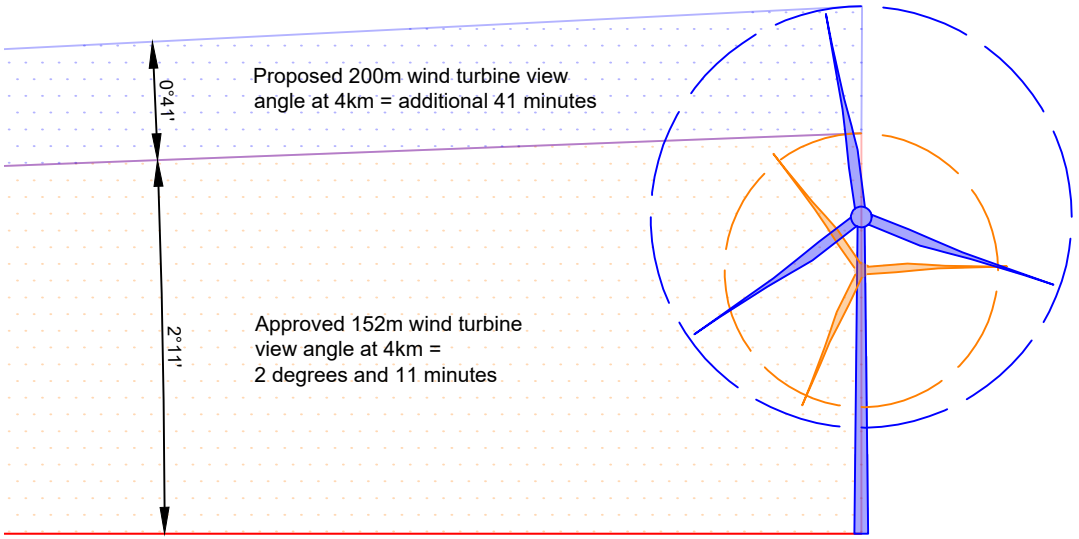
Comparative height of approved and proposed Stage Two Modification wind turbine from a 2.7 km view distance



Comparative height of approved and Stage Two Modification from a 4km view distance



View angle toward approved and Stage 2 Modification wind turbine tip of blade from a 2.7km view distance



View angle toward approved and Stage Two Modification wind turbine tip of blade from a 4km view distance

Figure 6 - Approved and Stage Two Modification wind turbine view angle comparison

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Boco Rock Wind Farm Stage Two Modification

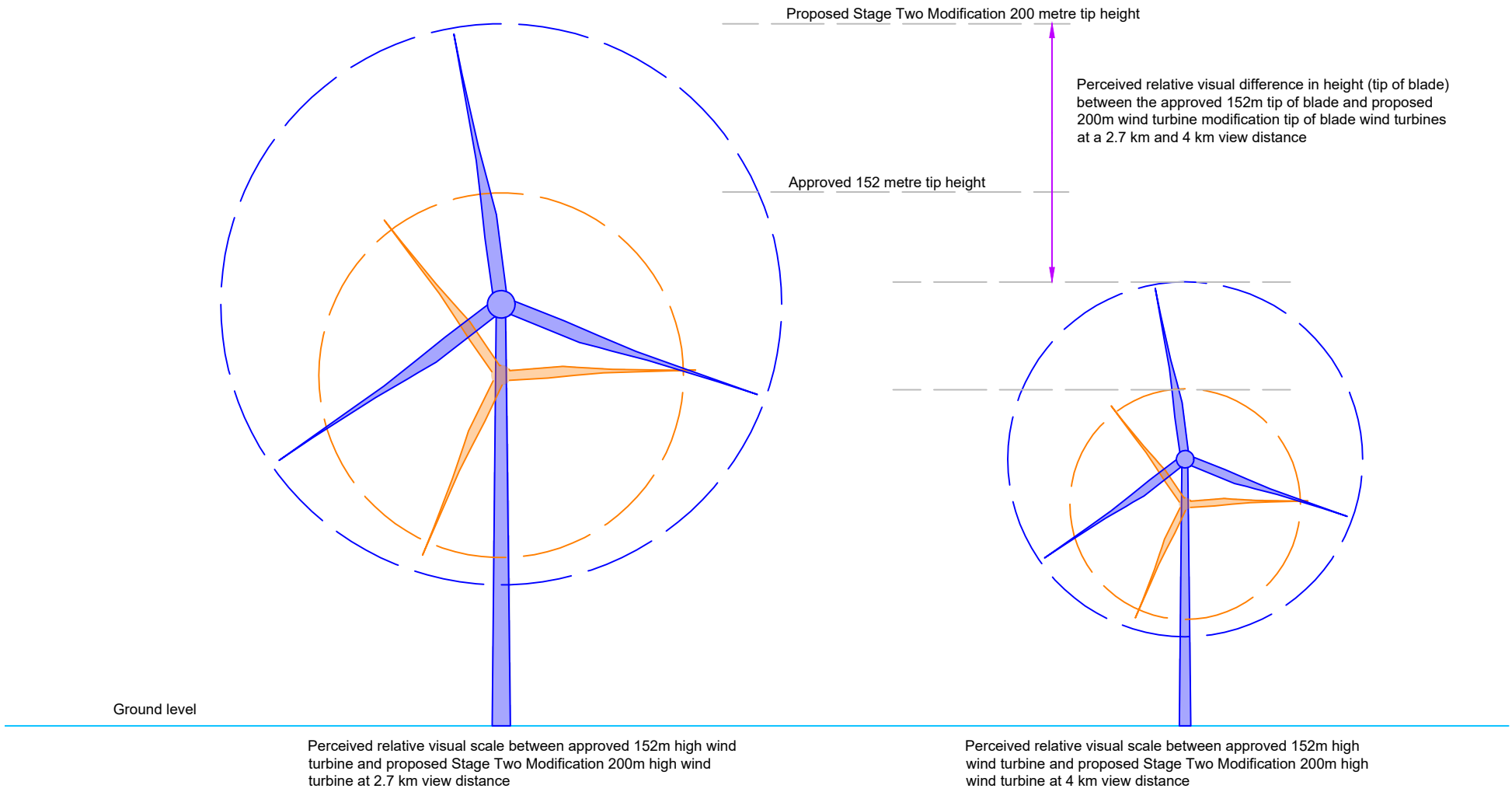


Figure 7 - Approved and Stage Two Modification wind turbine comparison at 2.7km and 4km view distance

For the purpose of this VIA the magnitude of visual effect takes account of the scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition or contrast with the landscape, including the proportion of the view occupied by the proposed Stage Two Modification wind turbine relative to the approved wind turbines.

For the purpose of this VIA **Table 6** sets out ratings and definitions associated with the magnitude of visual effects.

Table 6 – Magnitude of visual effect

Visual effect	Magnitude
The proposed Stage Two Modification would result in a major and prominent visual effect and introduce elements that contrast, or are not in character with the approved Yandra Cluster design.	High
The proposed Stage Two Modification would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved Yandra Cluster design.	Medium
The proposed Stage Two Modification would result in minor visual effects and introduce elements which are not prominent or out of character with the approved Yandra Cluster design.	Low
The proposed Stage Two Modification would result in a very minor visual effect and introduce elements which are not prominent or uncharacteristic of the approved Yandra Cluster design. There would likely be 'no change' to the approved Boco Rock Wind Farm effect.	Negligible

6.3 Visual effect matrix

Table 7 sets out the assessment of visual effects from residential dwellings up to 4km from the approved Boco Rock Wind Farm project and specifically addresses the residential dwellings locations assessed in the Environmental Assessment. The residential dwelling locations are illustrated in **Figure 1**.

Whilst the assessment includes a determination of visual effects from dwellings, it also considers any curtilage surrounding each dwelling which may be considered an extension to the dwelling for domestic or social activities. The criteria set out in **Table 6** are noted against each dwelling, with a visual effect rating determined against the matrix in **Table 7**.

Table 7 – Visual effect matrix (Refer **Figure 1** for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to proposed Stage Two wind turbine (m)	Approved Visual Rating* GBD 2009	Description and Magnitude of proposed Stage Two Modification visual effect	Stage Two Modification Visual Rating
Residential dwellings within 4km of approved Boco Rock Wind Farm Yandra Cluster wind turbine					
SPR002	A previously approved Development Application which has since lapsed.	2,100	Not assessed	The observable scale of change would be partially limited by scattered tree planting between the previously approved dwelling location and closest approved wind turbine. There would be some change in the composition or contrast between the approved and proposed wind turbines and the surrounding landscape due to the removal of at least 12 approved wind turbines. Scattered tree cover beyond the previously approved dwelling location would filter some views toward the proposed Stage Two Modification wind turbines. Views toward 6 Stage Two wind turbines would be restricted to blades and tips of blades by landform. Magnitude rating Low	Low

* Boco Rock Wind Farm Visual Rating as determined by GBD September 2009

6.4 Summary of visual effects

The Visual Effects Matrix includes five residential dwellings within 4km of a proposed Stage Two Modification wind turbine within the Yandra Cluster which were originally assessed in the Boco Rock Wind Farm Environmental Assessment. The overall assessment of magnitude of visual effects associated with the proposed Stage Two Modification is summarised as Low.

The scale of change in the wind turbine structures, whilst noticeable from residential view locations would not result in a degree of change significantly above the visibility of the approved Boco Rock wind turbines at a 152m tip height. This VIA notes that there would be some degree of change in the composition of wind turbines between the approved and proposed Stage Two Modification wind turbines within the Yandra Cluster due to proposed removal of at least 12 approved wind turbines.

6.5 Night time obstacle lighting

The Boco Rock Wind Farm Project Approval notes that the Proponent shall ensure that any aviation hazard lighting complies with CASA's requirements. This VIA notes that no requirements have been provided by CASA with the regard to the proposed Stage Two Modification. A night time lighting assessment to consider potential visual impacts will be prepared subject to NSW Department of Planning and Environment requirement.

7 Visual assessment

7.1 Introduction

Following the assessment of the magnitude of visual effects between the approved Boco Rock Wind Farm and the proposed Stage Two Modification, this VIA has undertaken a further visual assessment of the proposed wind turbines on people at residential dwellings within 4km of the Stage Two Modification wind turbines within the Yandra Cluster. The visual assessment has been prepared with regard to the Guidelines, and specifically the inputs required for the baseline study outlined in the Guidelines Appendix 1: Visual Assessment Process.

7.2 Sensitive Land Use Designations

The approved Boco Rock Wind Farm is wholly located within land use zone RU1 (Primary Production). Land use zone RU1 is not considered to be a sensitive land use designation as per the Guidelines, Appendix 1 Table 3.

The Nimmitabel township is located around 6km from the closest approved Boco Rock Wind Farm wind turbine.

7.3 Landscape character type

Subsequent to previous landscape assessments undertaken for the approved Boco Rock Wind Farm, this VIA considers that the Scenic Quality Class applicable to the landscape surrounding the approved Boco Rock Wind Farm is Moderate.

7.4 Viewer sensitivity levels and visibility distance zones

Viewer sensitivity and visibility distance zones are included in Table 8. These predominantly include Level 2 Sensitivity Levels from rural dwellings. Visibility distance zones have been classified from Far foreground to Far middle ground views.

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to approved Stage Two wind turbine (m) and Distance Zone	Visual Influence Zone	Approved Boco Rock Wind Farm visual rating*	Stage Two Modification visual assessment
SPR002	Non-associated residential dwelling Level 2	2,100 Near middle-ground	VIZ2	Not assessed	The Stage Two Modification would be unlikely to result in any significant amendment to an assessment of visual effect associated with the approved Boco Rock Wind Farm at the previously approved dwelling location. However, the removal of at least 12 approved wind turbines would result in a reduction in the overall extent of wind turbine visibility. Whilst no dwelling exists at this location, visual mitigation measures, including tree planting could be employed in a future design and result in some screening benefit toward the Stage Two Modification wind turbines.

***** Approved Boco Rock Wind Farm Visual Rating in accordance with the GBD Landscape and Visual Impact Assessment September 2009

8 Wireframe diagram and photomontages

8.1 Introduction

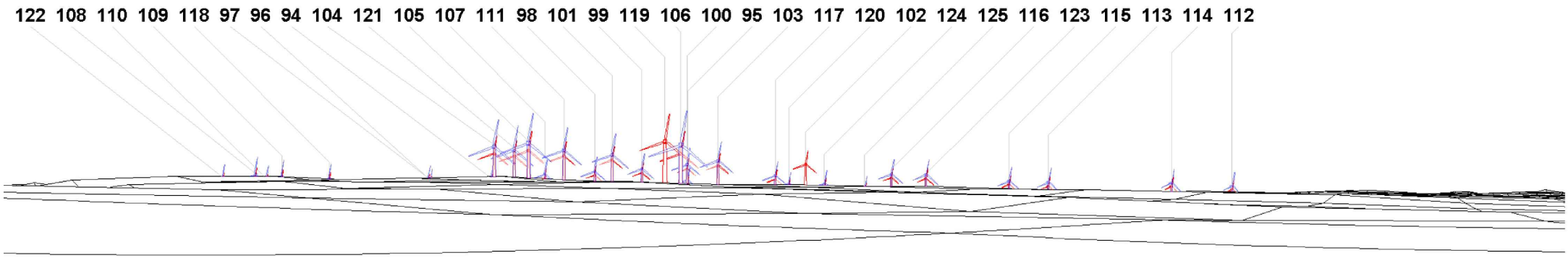
The wireframe diagram and photomontage locations illustrate viewpoints from public and residential dwelling locations within 4km of the approved Boco Rock Wind Farm Yandra Cluster wind turbines. The wireframe diagram and 2 photomontages locations are illustrated in **Figure 1**, and presented in **Figures 8** to **10**. The wireframe diagram illustrates the wind turbines with and without their individual identification numbers for clarity.

The wireframe diagram does not include, or illustrate, the location of tree planting between the wireframe view point and the approved Boco Rock Wind Farm and the Stage Two Modification wind turbines. The wireframe models are therefore considered to be very conservative in both the extent of view and visibility of wind turbines indicated in each wireframe diagram.

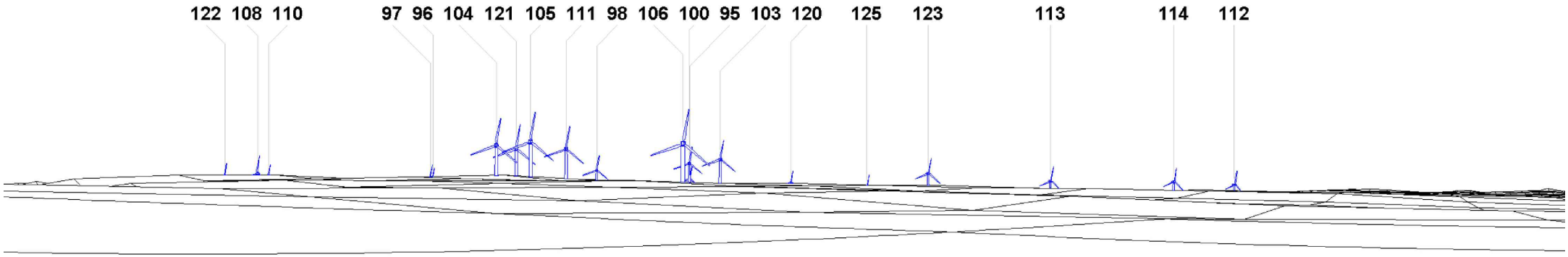
8.2 Wireframe diagram and photomontage preparation

The wireframe diagram and photomontages have been prepared with regard to the general guidelines set out in the Scottish Natural Heritage (2017) Visual representation of windfarms: good practice guidance. The wireframe diagrams were generated through the following steps:

- a digital terrain model (DTM) of the project site was created from a terrain model of the surrounding area using digital contours
- the site DTM was loaded in the DNV-GL 'WindFarmer' software package
- the layout of the wind farm and 3D representation of the wind turbine was configured in 'WindFarmer'
- the location of each viewpoint was configured in 'WindFarmer'
- the view from each wireframe location was then assessed in 'WindFarmer'. This process requires accurate mapping of the terrain as modelled
- the final image was converted to JPG format and imported and annotated as the final figure.



Viewpoint from proposed dwelling SPR002 looking south west. Approved 152m tip of blade wind turbines (red) and Stage Two Modification 200m tip of blade wind turbines (blue)
Approximate distance to closest approved wind turbine 2,100 metres



Viewpoint from proposed dwelling SPR002 looking south west toward Stage Two Modification 200m tip of blade wind turbines (blue)
Approximate distance to closest approved wind turbine 2,100 metres

Wireframe data:
Wireframe location: Easting 700000 Northing 5956027
Viewpoint elevation: 1095m AHD
View direction: 230°
Included angle: 100°

Notes:
Views toward wind turbines or portions of wind turbines below the wireframe will be screened by landform.

The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

Figure 8 -
Wireframe diagram 1 from proposed dwelling SPR002

GREEN BEAN DESIGN
landscape architects

Boco Rock Wind Farm Stage Two Modification

Approved 32 wind turbines 152m tip height

Viewpoint from Old Bombala Road looking north west toward the approved 32 wind turbines at 152m tip height
Approximate distance to closest approved wind turbine 7,100 metres

Stage Two Modification 30 wind turbine locations 200m tip height

Viewpoint from Old Bombala Road looking north west toward proposed 30 Stage Two Modification wind turbines at 200m tip height
Approximate distance to closest approved wind turbine 7,100 metres

Photomontage data:
Photomontage location: Easting 705236 Northing 5948718
Viewpoint elevation: 1041m AHD
View direction: 305°
Included angle: 75.8°

Figure 9 -
Photomontage 1 from
Old Bombala Road

GREEN BEAN DESIGN
landscape architects

Boco Rock Wind Farm Stage Two Modification

Approved 32 wind turbines 152m tip height

Viewpoint from Springfield Road looking south to south west toward the approved 32 wind turbines at 152m tip height
Approximate distance to closest approved wind turbine 1,100 metres

Stage Two Modification 30 wind turbine locations 200m tip height

Viewpoint from Springfield Road looking south to south west toward proposed 30 Stage Two Modification wind turbines at 200m tip height
Approximate distance to closest approved wind turbine 1,100 metres

Photomontage data:
Photomontage location: Easting 699064 Northing 5955836
Viewpoint elevation: 1079m AHD
View direction: 222°
Included angle: 75.8°

Figure 10 -
Photomontage 2 from
Springfield Road

GREEN BEAN DESIGN
landscape architects

Boco Rock Wind Farm Stage Two Modification

9 Review of Conditions of Consent

9.1 Introduction

The Boco Rock Wind Farm Conditions of Consent have been reviewed as part of this VIA to determine the type and extent of additional mitigation measures that would be required, or should be modified as a result of the proposed Stage Two Modification.

9.2 Review of Conditions of Consent

The following Table outlines the existing Conditions relevant to mitigate the potential visual effects of the Boco Rock Wind Farm.

Table 9 Conditions of Consent

Condition	Description	Comment
	Visual Amenity	
Condition 2.23	***Turbines*** Within six months of the commissioning of the project, the Proponent shall prepare and submit a Visual Impact Verification Report for the Director General's approval, confirming the visual impacts of the wind turbines at each non-associated receptor identified in the Environmental Assessment to be moderately of highly impacted. The Report shall consider the final model and layout of turbines for the project as well as any site-specific mitigating factors at the receptor. The Report shall identify all reasonable and feasible screen planting options available at each receptor for which impacts have been verified to be moderate to high including demonstrating that these measures have been determined in consultation with affected receptors. The Proponent shall ensure that the identified screen plantings are implemented within a time frame agreed to with the landowner, however no later than within 18 months of the approval of the Visual Impact Verification Report by the Director-General. Unless otherwise agreed to by the Director-General, the Proponent shall monitor and maintain the health of the plantings until such time that the plantings have been verified by an independent and suitably qualified expert (whose appointment has been agreed to by the Director-General) as being well established and in good health. Any plantings which are unsuccessful during that time shall be replaced by the Proponent at no cost to the landowner.	This condition remains valid.
Condition 2.24	Wind turbine generators shall be painted matt off-white/grey. The blades shall be finished with a surface treatment that minimises any potential for glare or reflection. No advertising, signs or logos shall be mounted on the turbines, except where	This condition remains valid.

Condition	Description	Comment
	required for safety purposes. A corporate logo may be placed on the turbines provided it is not distinguishable by the naked eye from any publicly accessible location or from any non-associated receptors.	
Condition 2.25	The Proponent shall ensure that shadow flicker arising from the operation of the project shall not exceed 30 hours/annum at any non-associated receptor.	This condition remains valid.
Condition 2.27	***Night Lighting*** With the exception of aviation hazard lighting implemented in accordance with the requirements of this condition, no external lighting other than low intensity security night lighting is permitted on site unless otherwise agreed or directed by the Director-General. Prior to the commencement of construction, the Proponent shall consult with the Civil Aviation Safety Authority on the need for aviation hazard lighting in relation to the wind turbines and implement such lighting only where it is specifically required by the Civil Aviation Safety Authority. In this case, aviation hazard light shall be implemented in a manner that minimises visual intrusion to surrounding non-associated receptors as far as reasonable and feasible. The potential for any intrusion from night lighting shall be considered as part of the Visual Impact Verification Report required to be prepared under condition 2.23.	This condition remains valid.

10 Conclusion

A determination for the potential increase in visual effect associated with the proposed Stage Two Modification has been based upon a professional judgement of:

- the proposed reduction in the number of wind turbines within the Yandra Cluster (including consideration of the removal of least 12 approved wind turbines)
- the blade length and tip height difference between approved Boco Rock wind turbines and proposed Stage Two Modification within the Yandra Cluster
- the proposed Stage Two Modification magnitude of visual effect compared to the approved wind turbines
- the degree of existing screening through landform and vegetation between non-associated dwellings and the approved wind turbine locations.

The proposed Stage Two Modification is not considered to be dissimilar to other approved and constructed wind farm projects in the NSW Southern Tablelands, and is located within an area of low density rural settlement zoned RU1 Primary Production. The closest rural town of Nimmitabel is around 6km from the closest approved wind turbine. View locations within the township are not expected to be visually impacted by the proposed Stage Two Modification.

The proposed removal of up to at least 12 approved wind turbines from the Yandra Cluster is considered to result in an overall reduction of wind turbine visibility from view locations surrounding the Yandra Cluster. Wind turbine removal would also mitigate the visual complexity of wind turbines where overlapping in the approved wind turbine layout.

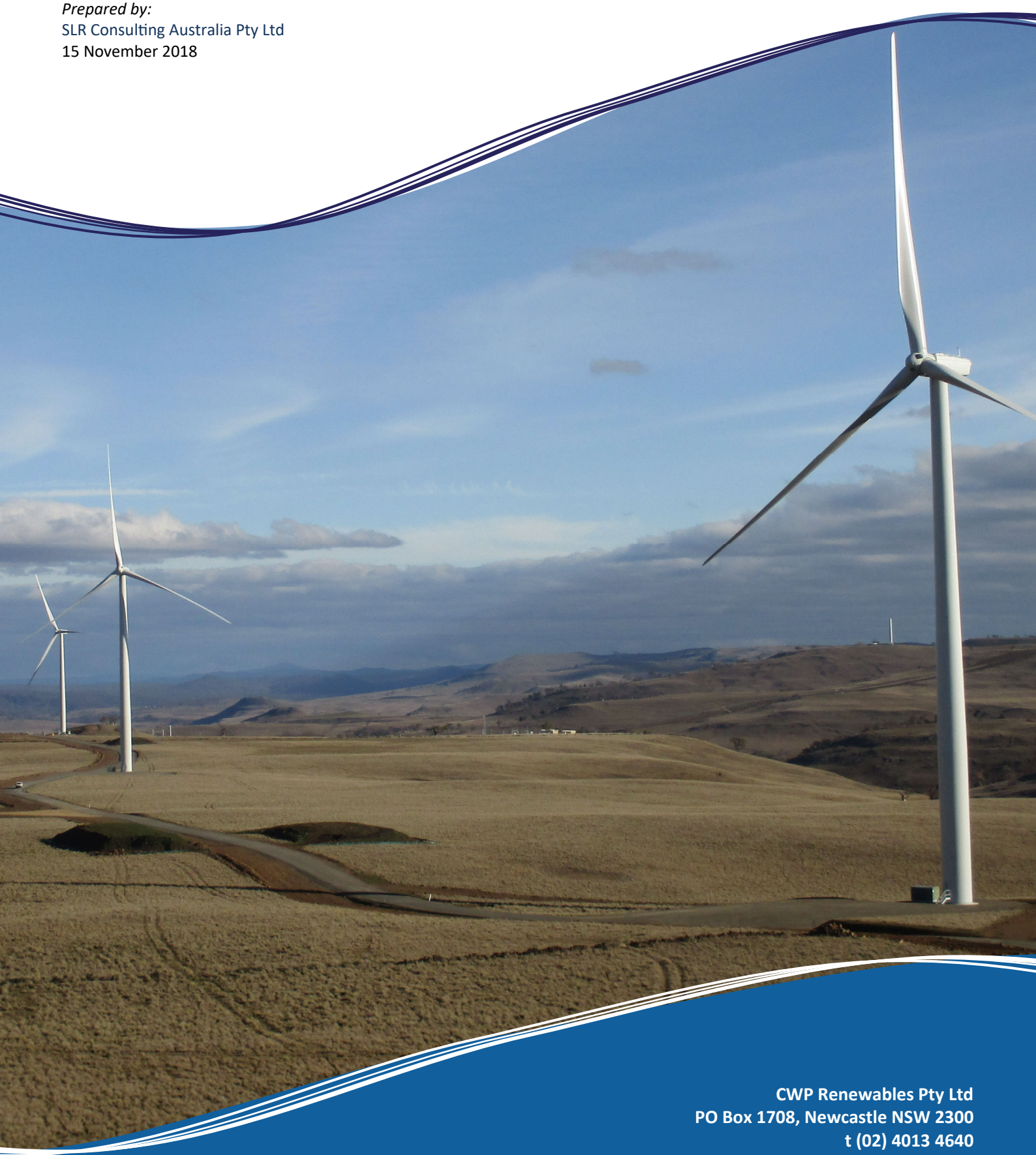
This VIA has illustrated and compared the approved Boco Rock Wind Farm against the proposed Stage Two Modification wind turbines within the Yandra Cluster. This VIA concludes that the proposed increase in wind turbine rotor diameter and tip height would be discernible from some surrounding and proximate view locations where views toward the approved Boco Rock Wind Farm wind turbines exist.

The proposed Stage Two Modification is not considered to be of a magnitude that would significantly increase visual effects and visual impact ratings associated with the approved Boco Rock Wind Farm development.

It is noted that Neighbour Agreements have been accepted by all owners of constructed dwellings within 4 km of the proposed Stage Two Modification.

Appendix B – Noise Impact Assessment

Prepared by:
SLR Consulting Australia Pty Ltd
15 November 2018



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BOCO ROCK WIND FARM

Revised Noise Assessment - Stage 2 Modification

Prepared for:

Boco Rock Stage Two Pty Ltd
c/- CWP Renewables Pty Ltd
PO Box 1708
NEWCASTLE NSW 2300

SLR Ref: 640.11757-R01
Version No: -v1.1
November 2018

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Boco Rock Stage Two Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
640.11757-R01-v1.1	15 November 2018	Benjamin French	Gustaf Reutersward	Gustaf Reutersward

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DOCUMENT REFERENCES

TABLES

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FIGURES

APPENDICES

1 Introduction

SLR Consulting Australia Pty Ltd (SLR), has been engaged by CWP Renewables on behalf of Boco Rock Stage Two Pty Ltd (the Proponent) to provide a Noise Impact Assessment for a proposed Modification to the Project Approval for Boco Rock Wind Farm.

The Project Approval was issued on 9 August 2010 permitting up to 122 wind turbine generators (WTGs). Stage 1 of the Project commenced construction in 2013 and became operational in 2015, consisting of 67 WTGs. The remaining 55 approved WTGs in the Boco and Yandra Clusters are yet to be constructed.

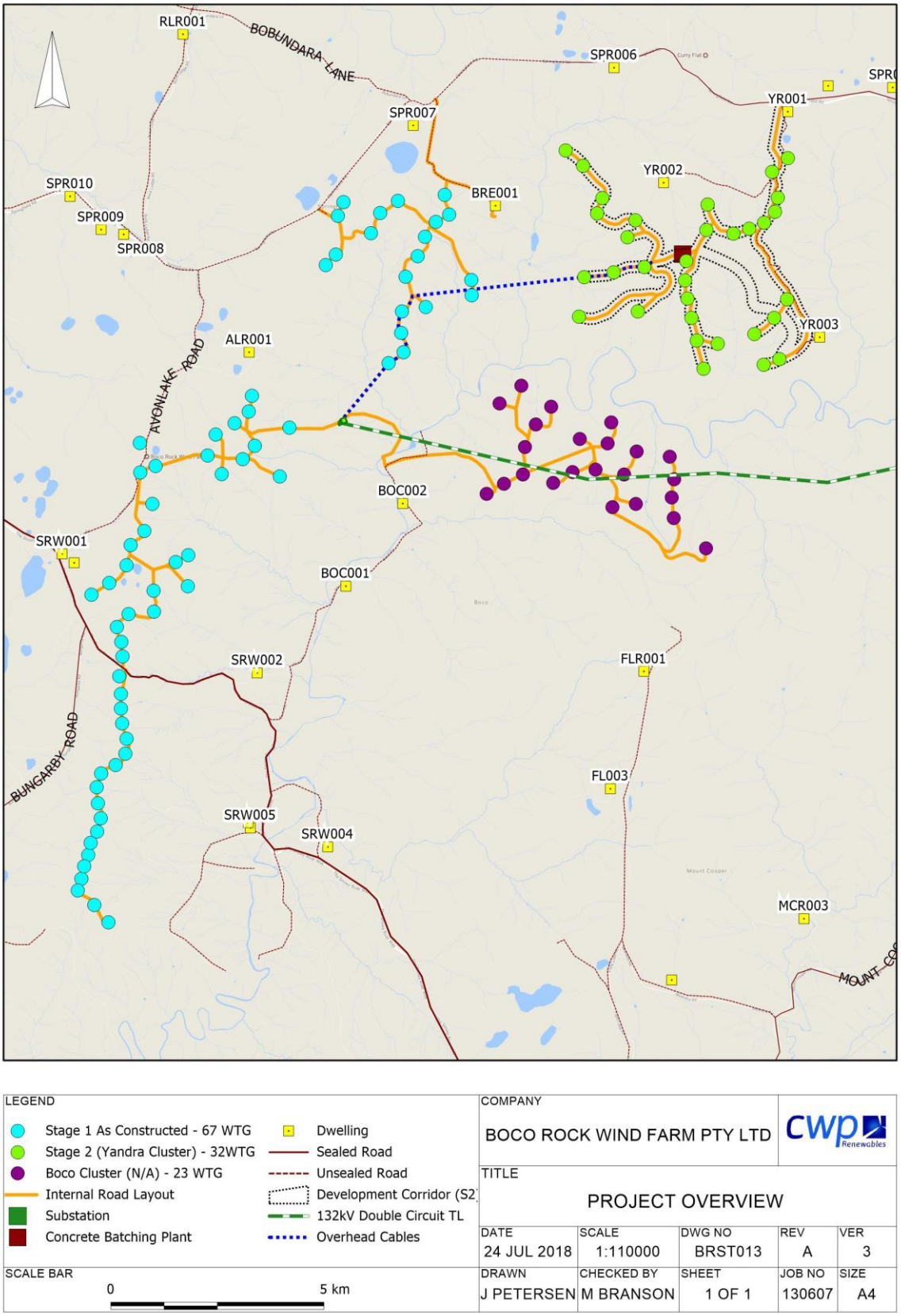
A previous Revised Noise Assessment report on the wind farm (report number 640.10799-R1R1) was completed for Stage One of the project which became operational in 2015.

The Yandra Cluster (see **Figure 1**) comprises Stage Two of the Project. The Project Approval currently permits a 32 WTG layout within the Yandra Cluster. The Proponent seeks to modify the Yandra Cluster as follows:

- Removal of two approved WTG locations, reducing the available WTG locations from 32 to 30 within Yandra Cluster.
- Construction, operation and decommissioning of up to 20 WTGs within these 30 locations.
- Increase in WTG tip height of up to 200m.
- Increase in WTG rotor diameter within the revised tip height.
- Addition of a temporary construction compound within the Yandra Cluster.

This report provides a Noise Impact Assessment for the above proposed Modification. It is important to note that although the proposed Modification includes the operation of 20 WTGs within the 30 locations, this impact assessment assumes that all 30 locations are utilised simultaneously as a worst-case scenario. Furthermore this assessment models the noise emissions from the 67 WTG from the existing Stage One development.

Figure 1 Project Overview



1.1 Wind Farm Assessment Methodology

1.1.1 Acceptability Limit Criteria

The methodology and acceptability limit criteria that have been applied to this study are based upon the *South Australia Environment Protection Authority (SA EPA) Wind Farms Environmental Noise Guidelines (July2009)* (SA EPA Guidelines), as the NSW Department of Planning & Environment (DPE) has adopted these guidelines with specific variations to account for the NSW environment.

The NSW Government recognises that rural land use zones in NSW are often more densely settled than those of South Australia and that there is a relatively high density of rural residential living in parts of regional NSW with reliable wind resources.

Therefore only the lower base noise criteria in SA 2009 will be applied in NSW. This criteria is defined as:

"The predicted equivalent noise level (LAeq,10 minute), adjusted for tonality and low frequency noise in accordance with these guidelines, should not exceed 35 dB(A) or the background noise (LA90(10 minute)) by more than 5 dB(A), whichever is the greater, at all relevant receivers for wind speed from cut-in to rated power of the wind turbine generator and each integer wind speed in between."*

** Determined in accordance with SA 2009, Section 4.*

Note: While the noise criteria is established on the basis of a 24-hour period, noise readings are taken at 10 minute intervals.

1.1.2 Wind Farm Noise Level Prediction

The noise emission model used in this study to predict wind farm noise levels at sensitive receptors is based on ISO 9613-2:1996 as implemented in the SoundPLAN computer noise model. The model predicts noise levels through spherical spreading and includes the effect of air absorption (as per ISO 9613), ground attenuation and shielding.

Predicted L_{Aeq} noise levels were calculated based upon sound power levels determined in accordance to the recognised standard IEC-61400-11:2002 *(Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques)*, where available, for the wind range 5 to 10 m/s.

1.1.3 Ambient Noise Monitoring

Noise monitoring was previously conducted in 2009 as part of the original Noise Impact Assessment and background noise regression curves established for the site. **Table 1** shows the derived curves for All Data (day and night) and Night-time only Data.

Table 1 Background Noise Regression Curves (derived 2009)

Location Name	All Data	Night only
Benbullen*	$-0.0165x^3 + 0.4281x^2 - 1.7523x + 25.428$	$-0.0301x^3 + 0.8541x^2 - 5.6006x + 33.564$
Boco*	$-0.0045x^3 + 0.2046x^2 - 1.6301x + 33.927$	$-0.0011x^3 + 0.1021x^2 - 0.5072x + 26.385$
Brooklyn*	$-0.0233x^3 + 0.5751x^2 - 2.7598x + 28.904$	$0.0107x^3 - 0.0837x^2 + 0.5524x + 22.767$
Coopers Hill*	$-0.0227x^3 + 0.5367x^2 - 2.5401x + 25.468$	$-0.0084x^3 + 0.1698x^2 - 0.0393x + 19.197$
Glenfinnan*	$-0.0063x^3 + 0.1063x^2 + 1.15x + 21.287$	$0.0098x^3 - 0.1249x^2 + 1.6304x + 19.202$
Old Springfield*	$-0.0303x^3 + 0.753x^2 - 4.2573x + 33.82$	$0.0283x^3 - 0.5203x^2 + 3.6303x + 15.092$

2 Environmental Noise Criteria

2.1 NSW DPE Wind Farm Noise Guidelines

The NSW DPE Guidelines (December 2016), (based on the SA EPA Guidelines (July 2009)) recommends the following noise criteria for new wind farms,

> *"The predicted equivalent noise level (LAeq,10 minute)*, adjusted for tonality and low frequency noise in accordance with these guidelines, should not exceed 35 dB(A) or the background noise (LA90(10 minute)) by more than 5 dB(A), whichever is the greater, at all relevant receivers for wind speed from cut-in to rated power of the wind turbine generator and each integer wind speed in between.*
>
> ** Determined in accordance with SA 2009, Section 4."*

These guidelines also provide information on measuring the background noise levels, locations and requirements on the number of valid data points to be obtained and the methodology for excluding invalid data points. It also outlines the process for determining lines of best fit for the background data, and determination of the noise limit.

The SA Guideline explicitly states that the "swish" or normal modulation noise from wind turbines is a fundamental characteristic of such turbines; however, it specifies that tonal or annoying characteristics of turbine noise should be penalised.

In NSW, tonality is defined as when the level of one-third octave band exceeds the level of the adjacent bands on both sides by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500 Hz to 10,000 Hz; •
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160 Hz to 400 Hz; and/or
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25 Hz to 125 Hz.

A 5 dBA penalty should be applied to the measured noise level if tonality is an issue..

The Guideline does not provide an assessment for the potential of low frequency noise or infrasound, but it does state that recent turbine designs do not appear to generate significant levels of infrasound, as the earlier turbine models did.

The Guideline accepts that wind farm developers commonly enter into agreements with private landowners in which they are provided compensation. The guideline is intended to be applied to premises that do not have an agreement with the wind farm developers. This does not absolve the obligations of the wind farm developer entirely as appropriate action can be taken under the *Environmental Protection Act* if a development 'unreasonably interferes' with the amenity of an area. The guideline lists that there is unlikely to be unreasonable interference if:

- a formal agreement is documented between the parties
- the agreement clearly outlines to the landowner the expected impact of the noise from the wind farm and its effect on the landowner's amenity

- the likely impact of exposure will not result in adverse health impacts (e.g. the level does not result in sleep disturbance)

The Proponent has discussed the possible noise implications of the project with the involved residents whose property the turbines would be located on and has entered into agreements with these parties. Agreements have also been offered to all landowners with residences within 4km of a wind turbine for Stage Two. The full noise assessment will be made available to all residents as part of the exhibited application for Modification.

These agreements constitute a noise agreement which satisfies the requirements of the SA Guidelines, by acknowledging any noise which may be experienced by the Landowner at the Residence must be within the parameters set out in the WHO Guidelines.

2.2 World Health Organisation (WHO) Guidelines

The WHO publication '*Guidelines for Community Noise'* identifies the main health risks associated with noise and derives acceptable environmental noise limits for various activities and environments.

The appropriate guideline limits are listed in **Table 2** below**.**

Table 2 WHO Guideline values for environmental noise in specific environments

Specific Environment	Critical Health Effect(s)	L_{eq} (dBA)	Time base (hours)	L_{Max} (dBA, Fast)
Outdoor living area	Serious Annoyance, daytime & evening Moderate annoyance, daytime & evening	55 50	16 16	- -
Dwelling indoors Inside bedrooms	Speech Intelligibility & moderate annoyance, daytime & evening Sleep disturbance, night-time	35 30	16 8	 45
Outside bedrooms	Sleep disturbance – window open, night-time	45	8	60

Where noise levels at project-involved residences do not comply with the SA EPA Guidelines, the proponent intends to enter into agreements with the owners of those residences to achieve noise criteria in accordance with World Health Organisation (WHO) Guidelines. The proponent will apply those guidelines as necessary to ensure that the project does not result in an 'unreasonable interference' with the amenity or cause any adverse health effects at those residences. (See **Section 2.1**)

For the assessment of project involved residences the adopted external criteria of 45 dBA or the level given by the SA EPA Guideline criteria, where higher, will be adopted. Effectively this becomes 45 dBA or background + 5 dBA, whichever is the higher.

3 General Site Description

Boco Rock Wind Farm (the Project) is an operating wind farm located approximately 6km south west of Nimmitabel and 30km north of Bombala in NSW within the Snowy-Monaro Regional Council.

3.1 Characteristics of the site

The site incorporates farming properties across four land holdings accessed from Springfield Road.

Topographically, the site broadly includes a number of rolling hills to the north and a single ridge/escarpment, Sherwin Range, to the south which all run approximately in a north-south direction. The Maclaughlin River runs through the north of the site and runs to the east of the escarpment in the southern part of the site. The Snowy River runs to the west of the site. The surrounding district is primarily used for agricultural (grazing) purposes.

The Monaro Highway is sufficiently far away to the east of the project site that background noise levels would not be affected by road traffic noise for the majority of receptor locations. All properties surrounding the proposed site have an ambient background noise environment that is determined by pre-dominantly natural sources which are largely wind influenced.

3.2 Dwelling Locations

SLR has been provided with the receiver locations to be assessed by the proponent and the 30 turbine Stage 2 Modification WTG positions. **Table 3** lists the receiver locations during Stage One of the project, their positions and identifies those that are project involved. **Table 4** lists the additional receiver locations not included in the Stage One assessment. All eastings and northings use reference WGS84, Zone 55.

Table 3 Surrounding Receivers – Stage One

Location	Easting (m)	Northing (m)
Belmore	680461	5941821
Benbullen*	699314	5951354
Boco*	691374	5948433
Brooklyn*	688326	5942494
Bungee	688606	5941567
Clifton	704525	5953058
Coombala	685402	5937496
Coopers Hill*	684531	5940643
Curry Flat*	699524	5957935
Edendale	682127	5951369
Glenfinnan*	698804	5955622
H1	680925	5942328

Location	Easting (m)	Northing (m)
Monastery	683155	5935393
Mountain View	682479	5948755
Nestlebrae*	688537	5951337
Old Curry Flat*	696738	5957694
Old Springfield*	686537	5953315
Peters Park	680341	5941115
Riverside*	690289	5946823
Rockybah*	693247	5953985
Roselea*	691826	5955463
Rosemount	695166	5942991
Roslyn	680312	5938990
Sherwood*	688579	5945345

Location	Easting (m)	Northing (m)
H2	688457	5935512
H3	703854	5951128
Hyland Grange	703866	5953807
Kangaroo Camp Retreat	689115	5936116
Kanoute	691256	5939524
Kenilworth	685288	5954313
Lofty Vale	689125	5959604
Lynndarra	687266	5957378
Mia Mia*	700779	5956037
Mohawke	703603	5950719

Location	Easting (m)	Northing (m)
Springfield*	685789	5953700
Telembugrm *	687560	5939773
Tinbery Lodge	682470	5949856
Windella*	689840	5942014
Wodburn	680399	5942869
Woodbine*	699584	5956091
Wyuna*	695544	5956531
Xenmor	683772	5936565
Yandra*	696387	5954178

Note: * Denotes the location is involved with the project

Note that two additional locations, Avonlake and Kelton Plain have been listed as uninhabited ruins and therefore have not been included in the assessment.

Table 4 Additional Receivers in the vicinity of Stage Two

Location	Easting (m)	Northing (m)
Unnamed property	705605	5947452
45 Clark St, Nimmitabel	703872	5957133
51 Clark St, Nimmitabel	703683	5957140
67 Springvale Rd, Nimmitabel	703579	5955976
86 Old Bega Rd, Nimmitabel	705315	5956526
87 Wallaces Rd, Nimmitabel	705260	5950960
95 Stanton St, Nimmitabel	703604	5957978

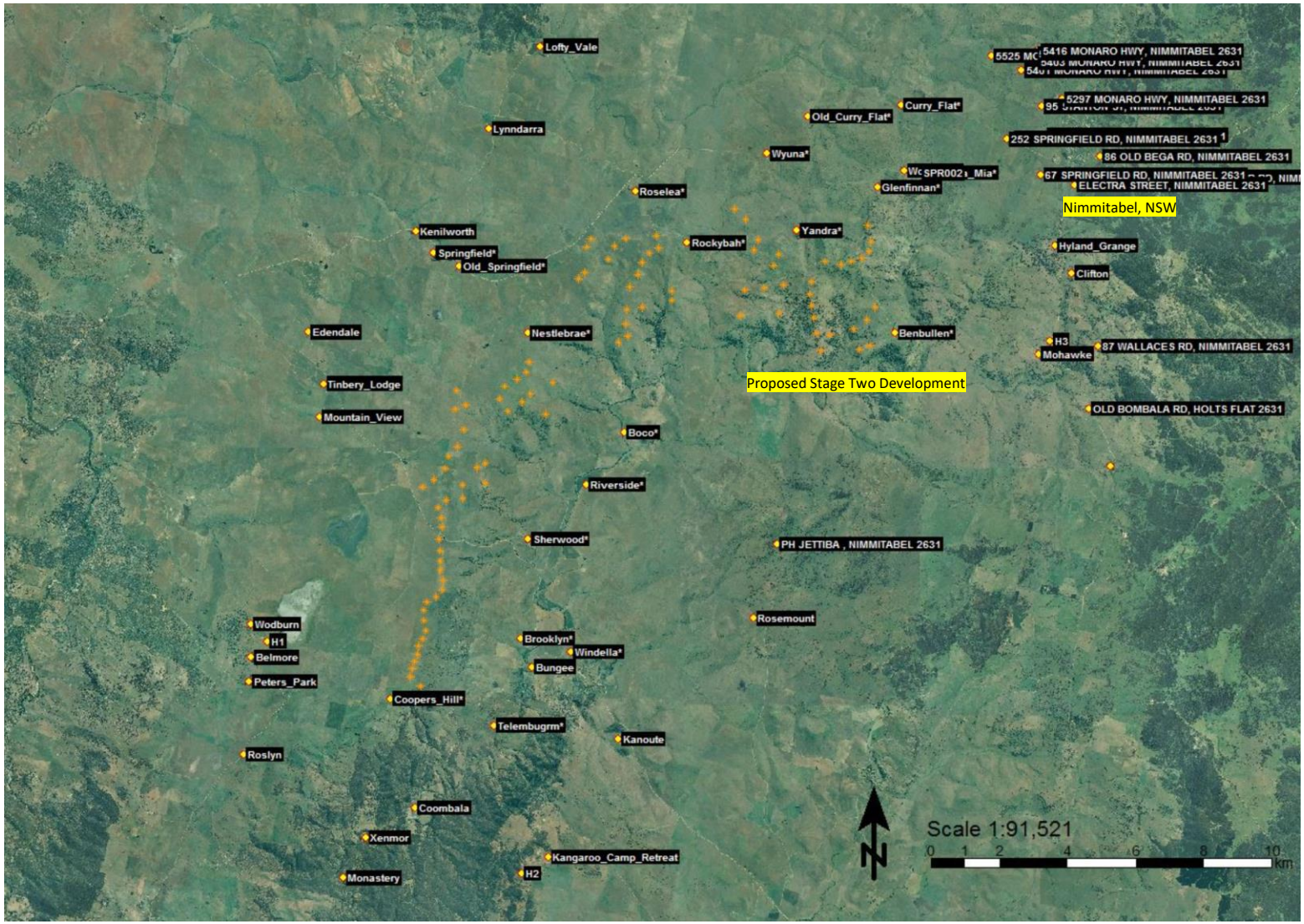
Location	Easting (m)	Northing (m)
5297 Monaro Hwy, Nimmitabel	704189	5958187
5401 Monarno Hwy, Nimmitabel	703011	5959032
5403 Monaro Hwy, Nimmitabel	703435	5959269
5416 Monaro Hwy, Nimmitabel	703396	5959519
5416 Monaro Hwy, Nimmitabel	703491	5959619
5525 Monaro Hwy, Nimmitabel	702115	5959459
Electra St, Nimmitabel	704556	5955692

Location	Easting (m)	Northing (m)
111 Warregal Corner Rd, Nimmitabel	705963	5955903
174 Ryedale Rd, Nimmitabel	702733	5957068
252 Springfield Rd, Nimmitabel	702578	5957018

Location	Easting (m)	Northing (m)
Ph Jettiba, Nimmitabel	695848	5945175
Old Bombala Rd, Holts Flat	704974	5949134
SPR002	700001	5956028

Figure 2 shows a map of the layout considered and all locations assessed.

Figure 2 Dwelling Locations and WTG Layout



4 WIND FARM LAYOUT

4.1 Stage One WTG Type and Details

The Stage One layout comprises a total of 67 Wind Turbine Generators (WTGs) which includes:

48 X General Electric 1.7 MW-100

10 X General Electric 1.7 MW -100 with Low Noise Trailing Edge (LNTE) Blades

9 X General Electric 1.6 MW -100 with Low Noise Trailing Edge (LNTE) Blades

All three WTGs considered are three bladed, upwind, pitch regulated and active yaw. **Table 5** and **Table 6** summarise the relevant turbine input data used for noise level prediction.

Table 5 Stage Two WTG Manufacturers Data

Make, model, power	GE 1.7 MW	GE 1.7 MW + LNTE	GE 1.6MW + LNTE
Rotor diameter	100 m	100 m	100 m
Hub height	80 m	80 m	80 m
Cut-in wind speed	3 m/s	3 m/s	3 m/s
Rated wind speed	11.0 m/s	11.0 m/s	10.5 m/s
Cut-out wind speed	23 m/s	23 m/s	25 m/s
Rotor speed	9.75 – 16.7 rpm	9.75 – 16.7 rpm	9.75 – 17.5 rpm
'Standard Mode' Sound Power Level, LWA,ref 8 m/s	107 dBA	105 dBA	103 dBA

Table 6 Stage One WTG Sound Power Levels (dBA)

Wind Turbine Model	Wind speed Vs (10m AGL)					
	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
GE 1.7 MW-100	98.2	102.8	106.1	107	107	107
GE 1.7 MW-100 LNTE blades	96.5	100.9	104.3	105	105	105
GE 1.6 MW-100 LNTE blades	95.8	100.5	102.8	103	103	103

Noise emissions for the General Electric WTGs have been provided by the manufacturer and have been independently tested according to International Standard IEC 61400-11. Copies of the certification test or manufacturers documentation that give the sound power level variation with wind speed, frequency spectra and tonality assessment have been provided by the Proponent and will be made available on request**.**

The Stage One layout presented in this report is a 67 WTG layout, as specified in **Table 7** below.

Table 7 Layout Rev4 WTG details

Turbine Name	Easting (m)	Northing (m)	Turbine Model
T-01	685651	5940690	1.6-100 LNTE
T-02	685086	5941303	1.6-100 LNTE
T-2A	685413	5941036	1.6-100 LNTE
T-03	685158	5941522	1.6-100 LNTE
T-04	685215	5941754	1.7-100 LNTE
T-05	685297	5941966	1.6-100 LNTE
T-06	685343	5942192	1.7-100 LNTE
T-07	685472	5942402	1.6-100 LNTE
T-08	685544	5942653	1.7-100 LNTE
T-09	685501	5942933	1.7-100 LNTE
T-10	685480	5943238	1.7-100 LNTE
T-11	685575	5943492	1.7-100 LNTE
T-12	685845	5943645	1.7-100 LNTE
T-13	686036	5943853	1.6-100 LNTE
T-14	686064	5944127	1.7-100 LNTE
T-15	685985	5944422	1.7-100
T-16	685973	5944698	1.7-100
T-17	685978	5944973	1.7-100
T-18	685950	5945309	1.7-100
T-19	686019	5945675	1.7-100
T-20	686007	5945949	1.7-100
T-21	685924	5946234	1.7-100
T-22	686152	5946469	1.7-100
T-23	686630	5946509	1.7-100
T-24	686634	5946898	1.7-100
T-25	687282	5946971	1.7-100
T-26	687062	5947430	1.7-100
T-27	687305	5947553	1.7-100
T-28	685462	5946852	1.7-100
T-29	685799	5947060	1.7-100
T-30	686134	5947390	1.7-100
T-31	686219	5947764	1.7-100
T-32	686480	5948025	1.7-100
T-33	686647	5948528	1.7-100

Turbine Name	Easting (m)	Northing (m)	Turbine Model
T-34	686429	5949123	1.7-100
T-35	686725	5949239	1.7-100
T-36	686437	5949679	1.7-100
T-37	687710	5949418	1.7-100
T-38	687869	5949807	1.7-100
T-39	688233	5950012	1.7-100
T-40	688506	5950225	1.7-100 LNTE
T-41	688569	5950519	1.7-100 LNTE
T-42	687965	5949062	1.7-100
T-43	688370	5949329	1.7-100
T-44	688607	5949577	1.7-100
T-45	689060	5948990	1.7-100
T-46	689264	5949903	1.7-100
T-47	690021	5952945	1.7-100
T-48	690216	5953133	1.7-100
T-49	690269	5953865	1.7-100
T-50	690378	5954117	1.7-100
T-51	690882	5953523	1.7-100
T-52	691064	5953898	1.7-100
T-53	691404	5954122	1.7-100
T-54	691191	5951073	1.7-100
T-55	691452	5951277	1.7-100
T-56	691417	5951635	1.7-100
T-57	691437	5952042	1.7-100
T-58	691890	5952113	1.7-100
T-59	691518	5952717	1.7-100
T-60	691759	5953070	1.7-100
T-61	691877	5953432	1.7-100
T-62	692111	5953706	1.7-100
T-63	692370	5953842	1.6-100 LNTE
T-64	692295	5954209	1.6-100 LNTE
T-65	692760	5952311	1.7-100
T-66	692762	5952598	1.7-100

4.2 Stage Two WTG Type and Details

The proposed Stage Two development comprises up to 20 WTGs within 30 approved WTG locations which are being considered as either:

- Vestas V150 – 4.2 MW blades with serrated trailing edge, power optimised mode
- General Electric 5.3 MW-158

These models are three bladed, upwind, pitch regulated and active yaw.

Both turbine types were simulated in the noise prediction model. **Table 8** and **Table 9** summarise the turbine input data used in the noise prediction model.

Table 8 Stage One WTG Manufacturers Data

Make, model, power	V150–4.2 MW	GE 5.3-158
Rotor diameter	150 m	158 m
Hub height	125 m	125 m
'Standard Mode' Sound Power Level, LWA,ref 8 m/s	104.9 dBA	106 dBA

Table 9 Stage Two WTG Sound Power Levels (dBA)

Wind Turbine Model	Wind speed Vs (10m AGL)					
	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
V150–4.2 MW	99.9	103.9	104.9	104.9	104.9	104.9
GE 5.3-158	101	104.6	106	106	106	106

Noise emissions for the WTGs have been provided by the manufacturer and are based on testing or estimates according to International Standard IEC 61400-11. Copies of the certification test or manufacturers documentation that give the sound power level variation with wind speed, frequency spectra and tonality assessment have been provided by the Proponent and will be made available on request**.**

The proposed WTG locations for the Stage Two development are shown in **Table 10**.

Table 10 Layout of Stage Two WTG

WTG ID	Easting (m)	Northing (m)
Yandra Cluster		
94	696989	5951367
95	695888	5951937
96	697108	5950831
97	697385	5951300
98	696829	5952159
99	696793	5952502
100	696828	5952868
101	697727	5953359

WTG ID	Easting (m)	Northing (m)
Yandra Cluster		
110	698243	5950882
111	698025	5953446
112	694594	5954992
113	695268	5954084
114	694917	5954701
115	695166	5953796
116	695722	5953341
117	696029	5952768

WTG ID	Easting (m)	Northing (m)
102*	697254	5953921
103	697222	5953441
104	698520	5953754
105	698582	5954018
106	698490	5954502
107	696897	5951793
108	698712	5952101
109	698463	5951758

WTG ID	Easting (m)	Northing (m)
118	698084	5951461
119*	698787	5954759
120	694775	5951867
121	698310	5953551
122	698542	5950987
123	695883	5953654
124	695453	5952686
125	694890	5952608

* Identifies an approved turbine location which is proposed to be removed by this Modification.

4.3 Assessment of Tonality and Infrasound

The NSW DPE Guideline states noise assessments for wind energy projects shall report the results of tonality assessments under IEC 61400-11 for each turbine type being considered.

WTG manufacturers are obliged to conduct independent tests in accordance with IEC 61400-11. A part of this assessment is to conduct a tonal audibility test. The tonal audibility $\Delta L_{t,a}$ is assessed using the methodology outlined in *Joint Nordic Method Version 2 – Objective Method for Assessing the Audibility of Tones in Noise*.

The tonal audibility data $\Delta L_{A,k}$ values for the turbines were not specified by the manufacturer but are stated as less than 2 dB. This is below the minimum reporting level in the SA EPA Guidelines and as such, no tonality penalty has been applied.

Infrasound is not tested as an obligatory part of IEC 61400-11. It is noted that, in general, modern WTG's do not exhibit significant infrasound emissions.

5 Operational Noise Levels

5.1 Introduction

As discussed in **Section 1.1.2**, a three-dimensional computer noise model was used to predict L_{Aeq} noise levels from all WTG's at all surrounding residential dwellings.

The ISO 9613 noise model incorporates a 'hard ground' assumption and includes one-third octave band calculated effects for air absorption, ground attenuation and topographic shielding. It is noted that ISO 9613 equations predict for average downwind propagation conditions and also hold for average propagation under a well-developed moderate ground-based temperature inversion.

The estimated accuracy of the prediction model is approximately ±3 dBA.

5.2 Wind Turbine Noise

For indicative purposes the WTG noise levels from the proposed WTG layout was calculated for the reference wind condition of 8 m/s at 10m above ground level (AGL) and listed in **Table 11**. The increase in noise levels with the inclusion of Stage Two WTGs are also shown, locations where there is no increase in noise level when the Stage Two turbines are introduced are denoted with a dash**.** The predicted noise contour plot is presented in **Appendix C.**

Table 11 Predicted WTG noise level increase with Stage Two

Location	Stage 1 dBA	V150 Increase dBA	GE 5.3 Increase dBA
Unnamed location	10.9	1.0	1.0
45 Clarke St	14.0	2.1	2.0
51 Clarke St	14.2	2.2	2.0
67 Springfield Rd	14.7	1.6	1.6
86 Old Bega Rd	12.5	1.4	1.3
87 Wallaces Rd	12.6	1.4	1.3
95 Stanton St	14.0	1.1	1.0
111 Warregal Corner Rd	10.1	1.4	1.3
174Ryedale Rd,	15.2	1.9	1.8
252 Springfield Rd	15.4	1.7	1.6
5297 Monaro Hwy	13.4	1.6	1.5
5401 Monaro Hwy	14.5	1.0	0.9

Location	Stage 1 dBA	V150 Increase dBA	GE 5.3 Increase dBA
Kangaroo Camp Retreat	25.8	-	-
Kanoute	27.6	-	-
Kenilworth	28.5	-	-
Lofty Vale	23.1	0.1	0.1
Lynndarra	26.0	-	-
Mia Mia*	18.5	5.5	5.6
Mohawke	15.2	2.0	1.9
Monastery	21.3	-	-
Mountain View	29.3	-	-
Nestlebrae*	40.8	-	-
Old Bombala Rd	12.8	2.9	2.7
Old Curry Flat*	22.5	1.7	1.7

Location	Stage 1 dBA	V150 Increase dBA	GE 5.3 Increase dBA
5403 Monaro Hwy	13.6	0.8	0.7
5416 Monaro Hwy	13.3	0.7	0.9
5416 Monaro Hwy	13.6	0.9	0.6
5525 Monaro Hwy	14.7	0.9	0.8
Belmore	29.5	-	-
Benbullen*	21.8	15.0	15.5
Boco*	34.3	-	-
Brooklyn*	34.2	-	-
Bungee	32.7	-	-
Clifton	14.2	2.1	2.0
Coombala	26.5	-	-
Coopers_Hill*	38.7	-	-
Curry_Flat*	18.7	1.6	1.6
Edendale	26.6	-	-
Electra St	13.8	1.3	1.2
Glenfinnan*	21.5	9.3	10.0
H1	31.1	-	-
H2	21.0	-	-
H3	14.9	1.8	1.8
Hyland Grange	14.6	1.9	1.8

Location	Stage 1 dBA	V150 Increase dBA	GE 5.3 Increase dBA
Old Springfield*	30.5	-	-
Peters Park	27.7	-	-
Ph Jettoba	26.8	0.1	0.1
Riverside*	33.7	-	-
Rockybah*	38.7	0.5	0.6
Roselea*	37.6	0.1	0.1
Rosemount	25.9	-	-
Roslyn	26.3	-	-
Sherwood*	36.9	-	-
Springfield*	29.9	-	-
Telembugrm*	31.5	-	-
Tinbery Lodge	33.0	-	-
Windella*	32.6	-	-
Wodburn	30.5	-	-
Woodbine*	20.0	4.6	4.8
Wyuna*	27.0	2.3	2.5
Xenmor	22.9	-	-
Yandra*	26.6	10.5	11.1
SPR002	19.4	3.9	4.1

* Denotes the location is involved with the project

6 Assessment of proposed wind farm Noise

An assessment of the acceptability of wind farm noise levels at all assessment receivers using the required noise limit set in SA EPA Guidelines has been completed. Dwellings further than these receptors are deemed to comply if dwellings closer to turbines comply with the SA EPA noise limit.

For the assessment of project involved residences the adopted external criteria of 45 dBA (as per the WHO guidelines) or the level given by the SA EPA Guideline criteria, where higher, will be adopted. Effectively this becomes 45 dBA or background + 5 dBA, whichever is the higher. (See **Section 2.2** for details)

Predicted external noise levels will be further mitigated by shielding effects of the building, with the anticipated internal noise levels similarly reduced by the façade of the dwelling.

It should be noted that all predicted noise levels are considered to be conservative with the model assuming 'hard ground' and average downwind propagation from all WTG's to each receiver or a well-developed moderate ground based temperature inversion.

Predicted noise levels for a reference wind speed of 8 m/s are shown in **Table 11** (See **Section 5.2**), based on the sound power levels provided by the manufacturer at this wind speed.

The assessment figures contained in **Appendix A** and **Appendix B** depict the predicted WTG noise level curves including the proposed Stage Two WTG layout for the Vestas V150 and the General Electric GE 5.3 WTGs respectively. The noise level curves are superimposed over SA EPA Guideline Criteria and WHO based noise limits. Previously derived background noise curves for the sites are shown in **Table 1** in **Section 1.1.3.**

All receiver locations are predicted to comply with their respective criteria.

6.1 Adaptive Management

If undue WTG noise impacts are identified during operations due to temperature inversion, atmospheric stability or other reasons, then an 'adaptive management' approach could be implemented to mitigate or remove the impact. This process could include:

- Receiving and documenting noise impact complaint through 'hotline' or other means.
- Investigating the nature of the reported impact.
- Identifying exactly what conditions or times lead to undue impacts.
- Operating WTG's in a reduced 'noise optimised' mode during identified times and conditions (sector management).
- Providing acoustic upgrades (glazing, façade, masking noise etc) to affected dwellings.
- Turning off WTG's that are identified as causing the undue impact.

7 Conclusion

Noise from the proposed Modification for Boco Rock Wind Farm Stage Two development has been predicted and assessed against the relevant noise limits.

WTG noise has been predicted to comply at all receptors.

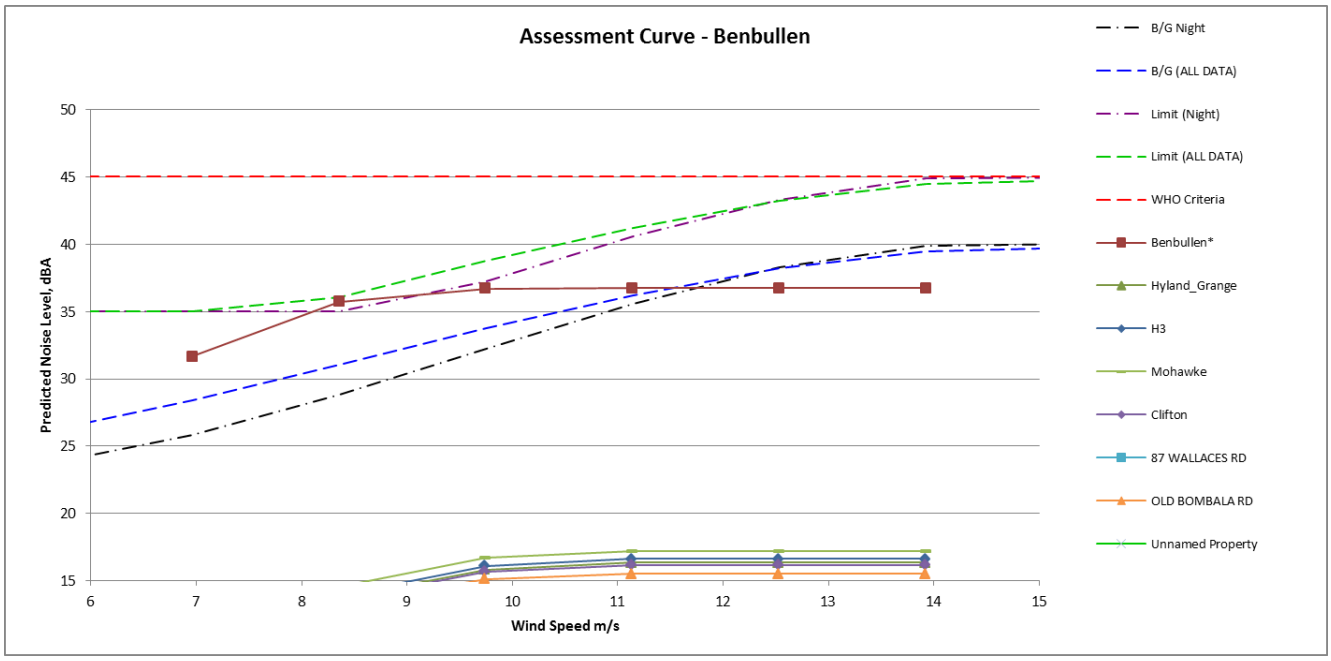
It is anticipated that post-construction noise levels will be monitored to evaluate if the wind farm is compliant, as per the planning conditions set for the project.

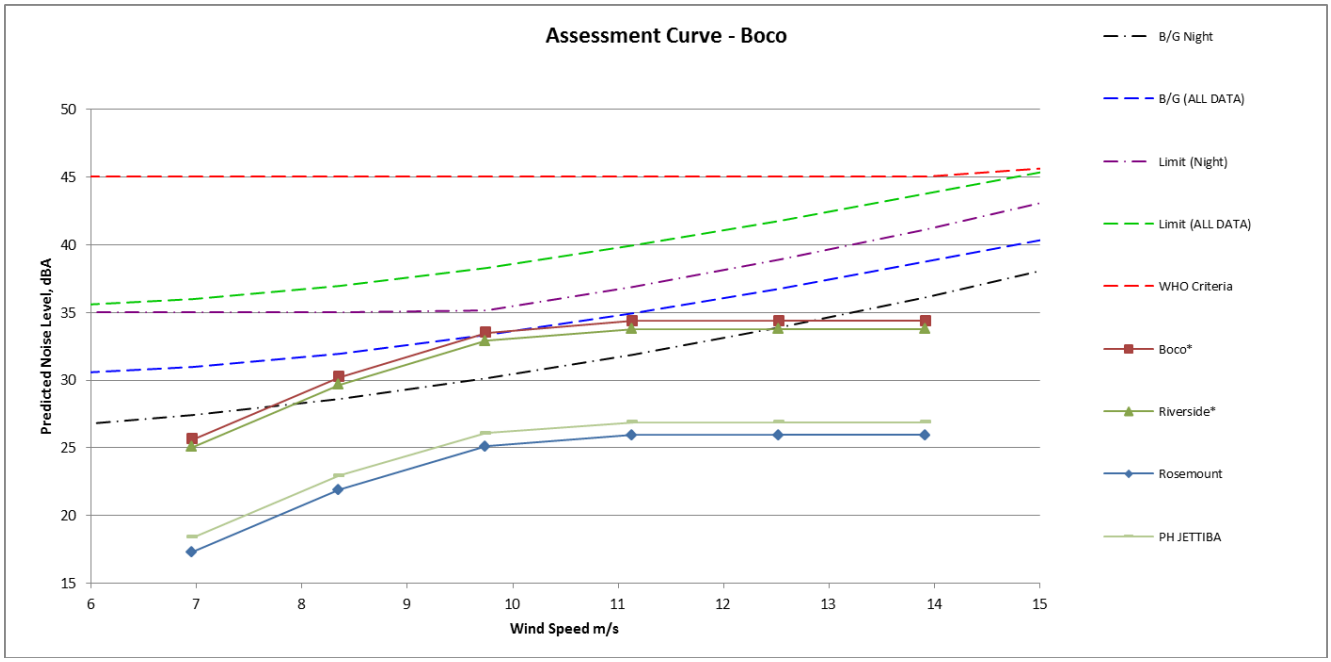
APPENDIX A

Noise Assessment Curves

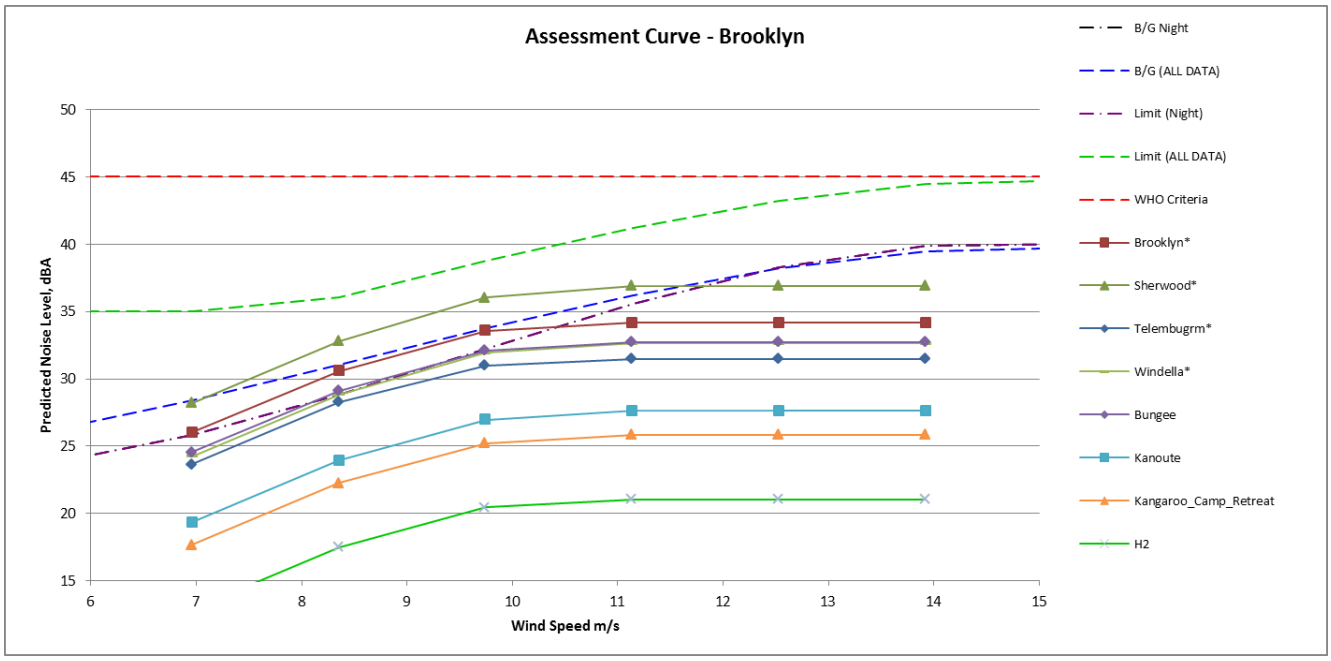
Vestas V150 – 4.2MW

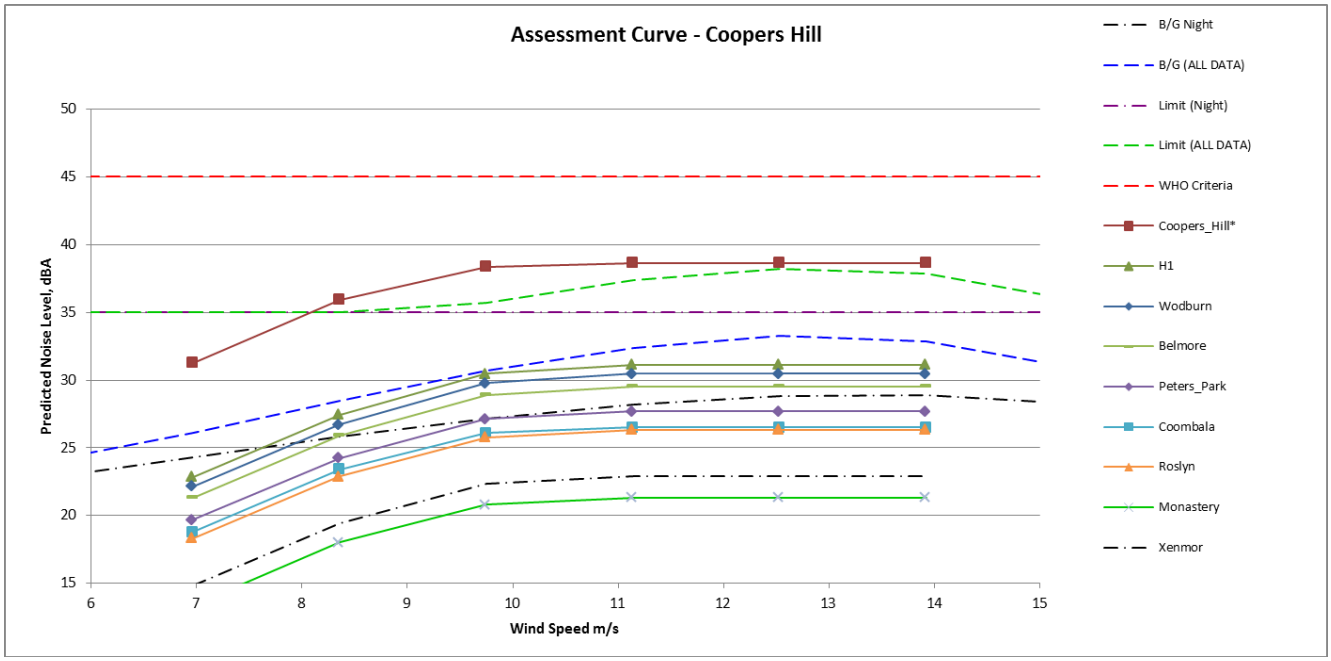
Assessment Curves: Stage Two Mod = Vestas V150 – 4.2 MW



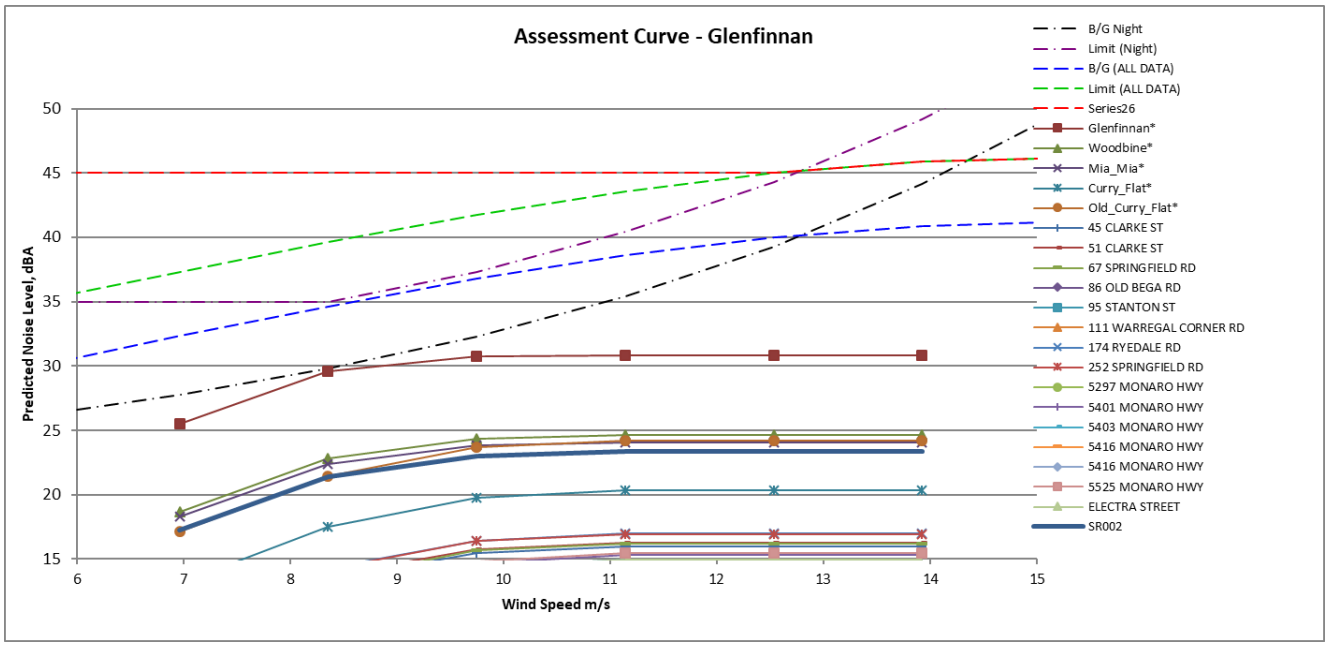


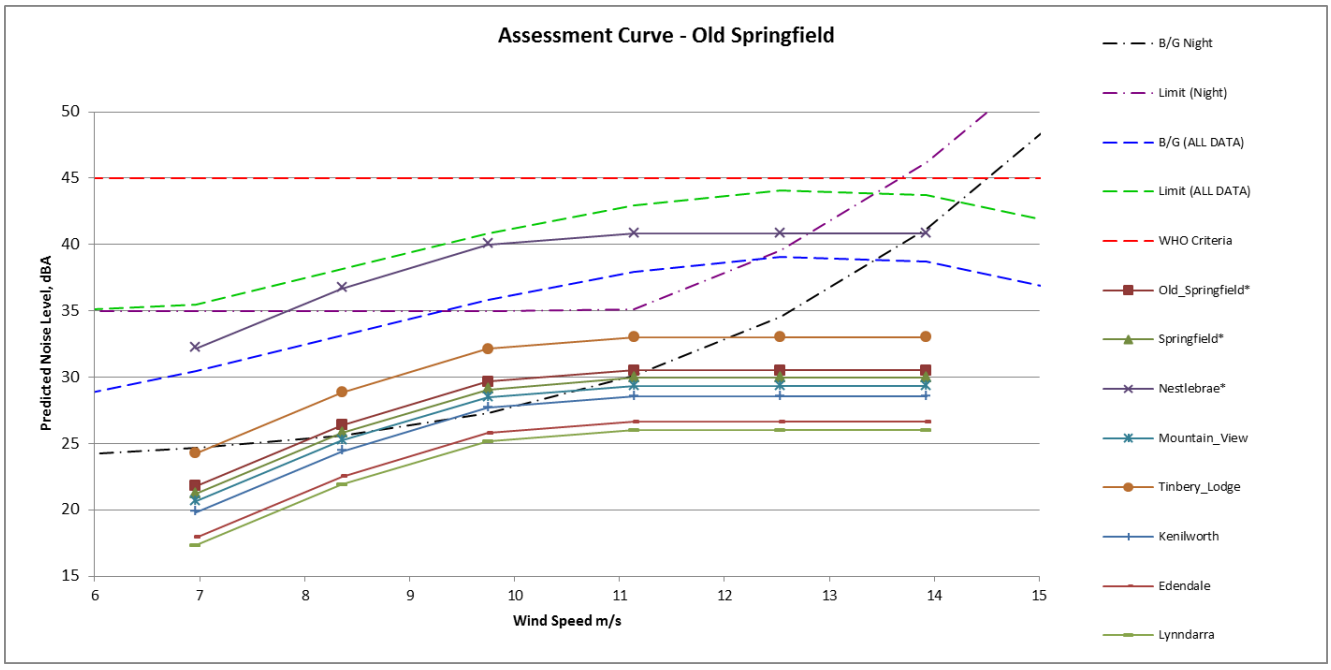
Assessment Curves: Stage Two Mod = Vestas V150 – 4.2 MW



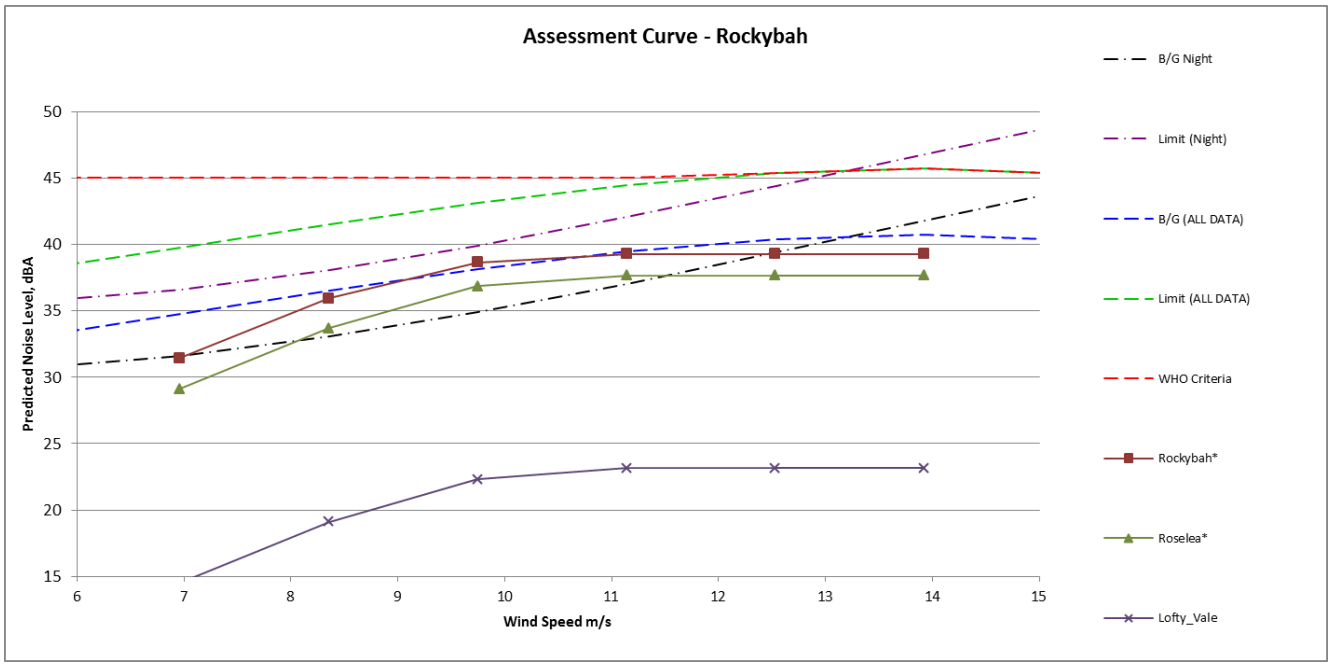


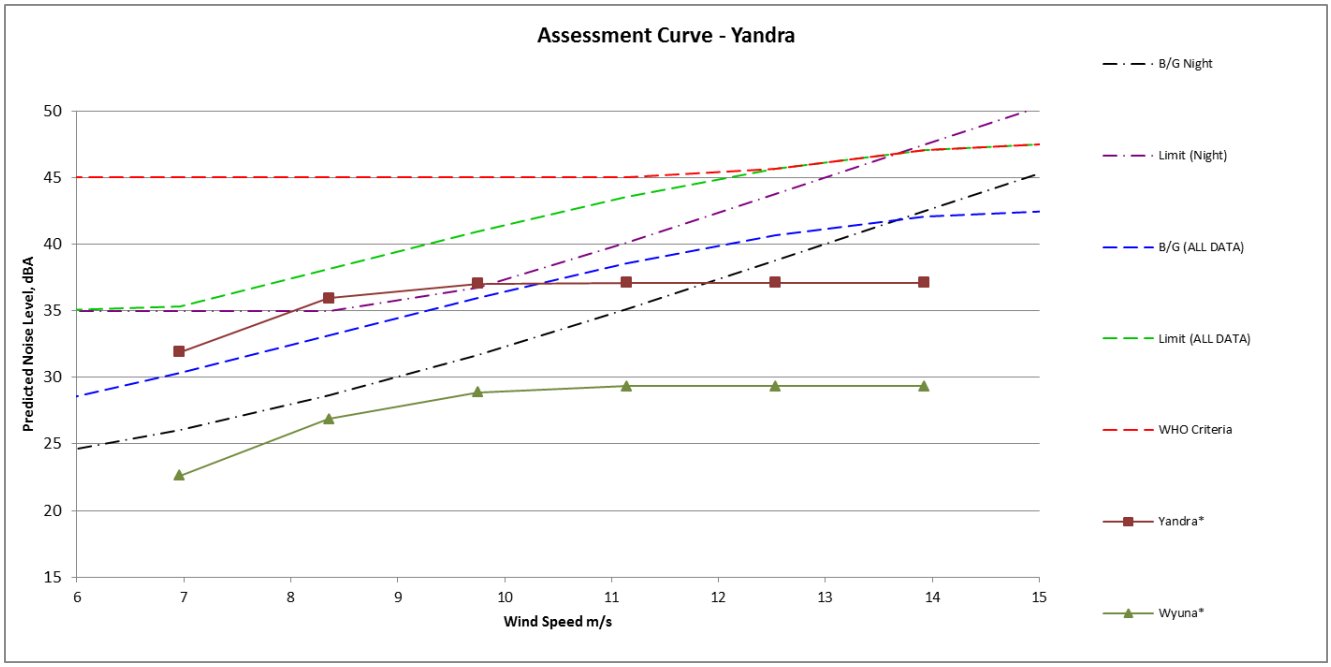
Assessment Curves: Stage Two Mod = Vestas V150 – 4.2 MW





Assessment Curves: Stage Two Mod = Vestas V150 – 4.2 MW



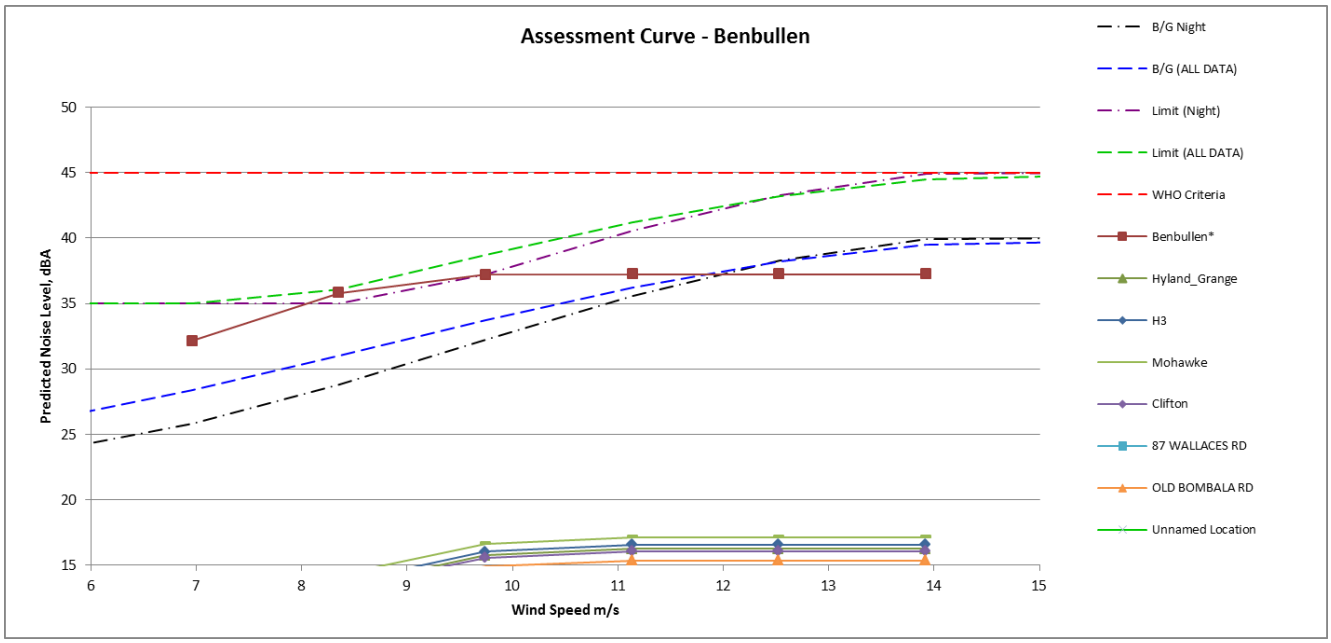


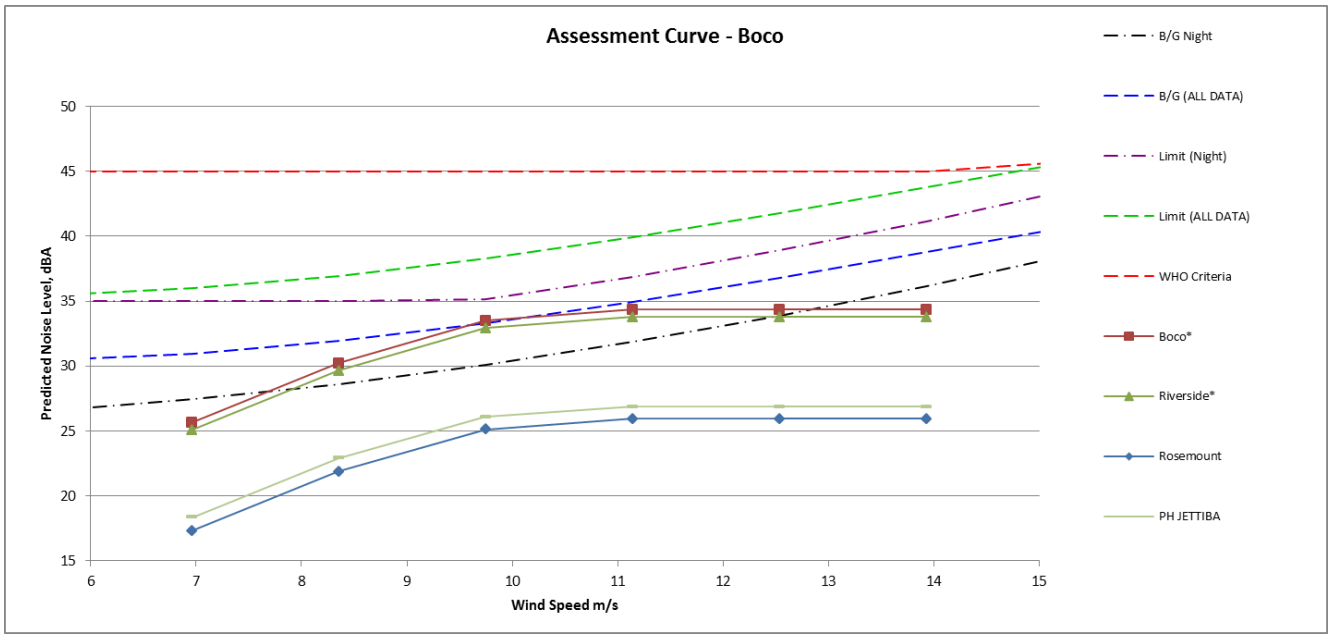
APPENDIX B

Noise Assessment Curves

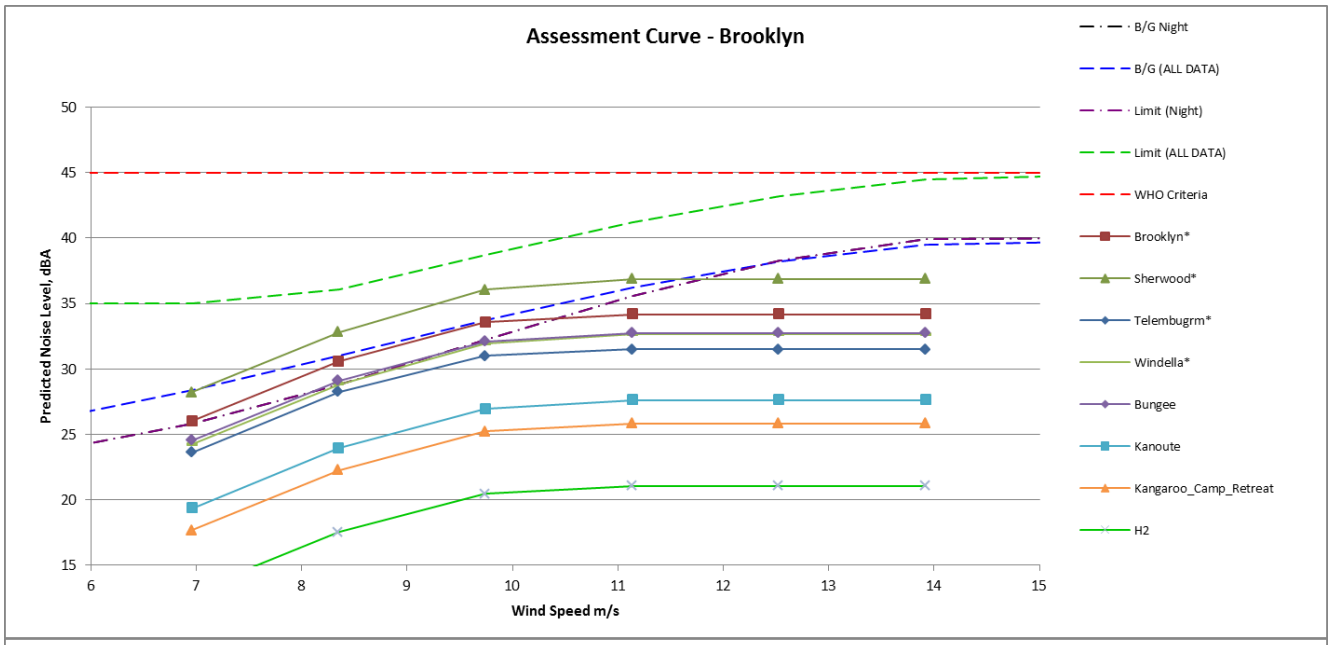
General Electric GE 5.3 MW - 158

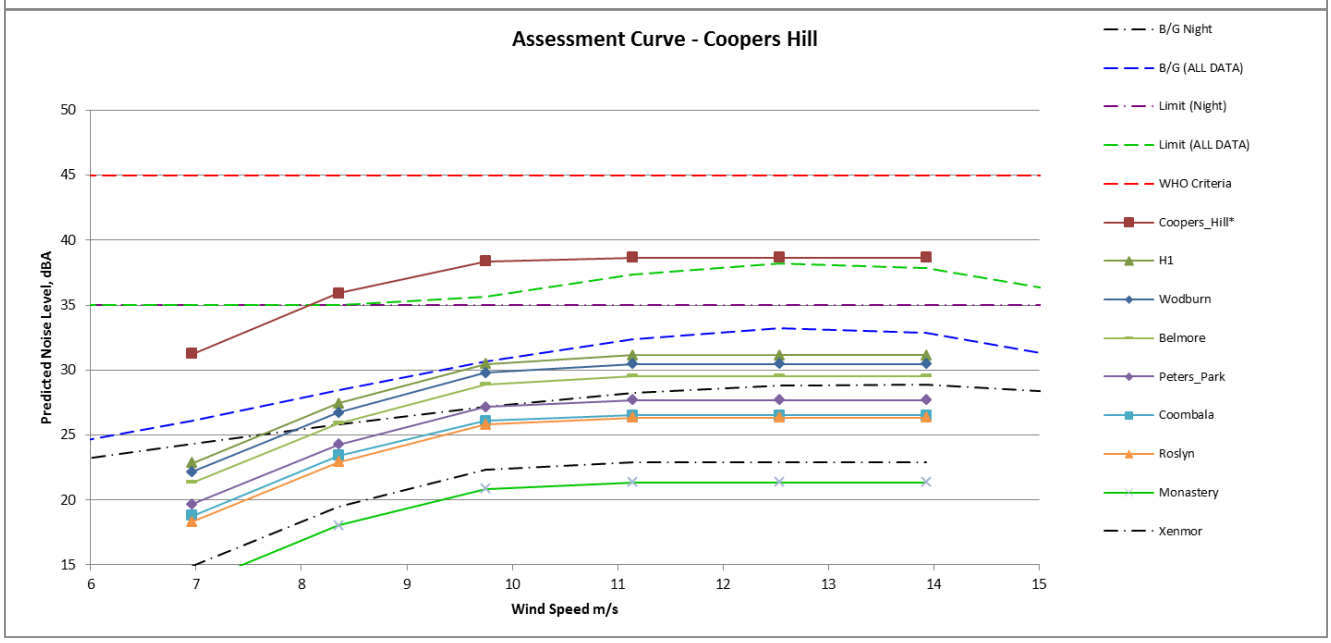
Assessment Curves: Stage Two Mod = General Electric 5.3 MW-158



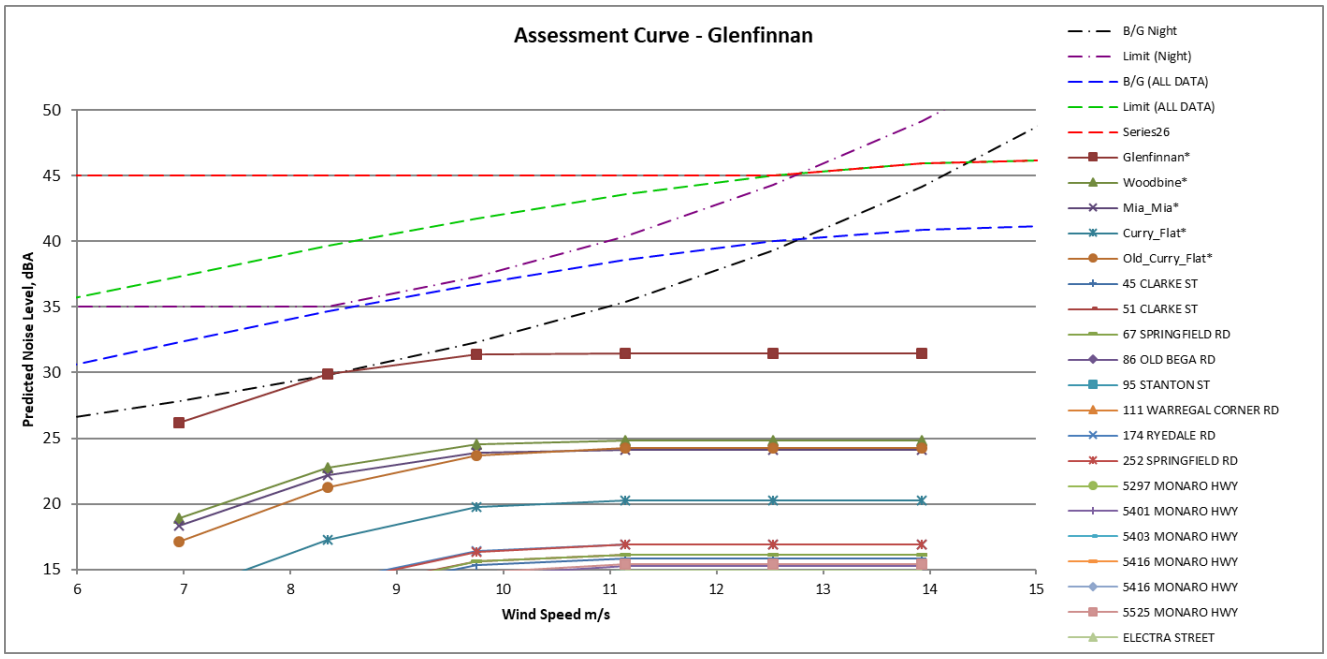


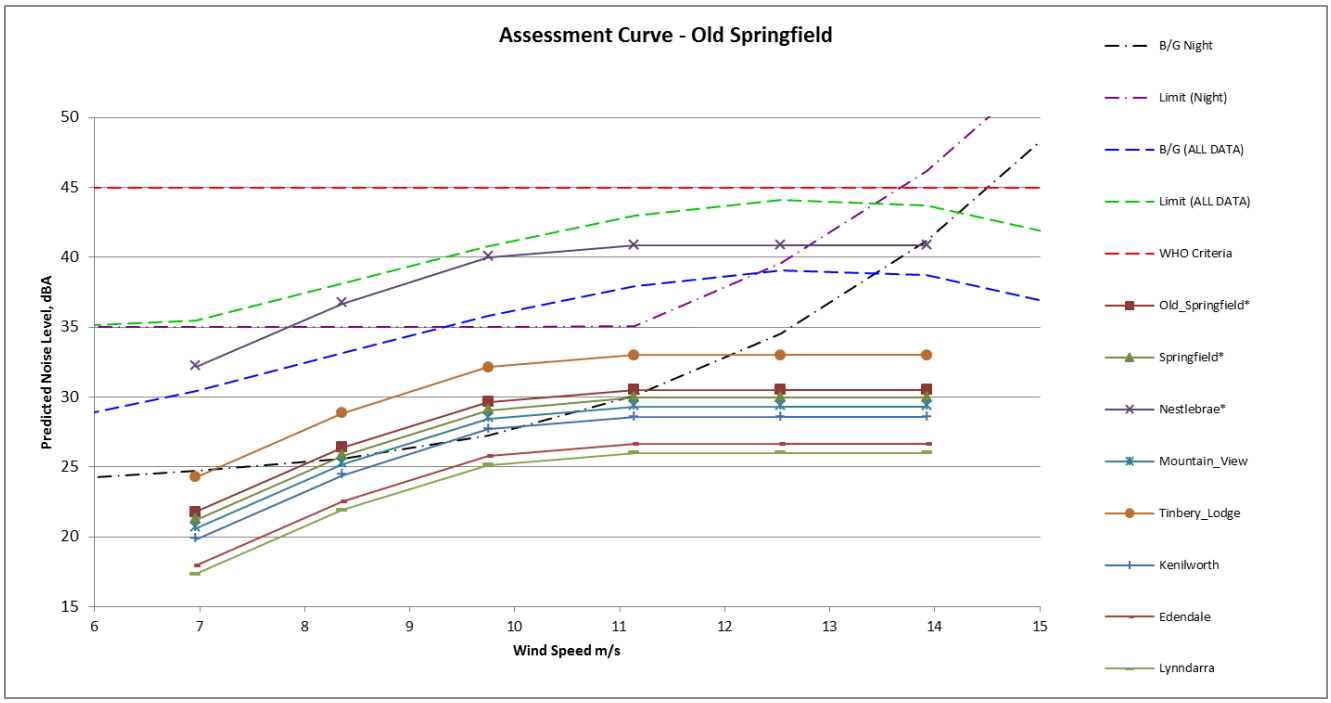
Assessment Curves: Stage Two Mod = General Electric 5.3 MW-158



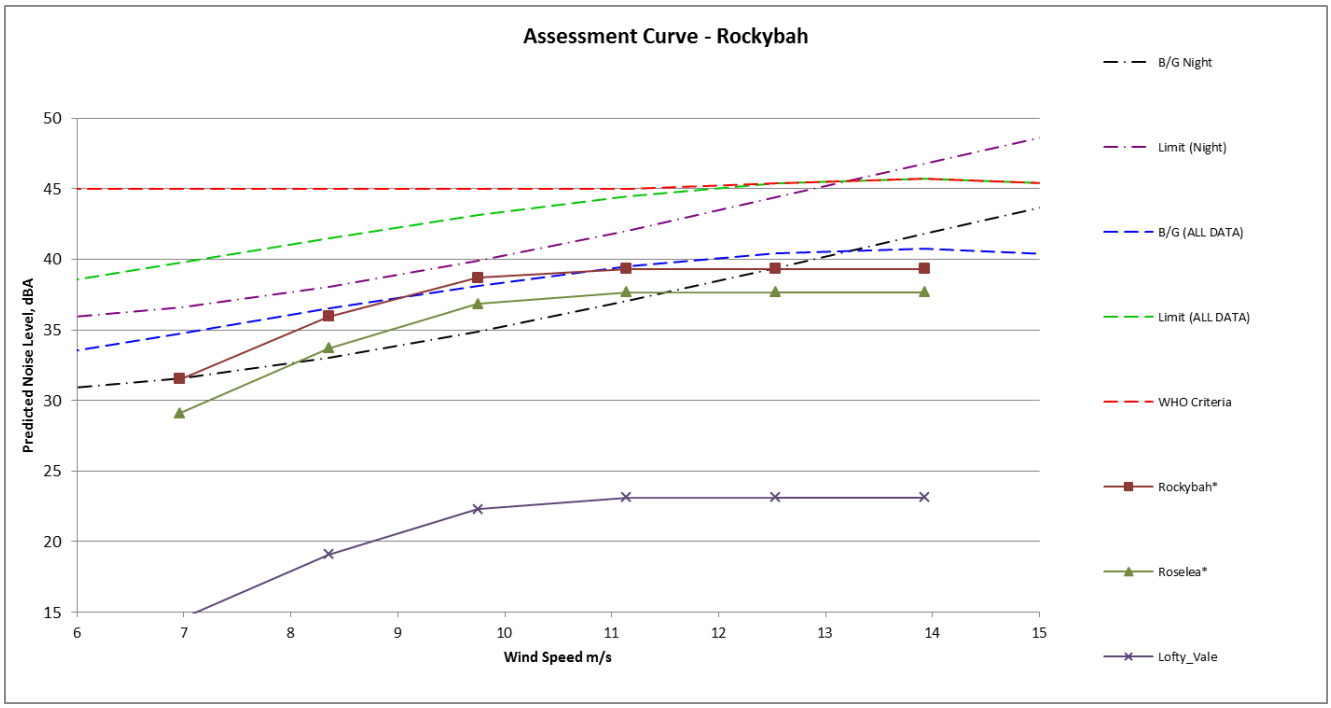


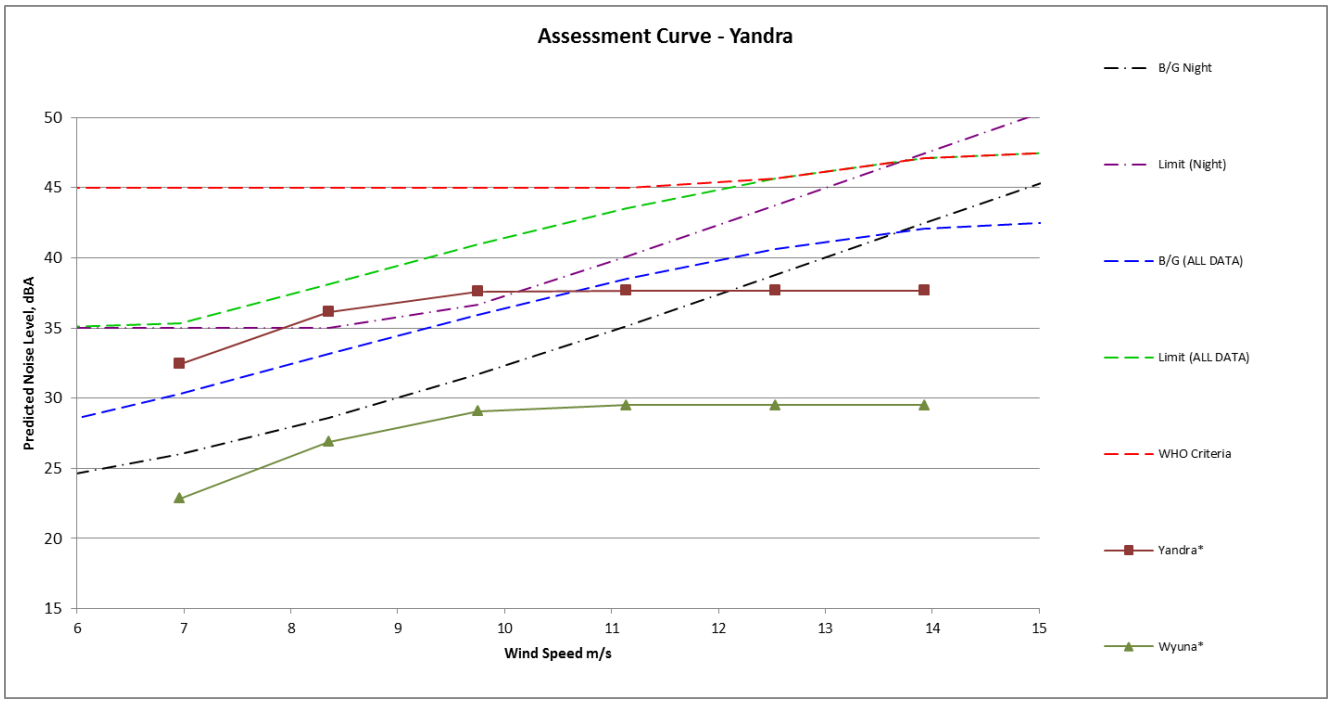
Assessment Curves: Stage Two Mod = General Electric 5.3 MW-158





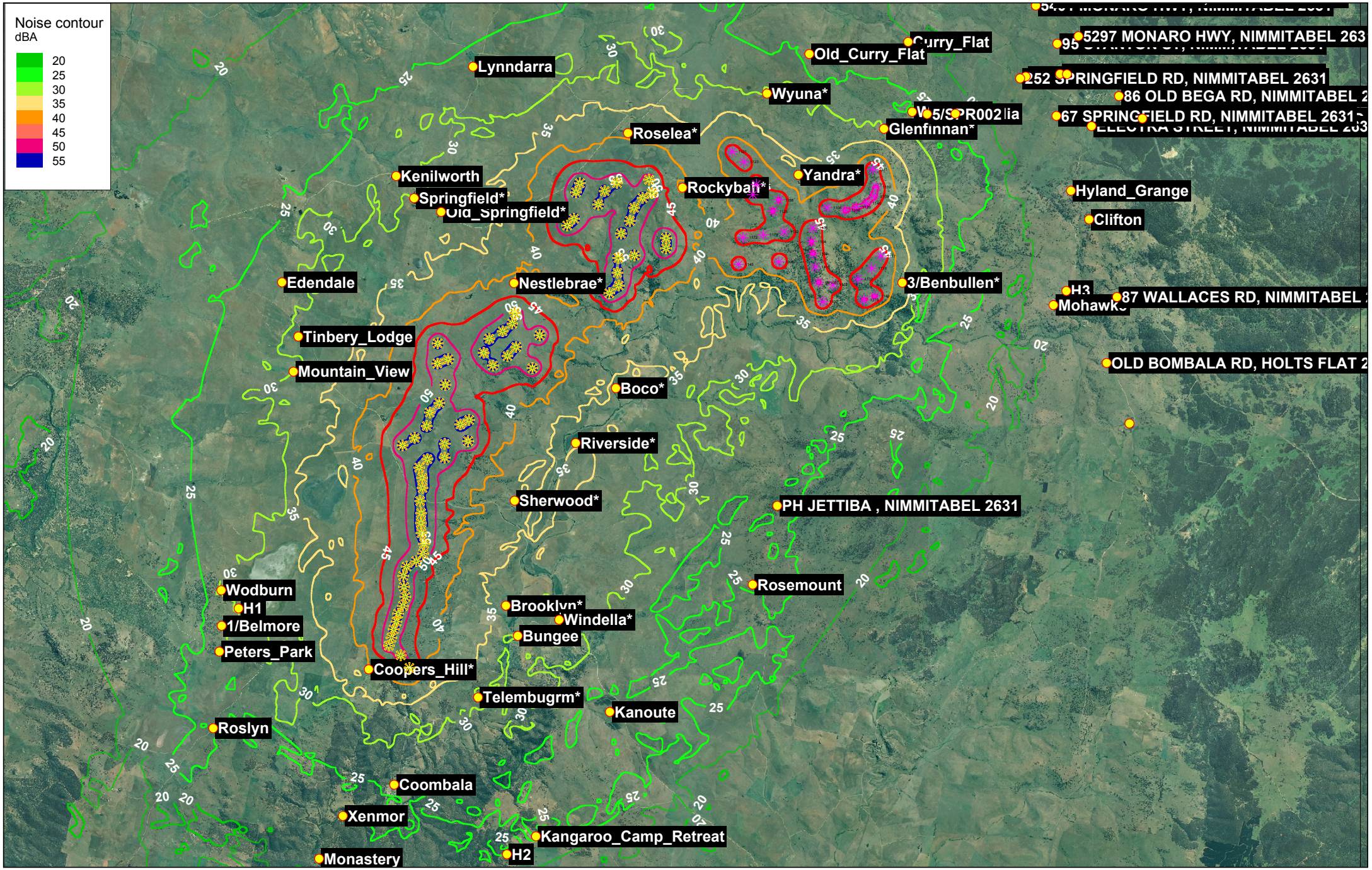
Assessment Curves: Stage Two Mod = General Electric 5.3 MW-158





APPENDIX C

Noise Contours



SLR

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Scale

0 0.5 1 2 3 4 km

ORIENTATION

N

LEGEND

- WTG Stage 1
- WTG Stage 2
- Receptor
- Limit 45dBA

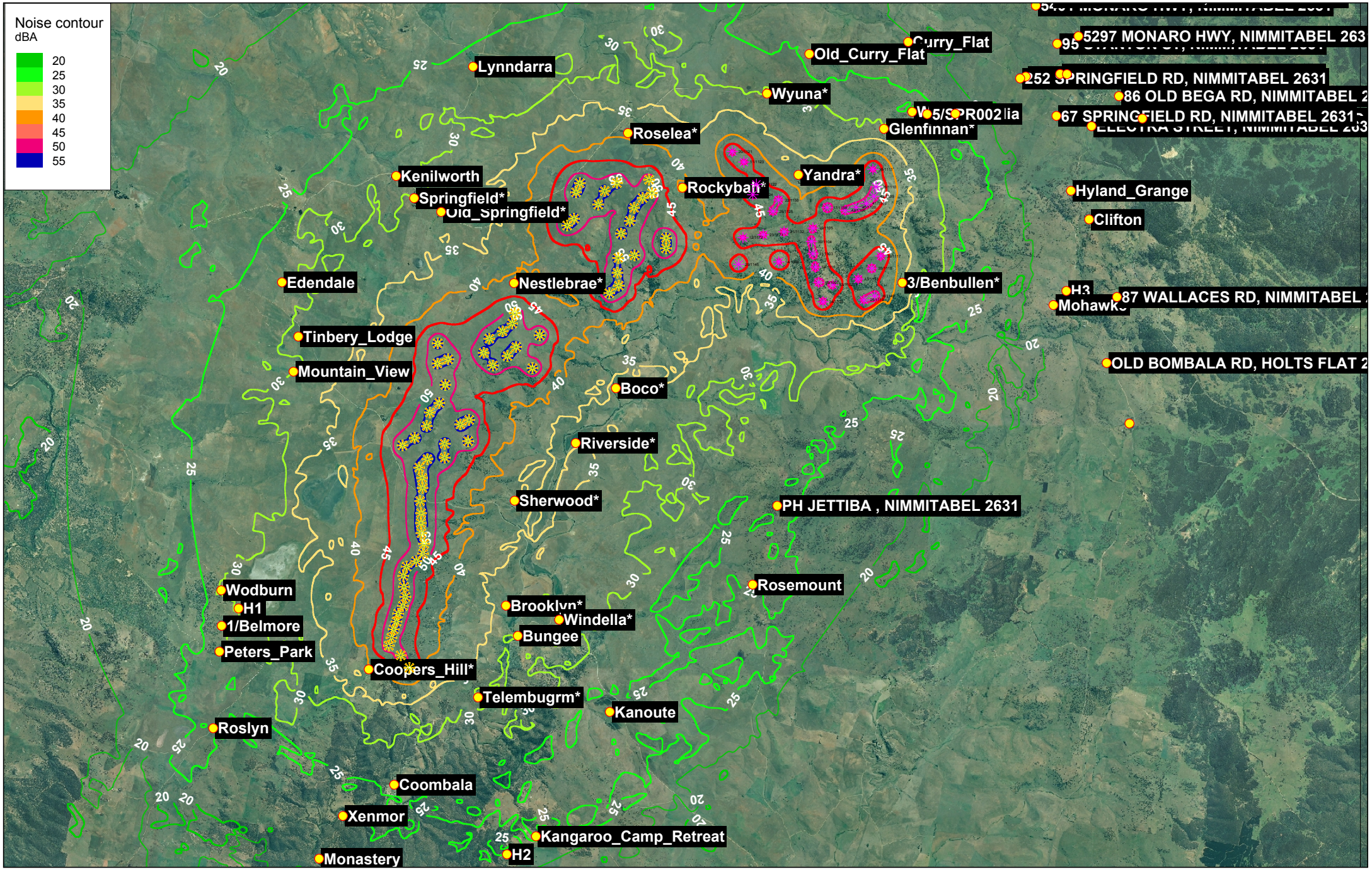
WIND SPEED
8 m/s at Hub height

PROJECT	Boco Rock Wind farm
CLIENT	Boco Rock Wind Farm Pty Ltd
DESCRIPTION	Stage 1 WTG (67 X GE 1.6MW & 1.7MW) Stage 2 WTG (30 x V150 4.2MW)

Date:	22-Aug-2018
Project No.:	640.11757
Report No.:	640.11757-R1
Prediction Method:	ISO 9613-2:1996
Prepared By:	BF
Prediction Height:	1.5 m

APPENDIX
C

MAP NO.
001



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Scale

0 0.5 1 2 3 4 km

ORIENTATION

N

LEGEND

- WTG Stage 1
- WTG Stage 2
- Receptor
- Limit 45dBA

WIND SPEED
8 m/s at Hub height

PROJECT	Boco Rock Wind farm
CLIENT	Boco Rock Wind Farm Pty Ltd
DESCRIPTION	Stage 1 WTG (67 X GE 1.6MW & 1.7MW) Stage 2 WTG (30 x GE 158 5.3MW)

Date:	22-Aug-2018
Project No.:	640.11757
Report No.:	640.11757-R1
Prediction Method:	ISO 9613-2:1996
Prepared By:	BF
Prediction Height:	1.5 m

APPENDIX
C

MAP NO.
002

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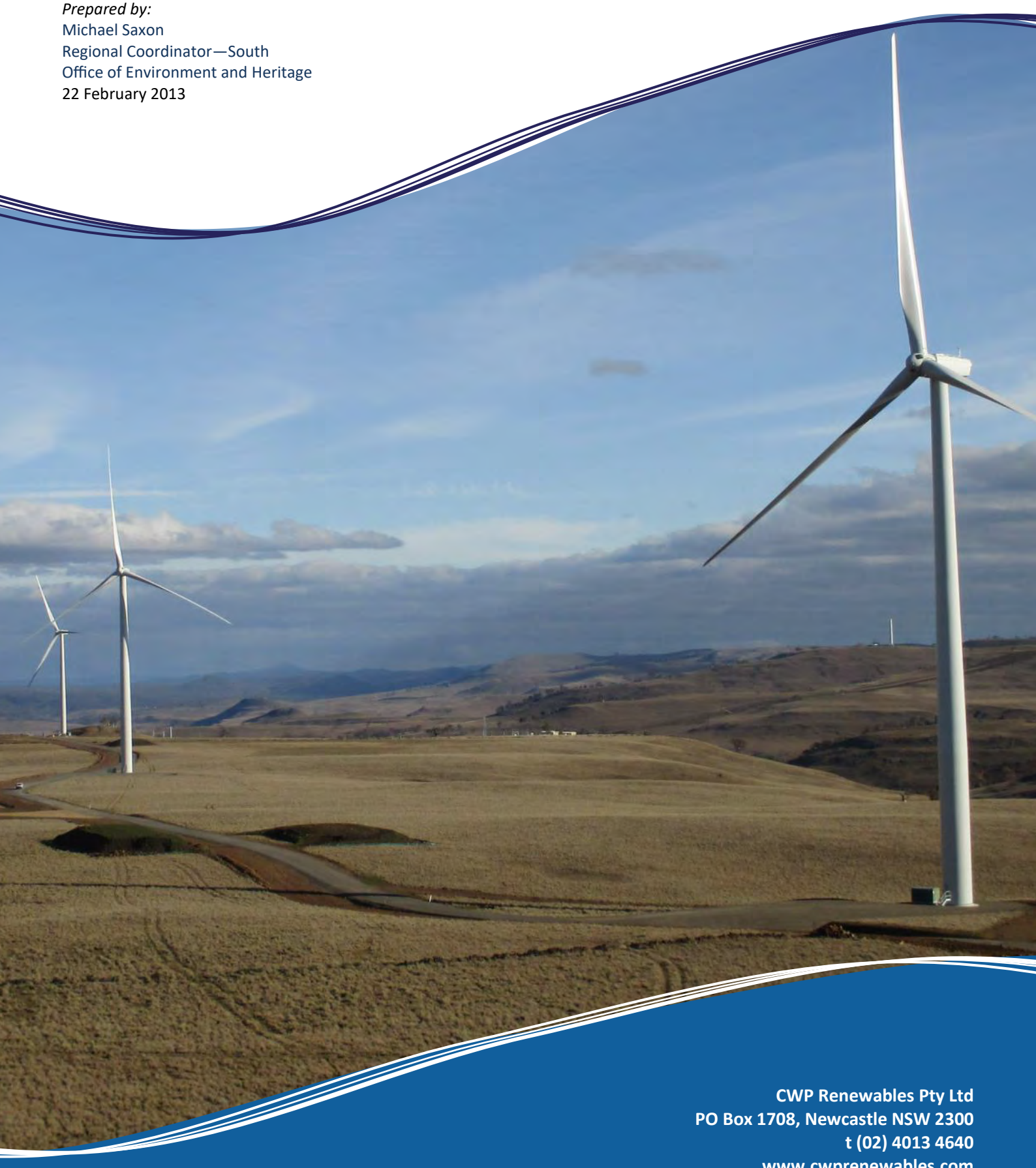
Appendix C – Letter from OEH regarding Biodiversity Offsets

Prepared by:
Michael Saxon
Regional Coordinator—South
Office of Environment and Heritage
22 February 2013



CWP Renewables Pty Ltd
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APPENDIX 2

NSW GOVERNMENT | Office of Environment & Heritage

Our reference: DOC14/122490

Boco Rock Wind Farm Pty Ltd

To whom it may concern,

This letter is to confirm and acknowledge that Boco Rock Wind Farm Pty Ltd have secured an environmental offset under the NSW Government's 'Biobanking' scheme for the Boco Rock Wind Farm (BRWF) project.

The offset consists of two properties over 1,100 hectares which have been purchased by BRWF. The offset meets the requirements for both Stage One (under construction) and all subsequent stages of the project (i.e. no further offsetting for Stage Two would be required).

The two offset properties contain Natural Temperate Grassland, with over 80% of each property considered to be of High conservation value. One of the properties provides known habitat for the critically endangered Grassland Earless Dragon, the Little Whip Snake and the Striped Legless Lizard. The other property provides high quality Natural Temperate Grassland including the Silky Swainson-pea and Snow gum woodland which is an endangered ecological community in NSW.

The offsets have been secured in perpetuity using a Biobanking agreement under the *NSW Threatened Species Conservation Act* 1995.
The offset properties will be managed to protect the conservation values of the Natural Temperate Grassland and habitat for Grassland fauna by a neighbouring landowner who has been engaged by BRWF to manage the properties.

The two offset properties combined area of 1,100 hectares will be largest area of Natural Temperate Grassland managed for conservation and secured in perpetuity in NSW.

It should also be noted that the Environment Protection Authority (EPA) has issued an environment protection licences for both the construction and operation of the Boco Rock Wind Farm as required under the *Protection of the Environment Operations Act* 1997 (POEO Act).

Please do not hesitate to contact me on 0427 231477 if you would like further information on this matter.

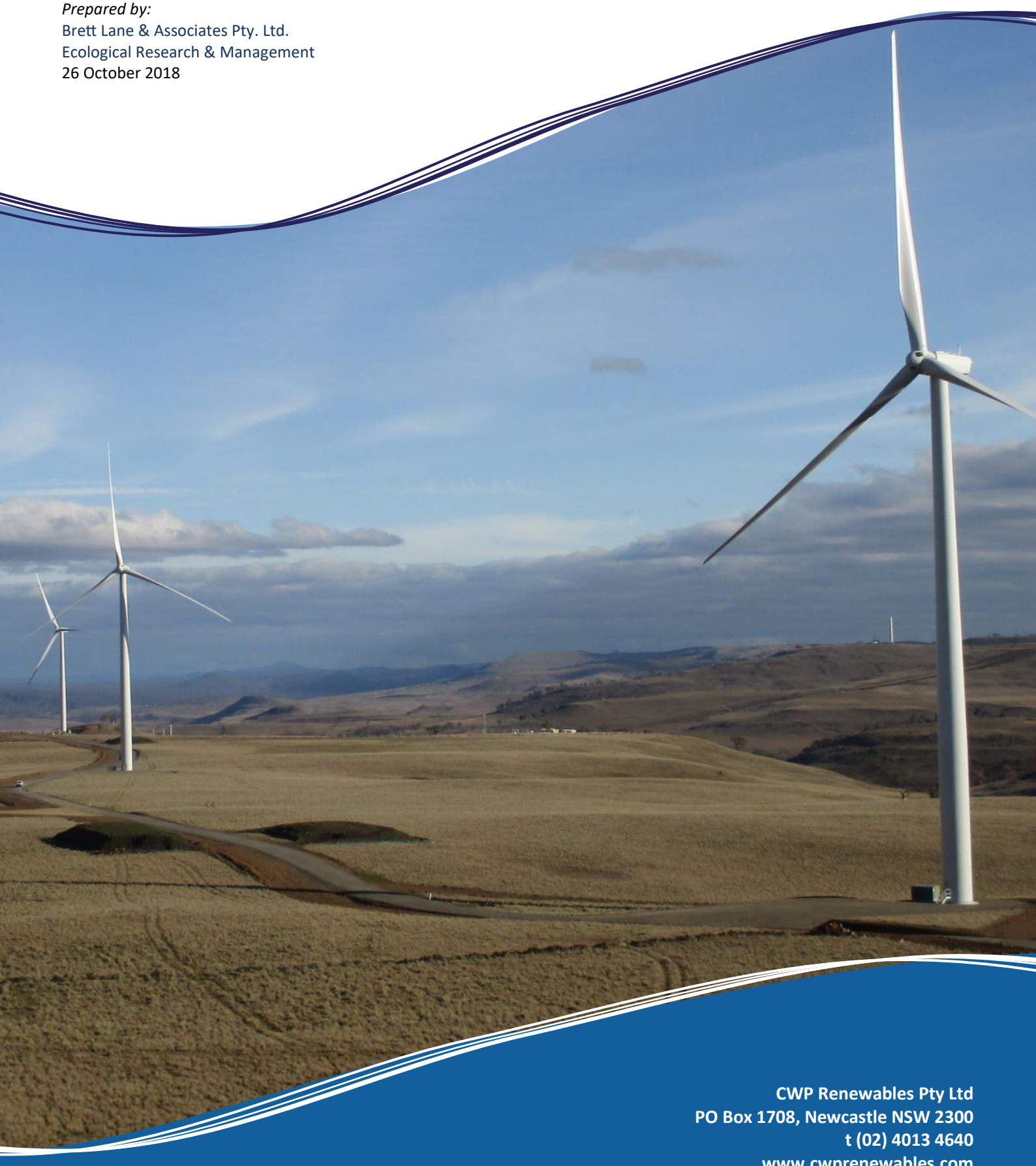
Yours sincerely

22.08.14

Michael Saxon
Regional Manager
South East Regional Operations
Office of Environment and Heritage

Appendix D – Bird and Bat Impact Study

Prepared by:
Brett Lane & Associates Pty. Ltd.
Ecological Research & Management
26 October 2018



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BOCO ROCK WIND FARM STAGE 2

MODIFICATION APPLICATION IMPACTS ON BIRDS AND BATS

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October 2018

Report No. 18179 (1.6)

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TABLES

APPENDICIES

1. INTRODUCTION

The Boco Rock Wind Farm (BRWF) is located approximately six kilometres west of Nimmitabel in the Bombola and Cooma-Monaro Shire local government areas in south-eastern New South Wales. It received planning approval in August 2010 (Minister for Planning). The Project Approval is for the construction and operation of up to 122 wind turbines.

Boco Rock Wind Farm Stage 1 is approved and is operational. Stage 2 of the wind farm is under detailed planning and this report assesses a modification to Stage 2 of the approved project.

The purpose of the modification application is to update the approval to accommodate fewer but larger wind turbine generators, whilst maintaining to minimise impacts and maximise the efficiency of the Project design.

In general, the proposed amendments involve:

- A reduction in the number of turbines within the Yandra cluster from 32 to up to 20;
- An increase in the size and capacity of turbines to 200 m tip height and c.160m rotor diameter consistent with current turbine technology; and
- An additional temporary construction compound within the Yandra cluster.

Two turbine locations will be removed from the plans. The 20 turbine sites to be constructed would be selected from the 30 remaining proposed locations in the Yandra cluster. We understand that no further alteration to the footprint of the Yandra cluster is required and, therefore, no additional impacts to biodiversity are anticipated, with the exception of rotor strike impacts arising from the proposed larger and higher turbines.

1.1. The proposed modification

In this report, RSA (rotor swept area) is defined as the zone encompassing the area of an operating wind turbine within which the blades rotate, defined in terms of an upper “maximum” and lower “minimum” rotor height, and a total circular swept area of the rotor. Table 1 shows the proposed changes to turbine specifications.

This document has been prepared to inform an application for modification of the Project Approval. It assesses the change in potential impacts on birds and bats from the increased size and height of the turbines.

Table 1: Proposed modifications to turbine specifications

Comparative RSA	Approval limits	Stage 1 (as built)	Boco cluster (approved)	Yandra cluster (approved)	Yandra cluster Modification (proposed)	Change in Yandra cluster
WTGs	122	67	23	32	20	12 less turbines
Upper RSA Height (m)	152	130	152	152	200	Increase in height by 48 metres
Lower RSA height (m)	-	30	30	30	40	Increase in minimum RSA height by 10 metres
Diameter (m)	104	100	104	104	160	56 increase in blades
Radius (m)	52	50	52	52	80	28 metre increase in radius
RSA (m^2)	8,495	7,854	8,495	8,495	20,106	11,611 increase in RSA / turbine
Total RSA (m^2)	*1,036,374*	*526,217*	*195,385*	*271,836*	*402,124*	*130,288 increase in RSA in Yandra cluster*

1.2. Assessment process

Initial ecological assessments of the project were undertaken by EcoLogical Australia Pty Ltd (ELA) (ELA 2009). ELA's assessment included a Desktop Assessment for threatened species and communities, flora and fauna surveys, targeted surveys, risk assessments and impact evaluation, and provides recommendations for mitigation measures.

Once operations commenced, a Bird and Bat Adaptive Management Plan (BBAMP) was implemented NGH Environmental (NGH) (2017a). Monitoring has been undertaken from 2015 yearly to 2018 which is on-going. Annual reports have been prepared for each completed year by NGH (2016, 2017b, 2018a, 2018b)

This report considers information from these previous investigations to assess the change in risk profile from the proposed modification as indicated in Table 1. The above-mentioned assessments provide baseline information on bird and bat species composition and utilisation at BRWF.

2. PREVIOUS INVESTIGATIONS

The following sections provides a summary of investigations undertaken relevant to the modifications proposed to BRWF Stage 2.

2.1. Pre-construction surveys 2008-2009

Initial ecological assessments were undertaken for BRWF by ELA (2009) and included a comprehensive assessment of all areas in which the wind farm various stages of development would occur.

The investigations relevant to the modification of turbines assessment are summarised below.

- Desktop assessment of threatened species likely to occur in the study area;
- Bird census, point method (20-60-minute surveys) undertaken between November-December 2008 and opportunistically from October 2008-April 2009 totalling, 60 person-hours across 13 sites on Yandra, 6 sites on Sherwins, 5 sites on Boco and 3 sites on Springfield;
- Call playback for owl Species and spotlighting between November-December 2008 totalling 8 call playback nights and 15.75 spotlighting hours; and
- Anabat detection for microbats totalling 30 Anabat nights.

Full methods for surveys can be reviewed in ELA (2009). The results of investigations are summarised below.

2.1.1. *Bird survey results*

A total of 76 bird species were recorded within the study area during the surveys. These species are listed in ELA (2009). Common species recorded included the Australian Magpie (*Gymnorhina tibicen*), Richards Pipit (*Anthus novaeseelandiae*), Australian Raven (*Corvus coronoides*), Crimson Rosella (*Platycercus elegans*), Red Wattlebird (*Anthochaera carunculata*), Eastern Rosella (*Platycercus adscitus eximius*), Striated Pardalote (*Pardalotus striatus*) and Brown Songlark (*Cincloramphus cruralis*).

One owl species was recorded; Southern Boobook (*Nixon novaseelandiae*).

Raptor species recorded included Nankeen Kestrel (*Falco cenchroides*), Wedge-tailed Eagle (*Aquila audax*) and Brown Falcon (*Falco berigora*). The Peregrine Falcon (*Falco peregrinus*) was recorded on one occasion adjacent to the study area.

Habitat for wetland birds was present across the project site as the site comprises wetlands, which were dry during the survey period. However, during wet periods they were considered likely to be a valuable resource for many birds and foraging habitat for bats.

One threatened species was recorded on site, namely the Diamond Firetail (*Stagonopleura guttata*).

White-bellied Sea Eagle (*Haliaeetus leucogaster*) was recorded within the study area. This species was listed as marine at the time of assessment but has since been listed as vulnerable under the *Biodiversity Conservation Act 2016* (BC Act).

A full list of threatened species for which habitat occurs within the search region is listed in ELA (2009) along with an assessment of the likelihood of their occurrence. Threatened bird species for which the study area is likely to provide potential habitat include: Brown Treecreeper (*Climacteris picumnus victoriae*), Gang-gang Cockatoo (*Callocephalon fimbriatum*), Hooded Robin (*Melanodryas cucullata cucullata*), Barking Owl (*Ninox connivens*), Powerful Owl (*Ninox strenua*) and Blue-billed Duck (*Oxyura australis*).

2.1.2. *Microbat surveys*

Habitat for Microchiroptera (small, insect-eating) bats is present across the study area and ten species were recorded foraging across both grassland and woodland areas. Woodland areas were more commonly used. Bat activity was generally low across the site, with an average number of calls recorded each night of 18.

Common bat species recorded included; Gould's Wattled Bat (*Chalinolobus gouldii*), Chocolate Wattled Bat (*Chalinolobus morio*), Long-eared Bat spp., White-striped Freetail Bat (*Austronomus australis*), Large Forest Bat (*Vespadelus darlingtonia*), Southern Forest Bat (*Vespadelus regulus*) and Little Forest Bat (*Vespadelus vulturnus*).

BC Act listed bat species recorded included Eastern False Pipistrelle (EFP) (*Falsistrellus tasmaniensis*) and Eastern Bentwing Bat (EBB) (*Miniopterus schreibersii oceanensis)*. The Yellow-bellied Sheathtail-bat *(Saccolaimus flaviventris*) was considered to have the potential to occur.

2.2. Bird and Bat impact operational monitoring

Monitoring of the impacts on birds and bats at BRWF Stage 1 has been undertaken consistent with the BBAMP for three years and is currently underway for a fourth year. Each year has included additional bird utilisation surveys and Microbat surveys along with carcass searches around turbines, including cleared hard-stand areas.

The results of BBAMP implementation are summarised below.

2.2.1. *Year 1 (NGH 2016)*

A total of 34 carcasses were detected at BRWF between January and December 2015 from monthly mortality surveys, additional mortality searches, and incidental finds. The carcasses found comprised of 23 bats (including 1 threatened bat) and 11 birds.

Of note were 3 individuals of 2 raptor species (Wedge-tailed Eagle (WTE) and Nankeen Kestrel) and 17 White-striped Freetail Bats which comprised 74% of the bat finds. Four carcasses of the threatened Eastern Bentwing bat were found: three in January and March 2015 and one in May 2015. Some additional observations of the monitoring were:

Post-construction bird utilisation surveys indicated little change in bird activity and abundance from the pre-construction surveys.

Four calls of the threatened EBB and two calls of the threatened EFP were detected.

2.2.2. *Year 2 (NGH 2017b)*

Mortality surveys in 2016 found 25 carcasses, comprising 18 microbats and seven birds. No threatened species were found in mortality surveys in 2016. The White-striped Freetail Bat was found with the highest frequency (11 carcasses found), followed by Gould's Wattled Bat (6) and Eurasian Skylark (4).

Bird utilisation surveys in 2016 recorded 76 bird species; a total of 90 bird species when opportunistic observations are included. The Eurasian Skylark (an exotic species) is the most abundant bird (334 observations), followed by Australian Magpie (104) and Little Raven (85).

Anabat surveys in 2016 identified 11 species of microbat at BRWF. The most frequently recorded microbat was the Southern Freetail Bat (2981 call files), followed by Chocolate Wattled Bat (870) and Southern Forest Bat (706). Bat activity at BRWF (as measured by number of calls identified) was highest in April with 53% of total activity recorded that month. Analysis indicates that the activity levels of White-striped Freetail Bat; Eastern Bentwing Bat and the Bentwing Bat/Forest Bat complex was similar in 2015 and 2016.

A review of the higher risk species nominated in BBMP v1.2 suggested that the majority of these species are unlikely to be at a high risk of collision mortality at BRWF. However, further review is required.

A review of the location of collision, i.e. are fatalities occurring at turbines considered at higher risk, identified that mortalities at BRWF have occurred more or less equally at turbines considered as higher risk and lower risk. This suggests the assumptions underpinning risk assignment (that turbines located close to prominent topographical features pose greater risk) is not correct, at least not at BRWF.

2.2.3. *Year 3 (NGH 2018a)*

Twenty-seven carcasses were found during mortality surveys in 2017, comprising 17 microbats and 10 birds. No threatened species were found during mortality surveys in 2017. No waterbirds were found during mortality surveys in 2017. White-striped Freetail Bat was found with the highest frequency (12 carcasses), followed by Gould's Wattled Bat (5) and Eurasian Skylark (3).

During bird utilisation surveys, 87 bird species were recorded in 2017, taking the total for the site to 118 species. Of these, 73 species were recorded during utilisation surveys and 26 were recorded opportunistically.

Eastern Bentwing Bat was recorded during bat detector surveys, with a low number of passes (1 – 14) in March, October and November. The most frequently recorded species was Gould's Wattled Bat with more than 1000 passes recorded throughout the year. White-striped Freetail Bat was recorded 155 times. No bats were recorded in August (winter) and very few recordings were made in April, a cold month in 2017.

The report concluded that Eastern Bentwing Bat is not an abundant species at BRWF and the wind farm does pose a significant risk to its population.

2.2.4. *Year 4 (NGH 2018b)*

Six bird carcasses and three bat carcasses were found in the first half of 2018. No raptors, waterbirds or threatened species were found in carcass searches.

2.2.5. *Eastern Bent-wing Bat risk analysis*

NGH (2017c) have undertaken an EBB risk analysis based on the further surveys undertaken for the post-construction bird and bat monitoring at BRWF. Full methods and analysis for the assessment can be found in NGH (2017c).

A risk assessment and updated Assessment of Significance were undertaken for the species. The operating wind farm is considered unlikely to result in a significant impact for the local population of EBB. On the basis of all information obtained to date, including extensive literature review and targeted surveys, the BRWF is assessed to pose a moderate risk to EBB. Ongoing monitoring in accordance with the BBMP will be sufficient to trigger further investigation or actions if further carcasses are identified.

3. IMPACTS ON BIRDS AND BATS FROM PROPOSED MODIFICATION

3.1. Changes in RSA at various height bands

The approved and modified turbine dimensions are provided in Table 1 above. As noted in Section 1, there are no changes proposed to the dimensions of the 67 operations turbines in Stage 1, or the 23 approved Boco cluster turbines.

Within the Yandra cluster the proposed change in the area of RSA for an individual turbine at various height bands is analysed and presented in Table 2 below.

Table 2 Change in RSA at each height range per turbine in Yandra cluster

Height range (m)	RSA of 100 m diameter blades between 30m-130m (m^2)	RSA of 160 m diameter blades (m^2) between 40m-200m	Change in area of exposure /turbine (m^2)	Incremental % change in RSA area
Ground				
0-10				
10-20				
20-30	-			
30-40	409		- 409	-100%
40-50	709	523	- 186	-26%
50-60	864	927	64	7%
60-70	952	1,159	207	22%
70-80	993	1,321	328	33%
80-90	993	1,437	444	45%
90-100	952	1,519	567	60%
100-120	1,573	3,166	1,593	101%
120-140	409	3,166	2,758	675%
140-160	-	2,956	2,956	Large
160-180	-	2,480	2,480	Large
180-200	-	1,451	1,451	Large
Total	**7,854**	**20,106**	**12,252**	**156%**

These changes would potentially lead to a corresponding change in collision risk to birds and bats that fly within each RSA height band for an individual turbine. In relation to the change the following points are noted:

- Between 30-40 the modification will remove RSA from this height band resulting in a removal of risk to birds and bats flying between 30-40 metres in Yandra cluster;
- Between 40-50 metres the modification will reduce the area of RSA in this height band by 26% resulting in a decrease in risk to birds and bats flying between 40-50 metres in Yandra cluster;
- Between 50-100 metres the increase in RSA area is approximately 64-567 m^2 per turbine. This will incrementally increase risk to those species flying at these heights in Yandra cluster, however this is an area where fewer birds and bats are recorded compared to below 50 metres; and
- Over 100 metres in height is the area where there is greater change in risk to birds and bats in Yandra cluster. The risk of collision will increase, however there are few flights at these heights. If collisions do occur area typically high-flying bat species and higher-flying birds, e.g. raptors and the White-throated Needletail. These are discussed in the following section.

The table below considers the cumulative change in RSA within the full wind farm as a result of the proposed modification considering the change in rotor dimensions and number of turbines as outlined in table 1 (including the change in the number of turbines from 32 to 20).

Table 3: Cumulative change in RSA in height bands as drawn from specifications in table 1 (note approved turbines are modelled as indicated below)

Height range (m)	Approved turbines (104 m diameter) with 122 turbines	Installed Stage 1 = 67 turbines (100 m diameter)	Boco cluster approved (104 m diameter) with 23 turbines	Yandra cluster mod = 20 turbines (160 diameter	Revised totals with modification (67+23+20) 110 turbines	Incremental change between approved and modified project m2	Incremental change between approved and modified project %
Hub Height*	82m	80 m	82 m	120 m			
0-10							
0-10							
10-20	-						
20-30	-	-					
30-40	50,923	27,390	9,600	-	36,990	- 13,933	-27%
40-50	88,572	47,530	16,698	10,464	74,692	- 13,880	-16%
50-60	108,129	57,855	20,385	18,548	96,787	- 11,342	-10%
60-70	119,670	63,784	22,561	23,183	109,528	- 10,142	-8%
70-80	125,526	66,551	23,665	26,420	116,636	- 8,890	-7%
90-100	249,100	130,335	46,961	59,119	236,416	- 12,684	-5%
100-120	211,158	105,384	39,808	63,327	208,520	- 2,638	-1%
120-140	83,302	27,390	15,704	63,327	106,421	23,119	increase
140-160	-	-	-	59,119	59,119	59,119	increase
160-180	-	-	-	49,604	49,604	49,604	increase
180-200	-	-	-	29,012	29,012	29,012	increase
Total	**1,036,378**	**526,218**	**195,383**	**402,124**	**1,123,725**	**87,347**	**8%**

*A range of hub heights were assessed in the original Environmental Assessment. For the purpose of this analysis, the hub height for the approved Project is conservatively considered to be 81 m

Cumulatively, these changes will potentially lead to a corresponding change in collision risk to birds and bats that fly within each RSA height band. In relation to the change the following points are noted:

- Between 30-40 metres the cumulative area of the RSA in this height bands will be decreased by 27% with a reduction in risk to birds and bats. This is an area where a higher level of birds and bat activity is recorded compared to higher heights where birds and bats may fly;
- Between 40-100 metres cumulatively there will be a decrease in RSA across the wind farm between 1% and 16% when compared to the approved turbines. This is an area where higher flying species of birds and a few species of bats are recorded; and
- Over 100 metres in height the risk to birds and bats will incrementally increase, albeit with fewer turbines. There are few flights at these heights, however if they do occur area typically high-flying bat species and higher-flying birds, e.g. raptors and the White-throated Needletail. These are discussed in the following section.

3.2. Consideration of the modification impacts in relation to the Biodiversity Conservation Act and Regulations

The Biodiversity Conservation Act 2017 Section 1.5 details the biodiversity and biodiversity values for the purpose of the act

> *1.5 Biodiversity and biodiversity values for purposes of Act*
>
> *(1) For the purposes of this Act, biodiversity is the variety of living animal and plant life from all sources, and includes diversity within and between species and diversity of ecosystems.*
>
> *(2) For the purposes of this Act, biodiversity values are the following biodiversity values:*
>
> > *(a) vegetation integrity—being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state,*
> >
> > *(b) habitat suitability—being the degree to which the habitat needs of threatened species are present at a particular site,*
> >
> > *(c) biodiversity values, or biodiversity-related values, prescribed by the regulations.*

The Biodiversity Conservation Regulations 2017 in part 1 Section 1.4 outlines additional biodiversity values for the purpose of Act (section 1.5 of the Act)

The following are prescribed as additional biodiversity values for the purposes of the Act:

> *(a) threatened species abundance—being the occurrence and abundance of threatened species or threatened ecological communities, or their habitat, at a particular site,*
>
> *(b) vegetation abundance—being the occurrence and abundance of vegetation at a particular site,*

> *(c) habitat connectivity—being the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range,*
>
> *(d) threatened species movement—being the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle,*
>
> *(e) flight path integrity—being the degree to which the flight paths of protected animals over a particular site are free from interference,*
>
> *(f) water sustainability—being the degree to which water quality, water bodies and hydrological processes sustain threatened species and threatened ecological communities at a particular site.*

The Modification provides an analysis of the on-ground impacts to biodiversity values. It identifies that there will be a net reduction in clearing of all vegetation and habitat types across the Yandra cluster. There are no proposed changes to infrastructure for Stage 1 or the Boco cluster and therefore overall the vegetation impacts across the Project area will be reduced. Thus, vegetation integrity and vegetation abundance are not further assessed in this report as they are addressed in the main body of the Modification.

The sections below consider the impacts to biodiversity values described above insofar as they relate to birds and bats of conservation concern.

The potential impacts of the proposed Modification on these species from any impacts caused by the proposed Modification are considered below. The impacts have been assessed using the biodiversity values as identified in Section 1.4 of the Biodiversity Conservation Regulation 2017 as outlined on the previous page.

3.3. Potential impacts on bird species

The previous ecological assessment of the project (ELA 2009) indicated the occurrence or potential occurrence of 25 EPBC Act and TC Act listed bird and bat species on the site. Ten of these were assessed as unlikely to occur.

Updated Protected Matters Search Tool (DoEE 2018a) search and NSW Bionet Search (OEH 2018b) indicated the occurrence or potential of occurrence of 19 bird or bat species listed under the EPBC Act and 16 species listed under the BC Act 2016. The search area was taken as a point from the approximate centre of the proposed stage 2 development (-36.5448 S, 149.2112 E), buffered with a radius of 20 kilometres. Marine and coastal species are not considered here as the project is approximately 75 kilometres from the coast and is unlikely to impact these species.

The potential impacts on these species, from the proposed Modification are considered below, considering the biodiversity values described under Section 1.5 of the BC Act and Section 1.4 of the BC Reg. A table is provided for each species summarising changes in impacts against each of these values.

3.3.1. *EPBC Act listed threatened species*

- **Australian Bittern (Endangered)**

Prefers terrestrial wetlands, including a range of wetland types but prefers permanent water bodies with tall dense vegetation, particularly those dominated by sedges, rush, reeds or cutting grass (Marchant & Higgins 1990).

ELA (2009) classified all wetlands as degraded and ephemeral. This is not preferred habitat for this species and it is unlikely to occur in the study area or be affected by modifications.

Biodiversity Value Criterion	Description
Summary of change	No significant change in impacts
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	The overall impacts area of habitat are not affected as this species prefers wetlands which are not present in Yandra cluster. Thus, there is no change in impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- **Painted Honeyeater (Vulnerable)**

Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum and Box-Ironbark forest. Is a specialist feeder on the fruits of Mistletoe growing on woodland eucalyptus and acacias (OEH; 2018b).

It is not known from the area and is considered unlikely to occur.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not known from the area. Any potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. This is not likely to impact on the movements of this species as it would occur infrequently over the site. There will be no RSA between 30-40 metres in the Yandra cluster.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

3.3.2. *EPBC Act listed migratory species*

- Rufous Fantail

This species usually occurs in wet habitats such as eucalyptus forest and subtropical and temperate rainforest (DoEE 2018b). When migrating it will sometimes pass through areas of dry forest and woodland and parks and gardens. This species breeds in south-east Australia during summer and heads north for the winter returning in the spring time. This species is usually observed lower down in the shrub layer and does not regularly fly at RSA heights.

Collisions are considered unlikely and resulting impacts to be negligible on the species' population. Modifications to the RSA are unlikely to increase risk to this species.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity. The turbines will not present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted.
(e) flight path integrity	No change in impacts; not recorded to occur in the study area. Strictly a woodland species and unlikely to fly high or be impacted by changes in turbine dimensions. There will be no RSA between 30-40 metres in the Yandra cluster reducing potential imapcts.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- Glossy Ibis

One record of this species exists in the study area and so it has the potential to occur within the wind farm site. The species prefers freshwater inland wetlands: in particular, permanent or ephemeral water bodies and swamps with abundant vegetation (Marchant & Higgins 1990). As wetland habitat within the site is considered to be degraded (ELA 2009), it is not preferred habitat and so unlikely to attract large numbers of the species to the site. This species movements are erratic and it occurs occasionally in south eastern Australia after inland breeding events and during droughts.

As a small number may occur in the study area occasionally, there is a low risk of collision with turbines. A change in lower minimum RSA from 30 to 40 metres for the 20 turbines in Yandra cluster, combined with a reduced cumulative RSA up to 100 metres is not likely to increase risk.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths. No changes in connectivity; turbines do not form a barrier between habitats of this species.
(d) threatened species movement—	No change. Fewer turbines will present fewer potential barriers to flight paths. Strictly a wetland species may fly high between wetlands. Could be impacted by changes by increased RSA above 100 metres. However, species considered as rare and has been recorded only once in past surveys.
(e) flight path integrity	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- White-throated Needletail

The White-throated Needletail was not recorded at BRWF during the initial surveys and were considered unlikely to occur (ELA 2009). It is listed as 'migratory' under the EPBC Act. It is a common species that migrates from its breeding grounds in north-east Asia then ranges over much of eastern Australia during its non-breeding season and (Higgins 1999). The Needletail is an aerial insect eater that forages over all habitat types with a preference for wooded areas, including open forest and rainforest (Higgins 1999). In Australia, its occurrence often coincides with weather fronts as wind increases the abundance of insects lifted into the air. Therefore, it is considered to pass through the wind farms site occasionally on migration in search of food. Its use of the site is transitory and brief in summer and early autumn.

As the species regularly flies at RSA height, occasional casualties are known from wind farms in south-eastern Australia (BL&A, unpublished data). Indeed, one individual has been recorded to date colliding with a wind turbine at other sites.

The increase in both the total RSA and its height will increase the number of WTNT flights potentially at risk of collision. However, the overall increase in total cumulative RSA is only 8% and much of this increase will be higher than 100 metres. As this species is considered secure at a population scale, the potential for a significant impact from the proposed modification is considered low.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site. This species is not listed as a threatened species. Potential interaction between turbines and this species will increase with the higher total RSA above 100 metres, however the population of this species is considered as secure.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is potentially less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths. The slight obstruction to airspace is not likely to impact the species' activity on the site significantly.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced

	by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site. The increased RSA extent will lead to a slightly greater impact on the flight behaviour of this species. However, the spacing of turbines is such that the project will not create a barrier to its movement across the site.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. Monitoring for past four years did not record the species regularly or find it among casualties. Strictly aerial species and migratory. The modification is likely to increase risk to this species as the area of RSA will increase above 100 metres. This may increase the risk of collision but the infrequency of observations and the lack of carcass finds to date indicates the site is in a low risk area for this species compared to wind farms elsewhere (BL&A, unpubl. data). Infrequent collisions are unlikely to impact the species to the extent that the population, which is secure, would be significantly affected.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.
Summary of change	Moderate increase in impact area as RSA above 100 metres will increase. This is the height at which this species flies. Population is not threatened so small increase in collision numbers would not affect the population significantly.

3.3.3. *Listed species under the Biodiversity Conservation Act 2016*

- **Blue-Billed Duck and Freckled Duck**

Blue-billed Duck has the potential to occur in the study area and Freckled Duck has been recorded during BUS surveys (NGH 2017b) in the study area. ELA (2009) states that there is potential for wetland species to be impacted by turbines whilst moving between wetlands in the study area. The majority of major wetlands in the region are to the west of the project area so collision risk is considered low. The wetlands in the study area are ephemeral and so do not always provide habitat, so these species are unlikely to be at risk when water is absent.

However, records for both species in the study area are scarce which indicates that significant numbers are not likely occur regularly. Thus, the likelihood of collision with turbines is very low. The proposed modifications are unlikely to have a significant impact on the populations of these two species.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. No change in impacts on wetlands
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. The wetland habitat these species use are degraded and not common on-site. Thus, overall there is no change in suitable habitat for this species as a result of the modification.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. Strictly wetland species but likely to fly between wetlands. Could be impacted by changes in turbine dimensions as area of RSA increase above 100 metres. The species are rather rare and have been recorded only occasionally in past surveys.

(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- **Spotted Harrier**

One recent record exists in the search region for this species, and it has been observed on site during BUS surveys in 2018 (NGH 2018b). It prefers open woodlands that do not obstruct low flight, and natural and exotic grasslands in arid and semi-arid areas (Higgins & Davies 1996). Suitable habitat exists on site so it has the potential to occur within the wind farm. It mainly exhibits low flight but can fly at height. Increasing the height of the RSA may not significantly change the risk to this species given it often flies low. It is also at a low risk from collision as it does not occur frequently.

Given the paucity of records in the search region it is unlikely that this species occurs in the study area frequently or in significant numbers. Whilst the species may collide with turbines this is unlikely to be more than a rare occurrence and is not expected to have a significant impact on the species' population.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.

(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. No significant change in impacts is expected as the species occurs infrequently on the site and flies more often below RSA height and there is less overall RSA below 100 metres.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- Gang-gang Cockatoo

This species occurs in summer generally in tall mountain forests and woodlands, particularly in heavily timbered, mature wet sclerophyll forests and woodlands. It prefers *Eucalyptus* dominated vegetation, including subalpine snow gum woodlands. It occurs occasionally in temperate rainforests and regenerating forests. In winter it occurs at lower altitudes in drier, more open *Eucalyptus* woodland (Higgins 1999) and farmland with treed vegetation nearby.

This species was recorded in the study area during bird and bat monitoring surveys in 2015 (NGH 2016), and some records exist within the wider search region. Observations at other wind farms have shown that this species typically flies at or below canopy height (approximately 30 metres) (BL&A unpubl. data) and may fly at greater heights when moving between habitats.

The overall risk to the species is considered to be reduced by the modification as overall the number of turbines has been reduced, and turbines are not situated between treed habitats (ELA 2009). In the Yandra cluster the minimum RSA has been lifted from 30 metres to 40 metres and the total area of RSA has reduced below 100 metres, a height at which this species rarely flies. As such the changes in turbine design and layout are not likely to lead to additional impacts of concern at a population scale.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is occasionally recorded on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres and the total number of turbines will be reduced by the modification compared to originally permitted. As the species does not fly high (typically less than 30 metres in height), this is not likely to impact on the movements of this species.
(e) flight path integrity	Fewer turbines will present fewer potential barriers to flight paths. As the species does not fly high (typically less than 30 metres in height), the reduction of project RSA below 40 metres and less will not impact on the movements of this species.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- Turquoise parrot

This species occurs in eucalypt woodlands and open forests, with ground cover of grasses and sometimes a low understorey of shrubs; usually in native grassy forests and woodlands composed of mixed assemblages of native pine and a variety of eucalypts. It also occurs in savannah woodlands and riparian woodlands (Higgins 1999).

Suitable habitat for this species exists in the study area and it therefore has the potential to occur. The species typically forages on the ground but will fly at height between habitats (OEH 2018). There is one record for the species in the search region although it has not been detected in surveys on the site (ELA 2009; NGH 2018a). For this reason, the risk of impacts on this species is negligible. The proposed modification will decrease this risk as the number of turbines has been reduced and the total area of RSA has reduced below 100 reduced through the modification.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species has not been recorded on site and there is only one record from the search region.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site. This species is a woodland species that occasionally crosses open areas between woodland patches. No further changes to movements are anticipated as turbines do not form a significant barrier and the reduced number probably reduces this barrier effect.

(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. The reduction in total RSA below 100 metres as a result of the modification will reduce potential interactions with wind turbines.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- **Woodland bird species**

This group includes the following listed species: Brown Treecreeper (eastern subspecies), Diamond Firetail, Speckled Warbler, Flame Robin, Scarlet Robin, Hooded Robin and Varied Sittella.

These species are woodland specialists with the potential to occur in the area. They typically forage within the canopy or understorey and on the ground (Higgins et al. 2001, Higgins and Peter 2002). This behaviour makes them very unlikely to fly at RSA height and collision with turbines is highly unlikely. The proposed modifications to turbines are unlikely to change this significantly.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	Some of these species have been recorded on the site. And the others could potentially occur there. None have been recorded among birds that have collided with turbines during ongoing monitoring Change in turbine dimensions is likely to reduce the risk to these species due to the increase of minimum RSA height from 30 to 40 m and the reduction of number of turbines. No significant change in impacts as species is species occur on site, however there is low potential interaction between turbines and these species fly low typically within the canopy or understorey and on the ground.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.

(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres. Also, the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of these species as they typically move below the minimum RSA height.
(e) flight path integrity	All woodland species fly below RSA heights. Therefore, the airspace used by these species will not be disrupted by the proposed changes. In fact the higher minimum RSA height will reduce impacts on movements. Fewer turbines will present fewer potential barriers to flight paths.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- Dusky Woodswallow

This species occurs in dry open eucalyptus forest and woodland with an open or sparse understorey and ground cover of grass, sedge or fallen debris. It is also found in farmland, usually on the edge of forest or woodland (OEH 2018a). It primarily feeds on insects which are caught in flight above wetlands or above and below the tree canopy. The species has not been recorded during pre-approval surveys (ELA 2009). It has been recorded during operational monitoring surveys on a small number of occasions (NGH 2018a). This suggests it occurs intermittently in small numbers on the wind farm site.

Turbine strike of this species may occur as it is known to fly at RSA height. Overall, the modification will decrease this risk as the number of turbines has been reduced and the total area of RSA below 100 metres has reduced. In addition, its sporadic occurrence makes frequent impacts of significance at a population level unlikely.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is a reduction in impacts on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. The reduction in total RSA below 100 metres and reduced number of turbines make incremental impacts on movements from the proposed modification less.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- White-bellied Sea Eagle

This species has been recorded in the south eastern part of the wind farm site and in the 2017 BUS survey (NGH 2018a). The species prefers large areas of open water including large rivers, swamps, lakes and the coastal sea (OEH 2018a). It is therefore likely to utilise the area around the rivers on the site.

This species flies at RSA height and the increased RSA area up to 200 metres at tip height will increase collision risk for this species. However, the species is unlikely to fly over the wind farm frequently as the site lacks permanent water bodies. Collision is considered unlikely and the increased risk from the proposed modification is not likely to result in collisions regularly enough to be of concern at a population scale.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is uncommon on site and potential interaction between turbines is low. The increase in total RSA above 100 metres increases the very low level of potential impact with turbines. The infrequent usage of the site make it unlikely any change in impacts will be of concern at a population scale.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification. However, there will be no change to the riverine habitat this species prefers.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths. No change will occur to the connectivity of riverine habitats from the proposed modification compared with the effects of the currently approved wind farm.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. The species is unlikely to fly over the wind farm frequently as the site lacks permanent water bodies.
(e) flight path integrity	The increased RSA may reduce the airspace available to this species for moving between rivers across watersheds but the infrequent occurrence of the species makes it unlikely that this effect will be of significance compared with the currently approved wind farm.

(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- **Barking Owl and Powerful Owl**

These two species are considered likely to occur within the study area as suitable habitat is present, though neither were detected during surveys (ELA 2009; NGH 2018a). These species inhabit larger blocks of woodland and open forest, including fragmented larger remnants and partly-cleared farmland. They are flexible in their habitat use, and hunting can extend into closed forest and more open areas (OEH 2018).

These species are not considered likely to fly at RSA height as they forage within and below the canopy (Higgins 1999), though there may be potential for individuals to fly higher than this when dispersing from territories. ELA (2009) states that turbines are not situated between large stands of trees which should reduce the risk of collision as dispersal movements for example of juvenile owls are unlikely to occur across the site.

The proposed modification will decrease this risk as the number of turbines has been reduced, and the total area of RSA has reduced below 100 metres. Collision between the turbines and these species is unlikely and would likely be very infrequent given the species' infrequent flights across the site.

Impacts on both species are not expected to change significantly from a very low level as a result of the proposed modification so population impacts are considered very unlikely.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	The lack of suitable, extensive wooded habitat near turbines and the resulting likely low frequency of occurrence in the area make significant impacts from the proposed modification very unlikely.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
(c) habitat connectivity	Habitats in the area are already highly fragmented and limited in extent. The proposed wind farm will not change this. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's

	fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres. Overall the total number of turbines will be reduced by the modification compared to originally permitted. The number of movements by these species on the wind farm is likely to be very low given the lack of extensive suitable habitat. Changes to this from the proposed modification are highly unlikely.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. The reduction in the number of turbines and the increase in minimum height and RSA below 100 metres will reduce the impacts on turbines in the height zone most likely to be used by these species (i.e. tree canopy height or a little higher) will likely slightly reduce collision risk. Their low frequency of occurrence across the wind farm site make collisions unlikely and population impacts therefore not of concern.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- Little Eagle

Whilst not identified as being likely to occur (ELA 2009), this species has been recorded on site during BUS surveys in 2016 (NGH 2017b). This species flies at RSA height and the increased RSA area between 100 and 200 metres at tip height may increase collision risk to this species. However, given the low frequency of its occurrence in the study area collision likelihood is considered low. Significant impacts as a result of turbine modification are therefore not expected.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site although there is potential interaction between turbines and this species with the increase in RSA above 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification. However, it is unlikely there will be a change in the availability of habitat on the site for this species as a result of the modification.
(c) habitat connectivity	There will be no loss in connectivity of habitats as a consequence of the changes in turbine design and layout compared with the currently approved design and layout. Less impacts on habitats by less vegetation removal should enhance habitat connectivity. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. The risk to this species will slightly increase due to the increase in the total RSA across the site at heights above 100 metres. The space between the turbines is sufficient to permit them to move about the area so movements are not expected to be significantly disrupted.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. However, the larger RSA above 100 metres will increase potential for interactions with the Little Eagle, which has been recorded only infrequently on-site.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

3.3.4. *Non-threatened raptor species*

This group includes raptor species not listed as threatened on the EPBC Act or BC Act, including Brown Falcon, Wedge-tailed Eagle and Nankeen Kestrel, as these were frequently recorded during post construction surveys. They are considered widespread and common. Raptor species are susceptible to collision with turbines due to their foraging habits. Soaring in updrafts and hovering at RSA heights while detecting prey can lead to collisions with wind turbines.

In relation to these species and the modification it is noted that they are not threatened species and therefore the majority of the biodiversity value parameters under the BC Act and BC Reg do not apply. However, these species are protected and therefore flight path integrity is required to be assessed under the BC Regulation Section 1.4(e). As has been assessed for many of the species above, fewer turbines will present fewer potential barriers to flight paths. However, overall through the modification the reduced RSA of the wind farm below 100 metres will improve the integrity of flights paths below these heights compared to the approved Project. However, the increased RSA above 100 meters will increase potential for interaction between turbines and these non-listed species when flying at height.

Non-threatened raptors are at a moderate risk from collision with wind turbines based on risk assessments at other wind farms (BL&A unpubl). Given their secure population numbers and widespread distribution, collisions are unlikely to significantly impact regional or national populations. Modification of turbines is likely to increase the risk to flight path integrity and therefore collisions or avoidance given the increased RSA above 100 metres. Experience from observations at other wind farms indicate raptors are the birds most often observed at these heights (BL&A unpubl. data), particularly Wedge-tailed Eagles. Wedge-tailed Eagle mortalities have occurred at Boco Rock Wind Farm: one individual per year in 2015, 2016 and 2017, which is not considered as a high level of mortality.

The increase in total RSA for the BRWF is around 8%, which is unlikely to have significant change in risk from the wind farm to collision with raptors. However, higher flying species may be at increased risk during the occasional flights above 100 metres. The additional risk of collision is still unlikely to significantly impact regional and national populations but may impact upon local populations, or act as a 'sink' in the local area.

3.3.5. *Summary of Potential impact on birds from modification*

Most birds recorded at BRWF were common, widespread species of partly wooded agricultural landscapes in south-eastern Australia. No species listed as rare or threatened under the EPBC Act were recorded.

Of the BC Act listed species recorded or considered likely to occur, none have a significantly increased risk of collision with the modified turbines in Stage 2. Overall the proposed modification will decrease risk to species flying below 100 metres as the total extent of the RSA below 100 metres has decreased across the wind farm as outlined in the modification. In the Yandra cluster the minimum RSA has been lifted from 30 metres to 40 metres and the number of turbines reduced. from 32 to 20. For these reasons, the proposed modification is not likely to lead to additional impacts of concern at a population scale. This will result in a decrease in risk will

not have a significant impact on any populations given the low frequency of occurrence of at-risk BC Act listed species in the area.

The modification will increase the risk of collision for those few species typically recorded flying over 100 metres including Wedge-tailed Eagles, other high-flying raptors and White-throated Needletails (WTNT). Overall, the risk to the WTE and WTNT from collision with turbines was considered to be low given the low number of birds utilising the site, the low frequency with which these flights occur and the non-threatened status of these species in mainland Australia.

Impacts on bird movements across the wind farm site are discussed below.

- Regular monitoring (NGH 2016, 2018a) has observed wetland birds flocking in the ephemeral wetlands on the site. Thus, it appears that the existing turbines are not causing a barrier to the use of wetlands on the site;
- For the other listed species discussed above, most are woodland species that primarily fly between patches of woodland vegetation in the area. As stated in ELA (2009), turbines are not planned to be situated between such patches and therefore would not inhibit the movements of forest-dwelling birds between such patches;
- Finally, the reduction in the total RSA below 1000 metres and a reduction in the number of turbines from 32 to 20 will reduce the potential for impacts on bird movements within wind farm and in the Yandra cluster; and
- On-going monitoring by NGH (2016, 2017b, 2018a) has found no significant impact on listed species or woodland birds.

3.4. Impacts of modification on bat species

3.4.1. *Bat species*

In 2016, extensive bat surveys were undertaken. Eleven species of microbat were recorded (NGH 2016). These were:

- Eastern Bentwing Bat *Miniopterus orianae*
- Bentwing/Forest Bat complex *Miniopterus/Vespadelus complex*
- White-striped Freetail Bat *Austronomus australis*
- Gould's Wattled Bat *Chalinolobus gouldii*
- Chocolate Wattled Bat *Chalinolobus morio*
- Southern Freetail Bat *Mormopterus ridei*
- Long-eared Bat group *Nyctophilus spp.*
- Inland Broad-nosed Bat *Scotorepens balstoni*
- Large Forest Bat *Vespadelus darlingtoni*
- Southern Forest Bat *Vespadelus regulus*

3.4.2. *Bat species commonly impacted – non-threatened*

White-striped Freetail Bat was the most frequently recorded bat on site during bat detector surveys and also consistently had the highest number of carcasses found

under turbines in each year, ranging from 11 to 17 individuals per year. Gould's Wattled Bat is another species for which a higher number of calls have been recorded and also a number of carcasses recorded. Both of these species are known to foraging at RSA height. The high numbers recorded on site during ongoing Anabat surveys indicate that sizeable resident populations of these species are likely to occur on and around the wind farm site.

In relation to these bat species it is noted that they are not threatened species and therefore the majority of the biodiversity value parameters under the BC Act and BC Reg do not apply. However, these species are protected and therefore flight path integrity is required to be assessed under the BC Regulation Section 1.4(e). As has been assessed for the bird species above, fewer turbines will present fewer potential barriers to flight paths. However, overall through the modification the reduced RSA of the wind farm below 100 metres would reduce potential impacts on bats. In contrast the increased RSA above 100 meters will increase potential for interaction between turbines and these non-listed species when flying at height.

When considering flight path integrity, it is noted that there will be no loss in connectivity of habitats as a consequence of the changes in turbine design and layout compared with the currently approved design and layout. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall.

The modified project's fewer turbines will present fewer potential barriers to flight paths. Fewer turbines will present fewer potential barriers to flight paths. Additionally, the reduced RSA of the wind farm below 100 metres will reduce impacts on flight path integrity for most bats.

The increased RSA above 100 meters will increase potential for interaction between turbines and these non-listed species. Only two bat species are regularly recorded above one hundred meters, these are the White-striped Freetail Bat and Gould's Wattled Bat. There may be increased impacts on these two species from the increase in the RSA above 100 meters.

It is likely that an increase to RSA area and height through turbine modifications will increase collision risk for these species. As these species are widespread and common across Australia, this increase is unlikely to impact significantly upon their populations.

3.4.3. *EPBC Act listed Species*

- Grey Headed Flying Fox (V)

The nearest known active and monitored Flying Fox camp is near Bega, approximately 58 kilometres from the Stage 2 development site. It is therefore unlikely that the species would occur in the study area regularly. Occasional individuals may pass across the site when moving southwards in the warmer months and northwards again for the cooler months. However, the lack of extensive treed habitat in the area means that very few food resources exist in the area so the area is not particularly suitable habitat for this species.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	Possible occasional visitor to the BRWF
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres, however a higher RSA above 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.
(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to the occasional flight through this area.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

3.4.4. *Listed species under the Biodiversity Conservation Act 2016*

- **Eastern Bentwing Bat**

EBB has been recorded consistently on site during initial investigations and during on-going bat detector surveys. To date, there have been four mortalities of EBB, all occurring during the first year of monitoring (2015). This suggests that the movement of this species through the region is irregular.

On-going bat detector monitoring at the wind farm as part of bird and bat monitoring found a small number of EBB calls, representing less than 1% of all recorded bat calls. This suggests a comparatively low level of activity by this species on the site. This may be due to a lack of a large cave roosting site nearby and the lack of extensive treed or wetland/waterway habitat preferred by EBB near turbines. Based on this, NGH (2017c) concluded that it is unlikely that a significant proportion of the population is utilising, or migrating through, the wind farm site. NGH have also undertaken a risk analysis of the EBB at BRWF (Section 2.1.5, NGH

2017c), which concluded that on-going operation of the wind farm is unlikely to significantly affect the species. However, for the numbers of EBB that are using the site, a moderate risk of collision was identified.

The modifications will reduce the extent of turbine RSA below 100 metres and thus will reduce the risk of collision with turbines for this species as this height zone regularly used by EBB during routine foraging movements.

As a significant population of EBB is unlikely to be utilising or migrating through the site (NGH 2017c), this change in risk will not lead to significantly increased collision rates and therefore significantly impact on the species' population.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	Comparatively low level of activity by this species on the site. This may be due to a lack of a large cave roosting site nearby and the lack of extensive treed or wetland/waterway habitat preferred by EBB near turbines. Based on this, NGH (2017c) concluded that it is unlikely that a significant proportion of the population is utilising, or migrating through, the wind farm site.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	The modifications will reduce the extent of turbine RSA below 100 metres and thus will reduce the risk of collision with turbines for this species as this height zone regularly used by EBB during routine foraging movements.
(e) flight path integrity	The modifications will reduce the extent of turbine RSA below 100 metres and thus will reduce the flight path risk of collision with turbines for this species as this height zone regularly used by EBB during routine foraging movements. Fewer turbines will present fewer potential barriers to flight paths.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management

	requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- Eastern False Pipistrelle

This species has been recorded on site during several surveys in low numbers. No carcasses of this species have been recorded to date (NGH 2018). It is unlikely that high numbers of the species occur on site.

The Eastern False Pipistrelle is known to roost in tree hollows (Churchill 2008). The species is thought to forage above and in the canopy but closer to the ground in open country (Churchill 2008). Consequently, it is anticipated that as the majority of turbines are to be sited in grassland there will be a low risk of collision for this species.

The modification will reduce risk to this species as the overall area of RSA below 100 metres has been reduced. In addition, increasing the minimum RSA height from 30-40 metres within the Yandra cluster will reduce risk. Given its tendency to fly lower in open country (where stage 2 turbines are located), the low numbers of calls this species recorded and the lack of mortalities thus far, it is unlikely that this species is at significant risk of collision. The modification is unlikely to significantly change this risk and is unlikely to significantly impact the species.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres. This is not likely to impact on the movements of this species as it is not considered as a high-flying species.

(e) flight path integrity	No change. Fewer turbines will present fewer potential barriers to flight paths. The modification will reduce risk to flight paths for this species as the overall area of RSA below 100 metres has been reduced. In addition, increasing the minimum RSA height from 30-40 metres within the Yandra cluster will reduce flight path risk.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

- **Yellow-bellied Sheathtail-bat and Large-footed Myotis**

Yellow-bellied Sheathtail-bat typically flies above the forest canopy making it susceptible to turbine collision. Flights are lower over open, untried habitats and along forest edges (Churchill 2008). It is a wide-ranging species distributed throughout northern and eastern mainland Australia and New Guinea. It migrates in summer to southern Australia (Churchill 2008).

Large-footed Myotis roosts in caves, mines, tree hollows, aqueduct tunnels, under bridges and in dense vegetation in the vicinity of bodies of slow-flowing or still water (including estuaries). It forages along creeks, rivers and lakes within a variety of vegetation communities (Menkhorst 1995). This species forages primarily over water but sometimes at height for aerial insects (Churchill 2008). It was assessed as being at low risk at the site (ELA 2009).

These species have not been recorded on site during any pre- or post-construction monitoring period and were only considered as having the potential to occur. Given the results of the detector surveys since the wind farm commenced operations, collision risk for these species are considered negligible. Any change in collision risk increase in risk is unlikely to have a significant impact on the population of either species given their low frequency of occurrence on the site.

Biodiversity Value Criterion	Description
(a) threatened species abundance—	No significant change in impacts as species is not common on site and potential interaction between turbines and this species reduced due to the overall decrease in total RSA below 100 metres.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.

b) habitat suitability—	The overall impacts area of habit being removed as a result of the modification is being reduced. Thus, there is less impact on suitable habitat for this species
(c) habitat connectivity	No change. Less impacts on habitats by less vegetation removal should enhance habitat connectivity overall. The modified project's fewer turbines will present fewer potential barriers to flight paths.
(d) threatened species movement—	Overall turbines in the modified project occupy less RSA below 100 metres. However, overall the total number of turbines will be reduced by the modification compared to originally permitted. This is not likely to impact on the movements of this species as it would occur infrequently over the site.
(e) flight path integrity	These species are not common on site and potential interaction between turbines and this species reduced due to the overall decrease in total RSA below 100 metres. Fewer turbines will present fewer potential barriers to flight paths.
(f) water sustainability	No impact, wetlands are not affected by the changes. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

4. CONCLUSION

Based on the foregoing analysis, it is not considered that the proposed modification represents a significant change in impact on habitats, connectivity, movements, water quality, turbine collision risk and vehicle impacts compared with the previously approved project and associated turbine specifications and layout for the listed species recorded or with the potential to occur in the affected area.

The table below provides a summary of the conclusions in relation to the biodiversity values identified in Section 1.4 of the BC Regulation.

Biodiversity Value Criterion	Change
a) Threatened species abundance;	The modification will be reducing the number of turbines, and associated infrastructure. Thus, there will be a reduced impact footprint on vegetation and habitats from construction of the wind farm (i.e. reduced number of turbines and associated infrastructure). Based on the above assessments, the proposed modification is unlikely to have any impact on the abundance of threatened species at the BRWF given that: ▪ there are few threatened species regularly recorded in the area, ▪ the number of turbines is being reduced; ▪ The overall RSA below 100 meters is reduced; and ▪ There is an increase in the RSA extent above 100 metres, however there are very few flights of threatened species above 100 metres. The overall impacts to threatened species and consequently their abundance as a result of the modification will not increase.
b) habitat suitability—	There is a net reduction of 12.45 ha of impacts to woodland and grassland habitats. Thus, overall there is a net reduction in impacts to habitat suitability as a result of the proposed modification.
b) vegetation abundance	The modification will be reducing the number of turbines, and associated infrastructure. This will reduce the overall impact of the wind farm on vegetation abundance, delivering a net gain of approximately 12.45 ha of native vegetation and habitat.
c) habitat connectivity	The modification will be reducing the number of turbines, and associated infrastructure. Thus, there will be a reduced impact footprint on vegetation and habitats from construction of the wind farm (i.e. reduced number of turbines and associated infrastructure).

	The reduction in the number of turbines will provide fewer barriers and opportunities for indirect impacts on flying species. The fewer larger turbines will decrease any "barrier effect", if this exists, within the wind farm and thus will contribute to decreasing aerial connectivity between habitats. Overall, the modification will not increase the overall impact of the wind farm on habitat connectivity.
(d) threatened species movement—	When compared to the approved Project, the modified project would: ▪ Reduce RSA below 100 metres; ▪ Increase RSA above 100 metres; ▪ Reduce the number of turbines compared to the originally permitted Project. There is likely to be less risk to threatened species movement for species that fly below 100 metres. There will be an increase in risk to species that may fly above 100 metres, but the above analysis does not identify any substantial increase in risk as "at risk" species do not regularly occur at the wind farm. In addition, the space between the turbines is sufficient to permit them to move about the area so movements are not expected to be significantly disrupted. In relation to birds and bats, the reduced number of turbines from 32 to 20 are overall likely to decease the potential for interaction with the wind turbines in the Yandra stage. However, overall the modification will not impact negatively on threatened species of birds and bats insofar as the movement over the site would contribute to the species life-cycle, particularly as few species of threatened birds and bats regularly use the site (as outlined above). Overall the modification is unlikely to impact negatively on threatened species of birds and bats particularly as few species of threatened birds and bats regularly use the site (as outlined above).
(e) flight path integrity	When compared to the approved Project, the modified project would: ▪ Reduce RSA below 100 metres; ▪ Increase RSA above 100 metres; ▪ Reduce the number of turbines compared to the originally permitted Project.

	There is likely to be less risk to threatened species movement for species that fly below 100 metres. There will be an increase in risk to species that may fly above 100 metres, but the above analysis does not identify any substantial increase in risk as "at risk" species do not regularly occur at the wind farm. BRWF is in a generally very open habitat with few other barriers and constraints to flight paths. Overall, flight path integrity is considered not to be affected by the proposed modification. Fewer turbines will present fewer potential barriers to flight paths.
(f) water sustainability	The modification does not propose any changes that would influence impacts to water sustainability. There is not expected to be any change in impacts on threatened species reliant on particular hydrological processes. Wetlands are not affected by the modification. The same construction environmental management requirements will apply that prevent detrimental water quality impacts from erosion and sedimentation during construction and operations.

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Appendix 1: Species listed under EPBC Act and BC Act for which potential habitat occurred within the search region

EPBC Act listed species:

- Regent Honeyeater (CE)
- Australian Bittern (E)
- Curlew Sandpiper (CE)
- Painted Honeyeater (V)
- Swift Parrot (CE)
- Eastern Curlew (CE)
- Australian Painted Snipe (E)
- Grey Headed Flying Fox (V)

Listed Migratory Species:

- Fork-tailed Swift
- White-throated Needletail
- Black-faced Monarch
- Satin Flycatcher
- Rufous Fantail
- Glossy Ibis

Migratory Wetland Species:

- Common Sandpiper
- Sharp-tailed Sandpiper
- Pectoral Sandpiper
- Latham's Snipe
- Osprey

Listed species under the Biodiversity Conservation Act 2016 (BC Act)

- Blue-Billed Duck (V)
- Freckled Duck (V)
- Spotted Harrier (V)
- Gang-gang Cockatoo (V)
- Turquoise parrot (V)
- Brown Treecreeper (eastern subspecies) (V)
- Speckled Warbler (V)
- Varied Sittella (V)
- Dusky Woodswallow (V)
- Hooded Robin (V)
- Scarlet Robin (V)
- Flame Robin (V)
- Diamond Firetail (V)
- Eastern False Pipistrelle (V)
- Eastern Bentwing Bat (V)
- White-bellied Sea Eagle (V)
- Barking Owl (V)
- Powerful Owl (V)
- Large-footed Myotis (V)

- Yellow-bellied Sheathtail-bat (V)
- Greater Broad-nosed Bat (V)

Appendix E – Heritage Impact Report

Prepared by:
New South Wales Archaeology
14 November 2018

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14 November 2018

Mark Branson
Boco Rock Stage Two Pty Ltd
c/o CWP Renewables

Dear Mark

Re: Boco Rock Wind Farm Stage Two – Section 4.55 of the EP&A Act Modification

The land subject to the Boco Rock Wind Farm (BRWF) Stage Two Modification was originally assessed by NSW Archaeology Pty Ltd in 2009 and documented in the report entitled: *Proposed Boco Rock Wind Farm Archaeological and Cultural Heritage Assessment*. A report to Wind Prospect CWP Pty Ltd. April 2009. This brief report provides a summary of the assessment of the land subject to the BRWF Stage Two Modification.

We understand that the purpose of the Modification is to contemporise the approval to accommodate fewer but larger wind turbine generators, whilst maintaining to minimise impacts and maximise the efficiency of the Project design. In general, the proposed amendments involve:

- A reduction in the number of turbines within Yandra Cluster from 32 to up to 20;
- An increase in the size and capacity of turbines consistent with current turbine technology;
- An addition of a temporary construction compound within the Yandra Cluster; and,
- Proposed administrative changes to the Project consent.

The modification area was original identified as the Yandra cluster and this area is encompassed by Survey Units 1 - 11, as defined in the 2009 assessment report (Maps 1-3 in Appendix 3 in Dibden 2009). All of the areas of proposed impact in the current modification were assessed during the original survey (cf. Dibden 2009).

The proposed impact areas within the Yandra cluster are all assessed to be of low archaeological potential and sensitivity. The landforms are large amorphous features with low biodiversity values and an absence of any potable water. These landforms are

likely to have been utilised by Aboriginal people on occasional and a generally limited basis for activities such as hunting and gathering forays and travel through country. Such activities are likely to have resulted in the discard of isolated and discrete clusters of stone artefacts in low densities only.

Seven Aboriginal object locales are present in the 11 Survey Units of the Yandra Cluster. They are all assessed to be of low heritage significance and a management strategy of unmitigated impact was originally recommended and remains valid. That is, impacts are permissible, and impact mitigation is not required.

Two historic sites are present in the Yandra cluster, SU10/H1 and SU10/H2. It was originally recommended that SU10/H1 be avoided, if feasible, and that unmitigated impact was appropriate for SU10/H2. These recommendations are still applicable.

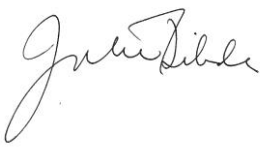
During the construction of the BRWF Stage 1, a breach of certain conditions relating to three Aboriginal sites occurred because the location of sites had not been adequately documented in construction plans. Since then, CWP Renewables has implemented detailed policy in regard to heritage so as to ensure that heritage is adequately maned during construction of their renewable energy projects.

An updated AHIMS site search has been undertaken which has identified no additional sites in the Stage 2 area other than those recorded in 2009 (AHIMS #365071 19 August 2018).

In summary, seven Aboriginal objects are located in the BRWF Stage Two Modification area. These sites are of low significance and impacts are allowable; impact mitigation is not required. Two historic sites are present one of which should be avoided if feasible. The mapping, and tables listing recommendations for all sites, in the 2009 are all still applicable to the Stage 2 project.

Please call to discuss this matter further if required.

Yours faithfully



Dr Julie Dibden
New South Wales Archaeology Pty Limited

Appendix F – Aviation Impact Assessment

Prepared by:
Landrum & Brown Worldwide (Aust) Pty Ltd
29 August 2018

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Aeronautical Impact Assessment

Boco Rock Wind Farm

Stage 2 - Yandra Cluster

NSW

CWP Renewables

LB00234

Final Version No.2
29 August 2018

Version No.	Basis of issue	Author	Date	Reviewers
001	Draft report for submission to Client	PWW	10 July 2018	SK, JW
002	Revised Draft	PWW	12 July 2018	JW
001	Final report for submission to Client	PWW	23 August 2018	JW
002	Revised Final Report	PWW	29 August 2018	JW

Contents

1 Introduction

1.1 The Development

CWP Renewables, on behalf of Boco Rock Stage Two Pty Ltd (the Proponent), has tasked Landrum & Brown Worldwide (Australia) Pty Ltd to prepare an Aeronautical Impact Assessment (AIA) for the proposed Stage 2 development of the Boco Rock Wind Farm, approximately 7 km southwest of Nimmitabel in the southern highlands of NSW.

Stage 2 adjoins the eastern boundary of Stage 1 of the wind farm that became operational in 2015.

Stage 2 will comprise 20 wind turbine generators (WTG) to be located on 20 of the 32 possible sites identified in this report.

The Stage 2 WTGs will have a maximum height from ground level to the tip of a WTG blade of 200 m AGL. A WTG situated on the highest nominated location of 1098 m AHD will have a maximum tip height of 1298m AHD (4259.3 ft).

Table 1 shows the distances from the proposed wind farm to the airports and aerodromes within the vicinity. Figure 1 maps the development in relation to these airfields

Airport	Direction and distance from site
Cooma	30.6 km northwest
Polo Flat	33.5 km north
Bombala	38 km south
Bunyan Gliding Club	43.7 km north
Jindabyne	52.4 km west northwest

Table 1: Airports in the vicinity

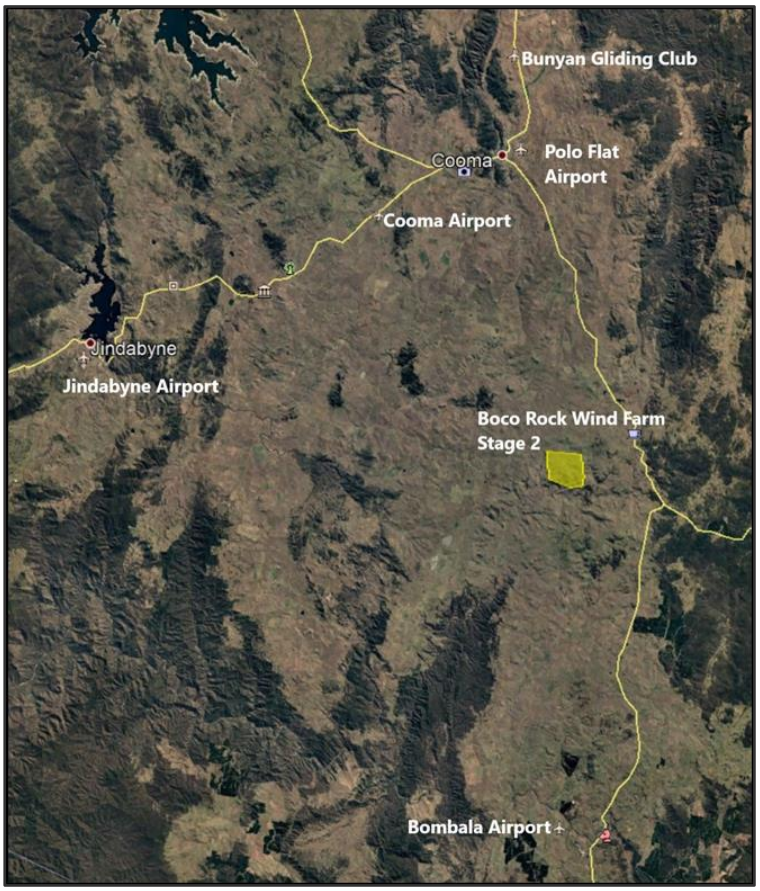

Figure 1: Development site in relation to the closest airports

Of these airports, Cooma and Polo Flat are the only ones provided with instrument approach procedures.

Bombala, Jindabyne and Bunyan are airports that cater for Visual Flight Rules (VFR) operations. Considering the distance to the proposed Stage 2 development, and the existing Stage 1 of the Boco Rock Wind Farm, the stage 2 development will not impact the take-off and landing procedures at these airports, even at a higher elevation.

There may be other privately owned airstrips in the area that are not published in the Aeronautical Information Publication (AIP). The owners of these airstrips and the pilots that use them are responsible for ensuring that the condition of the airstrip and the surrounding terrain and obstacle environment are suitable for the safe operation of the aircraft using them.

Ongoing consultation by the developer, together with the construction of Stage 1 of the wind farm, will have created a community awareness of any impact the wind farm will have on these airstrips.

Several Instrument Flight Rules (IFR) air routes exist in the vicinity of the Boco Rock Wind Farm. These routes and the clearances from the wind farm are discussed in detail later in this report.

2 Airspace Protection

2.1 Overview

Protected airspace for an airport is the airspace above any part of either an Obstacle Limitation Surface (OLS), a PANS OPS (Procedures for Air Navigation Services – Aircraft Operations) surface, or the Radar Terrain Clearance Chart (RTCC) protection surfaces.

The OLS are conceptual surfaces associated with an airport's runways that are designed to protect aircraft operations at the airport from unrestricted obstacle growth. Depending on the type of instrument flight procedures provided at the airport, the OLS can extend to a maximum of 15 km from the airport.

All of the local airports with OLS are in excess of 15 km from the wind farm and therefore their OLS are not infringed.

PANS OPS surfaces are designed around instrument approach and departure flight paths with a prescribed minimum obstacle clearance from terrain and structures. They designate an obstacle-free flight path to enable safe and efficient aircraft operations in Instrument Meteorological Conditions (IMC), where the pilot is not guaranteed to be able to see the ground, water or obstacles on or near their flight path.

Airspace within the lateral navigation tolerances of an air route, and the vertical allowance is also protected from terrain or obstacle intrusion to ensure safe flight operations during IFR flight on those routes.

Infringement by an infrastructure development or crane into protected airspace requires the approval of the aerodrome operator or Airservices Australia, and the Civil Aviation Safety Authority (CASA).

Infringement of PANS OPS protection surfaces are not supported by the aviation authorities.

2.2 PANS OPS Surfaces

Cooma (YCOM) and Polo Flat (YPFT) airports have PANS OPS protection surfaces extending to 55 km from the relevant point on or near the airport, and overlying the proposed Stage 2 development of the Boco Rock Wind Farm.

The clearance above the wind farm is shown in Table 2.

Instrument Approach Procedure	PANS OPS Surface Description	Height of PANS OPS Surface (m AHD)	Clearance by Development at 1298 m AHD (m)
All Cooma procedures	25 nm MSA	1401	103
Cooma DME or GNSS ARR Sector B	Initial Approach Segment	1401	103
Cooma NDB-Z RWY 36	Initial Approach Segment	1401	103
Cooma RNAV(GNSS) RWY 36	Initial Approach Segment and Holding @ COMSB	1401	103
Polo Flat RNAV(GNSS)-N	25 nm MSA	1401	103

Table 2: Development site impact on the PANS OPS surfaces of airports in the vicinity

The following instrument approach procedures at Cooma do not have approach segment PANS OPS surfaces above the Boco Rock Wind Farm:

- Cooma DME or GNSS Arrival Procedure – CB to COM;
- Cooma DME or GNSS Arrival Procedure – Sector A;
- Cooma DME or GNSS Arrival Procedure – Sector C;
- Cooma NDB-Y RWY 36;
- Cooma RNAV(GNSS) RWY 18.

This investigation reveals that the proposed Stage 2 development of the Boco Rock Wind Farm does not infringe the PANS OPS surfaces for any airport in the vicinity.

2.3 Air Routes

Two air routes, W541 from Cooma to Merimbula, and W675 from Cooma to Mallacoota, have navigation tolerances in close proximity to the Boco Rock Wind Farm.

The Lowest Safe Altitude (LSALT) published for each route is the lowest altitude that an IFR aircraft can fly on that route, without visual reference to the ground or water.

A Grid LSALT of 5900 ft, shown in green adjacent to the W541 label (refer to Figure 2), is above the wind farm. The grid is based on a whole 1-degree longitude x 1-degree latitude square.

LSALT protection surfaces for these routes and the Grid LSALT, with the relevant clearances above the wind farm are detailed in Table 3.

The wind farm does not infringe the LSALT protection surfaces for the air routes or the Grid LSALT above the proposed Stage 2 development of the Boco Rock Wind Farm.

Air Route (LSALT)	Height of Protection Surface (m AHD)	Clearance of development at 1298m AHD (in metres)
W541(1707 m)	1401	103
W675 (1859 m)	1554	256
Grid LSALT (1798 m)	1493	195

Table 3: Air Routes Clearances

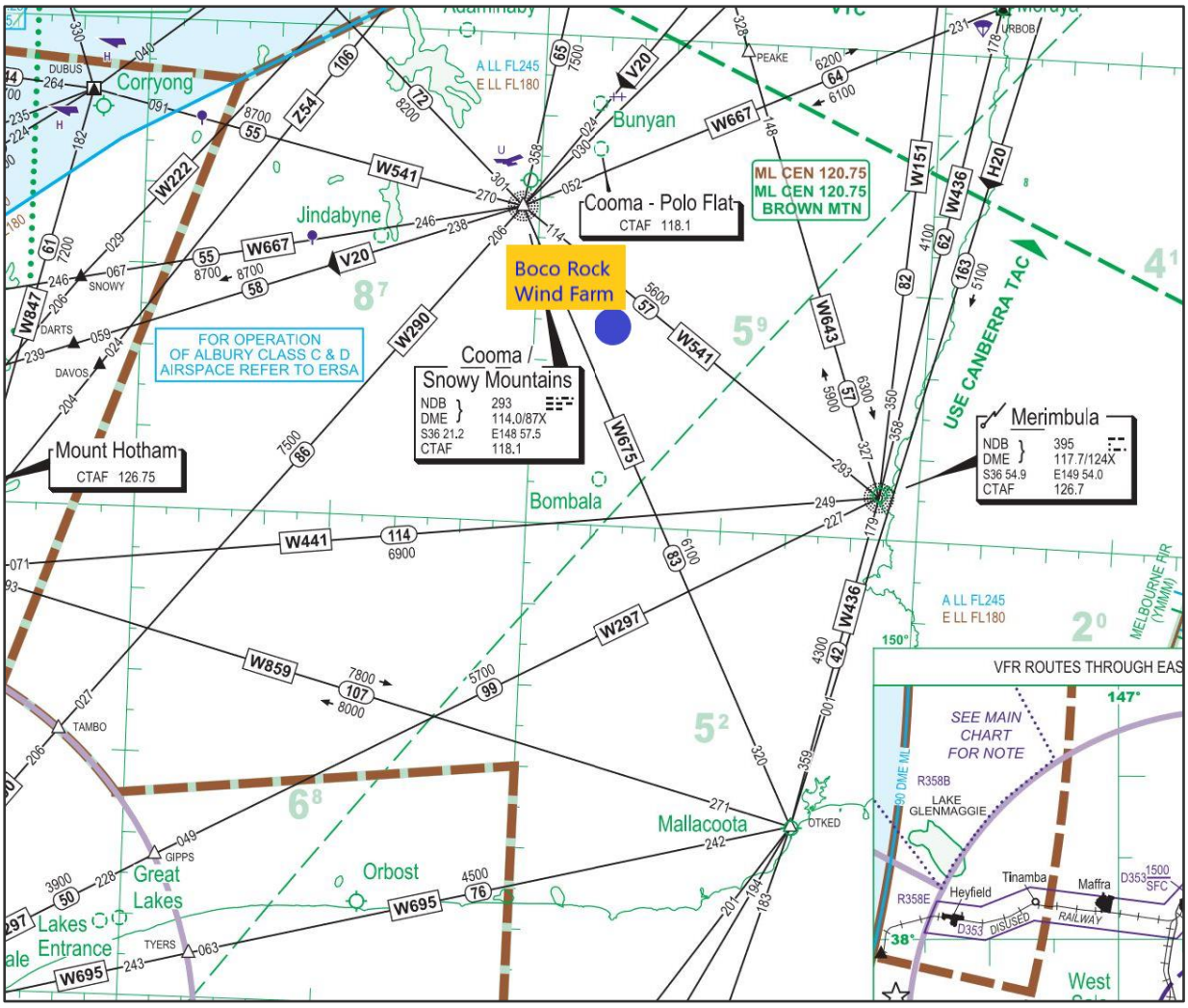

Figure 2: Air Routes and development site (AIP ERC 2 - 24 May 2018)

3 ATC Surveillance System and Navigation Aids

Wind farms have the potential to cause both electro-magnetic and reflective type interference to ATC radar surveillance systems and to the accuracy of aeronautical navigation aids.

The nearest ATC surveillance system is located at Mt Majura, to the north of Canberra, approximately 140 km from the wind farm.

Stage 2 is located outside of the clearance zones associated with Air Traffic Control surveillance facilities.

The nearest aeronautical navigation aid is located approximately 5 km south of Cooma at approximately 27 km northwest of the Stage 2 development.

Stage 2 is located outside the clearance zones associated with all navigation aids.

Details of stage 2 of the wind farm should be provided to Airservices Australia to enable their engineers to confirm that the wind farm does not interfere with ATC communications, surveillance or navigations systems.

4 Aviation Activity in the Vicinity of the Wind Farm

4.1 VFR operations

It is difficult to assess the level of aviation activity in the vicinity of the Boco Rock wind farm due to the lack of reporting requirements for VFR flights in this area.

VFR flights between airports in the Melbourne and the Canberra regions, and airports on the south coast of NSW, normally operate at a comfortable altitude above terrain for their transit over this area of rugged terrain to their destinations. They are required to maintain visual reference to the ground or water at all times.

VFR scenic and local flights might operate at lower altitudes in calm conditions but the prominent wind farm turbines will be readily identifiable and avoidable, and will serve as a navigation feature.

Wind conditions conducive to productive wind farms also produce mechanical turbulence from the surrounding terrain that most prudent pilots avoid, either by remaining out of the area in windy conditions or flying above the mechanical turbulence.

Glider flying training and cross-country soaring activity occurs from Bunyan airfield, approximately 43.7 km north of the windfarm, on weekends, public holidays and during gliding camps usually conducted to give pilots experience in mountain flying conditions. Frequent high altitude soaring flights are conducted from Bunyan. Glider flights are conducted by day only and in good weather conditions using either thermal or mountain wave type updrafts to conduct cross-country flights away from the airfield. Gliding operations in mountainous areas requires careful consideration of the weather conditions for the entire period of the planned flight and constant awareness of available landing areas should the conditions change adversely. The glider flights will either be at an altitude well above the wind farm, or be landing in paddocks if they cannot get back to Bunyan. Either way, the wind farm is a prominent feature that will enable pilots to avoid it if they need to land nearby or use it as a prominent navigation feature.

An aero club based at Jindabyne conducts flying training and scenic flights in good weather conditions within the region. The wind farm is a prominent navigation feature that will assist pilots to navigate accurately in the area.

4.2 Low level operations

Pilots undertaking authorised low level operations such as crop dusting, aerial firefighting, aerial cattle mustering, search and rescue, power line survey, gas pipe line monitoring and military low level flying operating in the area undergo specialised training and are required to take account of obstacles when planning and conducting low level operations. Depiction of the wind farm on aeronautical charts will provide sufficient information for pilots planning to operate in the vicinity of the Boco Rock Wind Farm, to be aware of its presence and to plan their flights in order to either avoid the location altogether or consider its impact upon their proposed flight operations.

4.3 IFR Operations

IFR pilots operating in the area are required to maintain minimum altitudes published on aeronautical charts and instrument approach charts that are well in excess of the highest terrain and consequently the highest turbine in the existing and the expanded wind farm. As shown in section 2.2, the protection surfaces for these altitudes are not infringed by the Stage 2 development of the wind farm.

4.4 Contingency Procedures – Engine Inoperative Flight Paths

In the context of the aircraft and airport operations in the vicinity of the proposed Stage 2 development of the Boco Rock wind farm and the physical environment, it is considered to be sufficiently distant from nearby airports to have no impact on contingency procedures and engine inoperative flight paths in the area.

5 Obstacle Marking and Lighting

Previous experience suggests that obstacle marking of the wind turbines will not be required as CASA considers that WTGs are sufficiently conspicuous by day due to their shape, size and colour. CASA is likely to impose a condition that the WTGs are painted in a colour that is visually conspicuous against the prevailing background.

Stage 1 of the Boco Rock Wind Farm is not equipped with obstacle lighting. If obstacle lighting is required for Stage 2 by CASA or DoD, shielding of the lights to avoid distraction to residents may be installed, however the lights must remain visible above a horizontal plane. Discussion notes regarding the lighting of wind farms can be found in Appendix C.

As Stage 2 of the Boco Rock Wind Farm turbine tip heights will exceed the height of 110m AGL, formal notification to CASA and the Department of Defence (DoD) is required in accordance with:

- CASA Advisory Circular AC 139-08(0) “Reporting of Tall Structures” to enable inclusion of the wind farm location and height of turbines in relevant aeronautical information publications; and
- CASA Form 406 – “Operational Assessment of Existing and Proposed Structures”.

This aeronautical impact assessment and review of obstacle marking and lighting requirements supports this formal notification requirement.

Formal notification of the intention to extend the wind farm at Boco Rock should also be provided to local aviation parties and relevant aviation stakeholders.

6 Conclusion

The proposed Boco Rock Wind Farm, Stage 2 development in the NSW southern highlands, to a maximum height of 1298m AHD:

- will not infringe any OLS;
- will not infringe the PANS OPS surfaces of any airport;
- will not impact on contingency procedures;
- is located outside the clearance zones associated with all ATC surveillance systems;
- will not infringe the LSALT protection surfaces for any air routes or Grid LSALTS in area;
- is outside the clearance zones associated with any aeronautical navigation aids;
- will not have a significant impact upon local flying activities; and
- will provide a significant visual navigation feature in the region.

Notification of the details of the wind farm to CASA and The Department of Defence, for assessment of the need for obstacle lighting will be required.

Notification to Airservices Australia for inclusion on aeronautical charts will be required.

Appendix A

Site Coordinates and Terrain Elevations

Only 20 of the possible sites will be selected

WTG ID	Easting	Northing	Elevation
94	696989	5951367	1025
95	695888	5951937	1010
96	697108	5950831	1000
97	697385	5951300	1009.3
98	696829	5952159	1060
99	696793	5952502	1060
100	696828	5952868	1074.1
101	697727	5953359	1091.2
102*	697254	5953921	1075.8
103	697222	5953441	1080
104	698520	5953754	1090
105	698582	5954018	1082.8
106	698490	5954502	1070
107	696897	5951793	1041.6
108	698712	5952101	1020.9
109	698463	5951758	1020
110	698243	5950882	1010
111	698025	5953446	1098
112	694594	5954992	976.3
113	695268	5954084	993.8
114	694917	5954701	990
115	695166	5953796	1000
116	695722	5953341	1033.6
117	696029	5952768	1033
118	698084	5951461	1021.8
119*	698787	5954759	1082.4
120	694775	5951867	990
121	698310	5953551	1080
122	698542	5950987	1015.2
123	695883	5953654	1034.6
124	695453	5952686	990
125	694890	5952608	962.019

WTG Coordinates and Terrain Elevations
Source: CWP Renewables

Appendix B

Assessment Methodology

In preparing aeronautical impact assessments associated with airport safeguarding and protection, it is necessary to observe the requirements of the relevant aviation authorities including:

- The Department of Infrastructure, Regional Development and Cities (DIRDC);
- The Civil Aviation Safety Authority of Australia (CASA);
- Airservices Australia (ASA);
- Airport Operators; and
- Department of Defence where appropriate.

Relevant Acts and Regulations applicable to developments near airports and air traffic routes were referenced during this assessment.

The major relevant documents include:

- The Airports Act 1996, Airports (Protection of Airspace) Regulations 1996;
- Civil Aviation Safety Regulation (CASR) Part 139 Manual of Standards – Aerodromes;
- Aeronautical Information Publication (AIP);
- Airservices Australia's Airways Engineering Instruction – Navigation Aid Building Restricted Areas and Siting Guidance (BRA);
- International Civil Aviation Organisation (ICAO) DOC 8168 Procedures for Air Navigation – Aircraft Operations (PANS OPS).

A Glossary of Aeronautical Terms and Abbreviations is shown at Appendix C.

Appendix C

Discussion of Obstacle Lighting

The aeronautical requirements for marking and lighting of wind farms are currently undergoing review by the International Civil Aviation Organization (ICAO), the Department of Infrastructure, Regional Development and Cities (DIRDC) and CASA.

It is understood that ICAO will be issuing an amendment to ICAO Annex 14 (Aerodromes) later this year that addresses, inter alia, wind farms.

DIRDC recently issued a Discussion Paper "Safeguards for airports and the communities around them" that implies an amendment to the criteria for wind turbine heights from 110m to 152m AGL as being applicable to wind farms in the vicinity of aerodromes. In addition, CASA is currently reviewing its withdrawn Advisory Circular AC139-181 "Obstacle Marking and Lighting of Wind Farms". The outcomes of these various reviews may result in:

- Revised criteria for wind farms; and
- Wind farms such as Boco Rock Wind Farm not requiring obstacle lighting, depending on the findings of a qualitative risk assessment to be undertaken by the proponent.

While the DIRDC Discussion Paper applies specifically to wind farms within the vicinity (generally accepted as 30km) of aerodromes, CASA is also currently reviewing the requirements for marking and lighting of obstacles and hazards remote from aerodromes. CASA has informally advised the wind farm industry that a qualitative risk assessment approach to the potential hazards, as presented by wind farms, may be considered.

CASA's current position on obstacle lighting of wind farms that are remote from an aerodrome (which is the situation for Boco Rock Wind Farm) is summarised as:

- CASA cannot mandate obstacle lighting for wind farms that are not within the vicinity of an aerodrome;
- provision of obstacle lighting is the responsibility of the proponent;
- any associated requirements placed on proponents by planning authorities, insurers or financiers are beyond CASA's scope;
- a wind farm proponent may have a duty of care to the aviation industry and local operators in terms of ensuring obstacles are made conspicuous; and
- obstacle marking and lighting requirements as specified in the CASA Manual of Standards Part 139, Chapters 8 and 9 applies.

CASA Manual of Standards (MOS) 139, Chapter 9, Section 9.4 indicates that for structures more than 110m AGL, the proponent should expect that obstacle lighting will be required unless there are unusual circumstances. The turbines to be installed at Stage 2 of the Boco Rock Wind Farm will have a maximum height of 200m AGL. However, there have been situations where CASA has acknowledged non-provision of obstacle lighting of wind farms in Australia where the turbine height exceeds 110m AGL. Such installations have been the subject of a hazard risk assessment that takes into account such factors as location of the wind farm with respect to nearby airfields and air routes, potential impact on navigable airspace, surrounding terrain, local aviation activity in the area, and environmental considerations. The wind farms concerned are Capital Wind Farm and Gunning Wind Farm, both of which are sited in mountainous area to the north of Goulburn in NSW, are remote from regulated airports, and were assessed as not presenting a hazard to aircraft operations.

The World Aeronautical Chart (WAC) covering the area of the Boco Rock Wind Farm site indicates the existence of lit towers closer to Cooma and Polo Flat airports; i.e. Brown Mountain at 4591ft AHD and Hudsons Peak at 4129 ft AHD, both of which are higher than the highest turbine at Boco Rock. As pilots are required to plan for a minimum clearance at night of 1000ft above the highest obstacle, then the minimum height of aircraft operating in the vicinity of the wind farm should be approximately 1481 ft (451m) above the highest turbine.

As indicated above, Australian policy, standards and recommended practices for obstacle marking and lighting of wind farms are currently under review. A current proposal includes a change to the criterion height of 110m (361ft) to 152m (500ft) AGL for wind farms within the vicinity of a certified or registered aerodrome.

Appendix D

Glossary of Aeronautical Terms and Abbreviations

To facilitate the understanding of aviation terminology used in this report, the following is a glossary of terms and acronyms that are commonly used in aeronautical impact assessments and similar aeronautical studies.

Advisory Circulars (AC) are issued by CASA and are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the *Regulations*.

Aeronautical Information Publication (AIP) is a publication promulgated to provide operators with aeronautical information of a lasting character essential to air navigation. It contains details of regulations, procedures and other information pertinent to flying and operation of aircraft within the applicable country. AIP Australia is produced by Airservices Australia under contract to CASA.

Aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria are appropriate.

Air routes exist between navigation aids or waypoints to facilitate the regular and safe flow of aircraft operating under the IFR.

Airservices Australia (ASA) is the Australian government-owned corporation Air Navigation Service Provider (ANSP) providing safe, secure, efficient and environmentally sound air traffic management and related airside services including telecommunications, aeronautical data, navigation services and aviation rescue and firefighting services to the aviation industry within the Australian flight information region.

Air Traffic Control (ATC) service is a service provided in controlled airspace for the purpose of preventing collisions between aircraft and between aircraft and obstructions on the manoeuvring area of controlled aerodromes whilst maintaining an expeditious and orderly flow of air traffic.

Altitude is the vertical distance of a level, a point or an object, considered as a point, measured from mean sea level.

Area navigation (RNAV) A method of navigation which permits aircraft operation on any desired flight path within the coverage of the station-referenced navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Circling approach An extension of an instrument approach procedure which provides for visual circling of the aerodrome prior to landing.

Civil Aviation Safety Authority (CASA) is the Australian government authority responsible under the *Civil Aviation Act 1988* for developing and promulgating appropriate, clear and concise aviation safety standards. As Australia is a signatory to the ICAO *Chicago Convention,* CASA adopts the standards and recommended practices established by ICAO, except where a difference has been notified.

Civil Aviation Safety Regulations (CASR) are promulgated by CASA and establish the regulatory framework *(Regulations)* within which all service providers must operate.

Civil Aviation Act 1988 (the Act) establishes the CASA with functions relating to civil aviation, in particular the safety of civil aviation and for related purposes.

Decision altitude (DA) or decision height (DH) A specified altitude or height in a 3D instrument approach operation at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. *Note— Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.*

Elevation The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

Height The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

Instrument Flight Rules (IFR) are rules applicable to the conduct of flight under IMC. IFR are established to govern flight under conditions in which flight by outside visual reference is not available due to cloud cover or restricted visibility. IFR flight depends upon a qualified instrument rated pilot flying by reference to instruments located in the flight deck. Navigation is accomplished by reference to electronic signals. It is also referred to as, "a term used by pilots and controllers to indicate the type of flight plan an aircraft is flying," such as an IFR or VFR flight plan. IFR flights can and do regularly operate in VMC but remain an IFR flight for rule and ATC requirements. Regular Public Transport flights are required to file an IFR flight plan, irrespective of the weather conditions.

Instrument Meteorological Conditions (IMC) are meteorological conditions that are less than the minimum specified for visual meteorological conditions.

International Civil Aviation Organization (ICAO) is an agency of the United Nations which codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. The ICAO Council adopts standards and recommended practices concerning air navigation, its infrastructure, flight inspection, prevention of unlawful interference, and facilitation of border-crossing procedures for international civil aviation. In addition, the ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the *Chicago Convention*. Australia is a signatory to the *Chicago Convention.*

Lowest Safe Altitude (LSALT) are published for each low level air route segment. Their purpose is to allow pilots of aircraft that suffer a system failure to descend to the LSALT to ensure terrain or obstacle clearance in IMC where the pilot cannot see the terrain or obstacles due to cloud or poor visibility conditions. It is an altitude that is at least 1,000 feet above any obstacle or terrain within a defined safety buffer region around a particular route that a pilot might fly.

Manual of Standards (MOS) comprises specifications (Standards) prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation in relation to a particular segment of the aviation regulations. For example, MOS 139 relates to CASR Part 139 – Aerodromes.

Minimum descent altitude (MDA) or minimum descent height (MDH) A specified altitude or height in a 2D instrument approach operation or circling approach operation below which descent must not be made without the required visual reference. Note: Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.

Minimum Obstacle Clearance (MOC) is the minimum distance above an obstacle or terrain that aircraft conducting instrument approach or departure procedures are not allowed to fly below in IMC. The MOC varies depending on the distance from the runway or in mountainous areas.

Notices to Airmen (NOTAMs) are notices issued by the NOTAM office containing information or instruction concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

Obstacles. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.

Obstacle assessment surface (OAS) is a defined surface intended for the purpose of determining those obstacles to be considered in the calculation of obstacle clearance altitude/height for a specific APV or precision approach procedure.

Obstacle Limitation Surfaces (OLS) are a series of planes associated with each runway at an aerodrome that defines the desirable limits to which objects may project into the airspace around the aerodrome so that aircraft operations may be conducted safely.

Prescribed airspace is an airspace specified in, or ascertained in accordance with, the Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected. The prescribed airspace for an airport is the airspace above any part of either an OLS or a PANS OPS surface for the airport and airspace declared in a declaration relating to the airport.

Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) is an ICAO term denominating rules for designing instrument approach and departure procedures. Such procedures are used to allow aircraft to land and take off under Instrument Meteorological Conditions (IMC) using the Instrument Flight Rules (IFR). ICAO document 8168-OPS/611 (volumes 1 and 2) outlines the principles for airspace protection and procedure design which all ICAO signatory states must adhere to. The regulatory material surrounding PANS-OPS may vary from country to country.

PANS OPS Surfaces. Similar to an Obstacle Limitation Surface, the PANS-OPS protection surfaces are imaginary surfaces in space, below the nominal flight path of the aircraft, which guarantee a certain minimum obstacle clearance above the ground or man-made obstacles. These surfaces may be used as a tool for local governments in assessing building development. Where buildings may (under certain circumstances) be permitted to penetrate the OLS, they cannot be permitted to penetrate any PANS-OPS surface, because the purpose of these surfaces is to guarantee pilots operating in IMC an obstacle free descent or climb path for a given approach, holding procedure or departure.

Regulations (Civil Aviation Safety Regulations)

Threshold (THR). The beginning of that portion of the runway usable for landing.

Visual Flight Rules (VFR) are rules applicable to the conduct of flights that are only permitted in VMC due to aircraft equipment and pilot qualifications. The visual flight rules allow a pilot to operate an aircraft in weather conditions that allow the pilot to navigate by visual reference to the ground or water by maintaining visual contact with the terrain and obstacle environment in order to be able to see and avoid other aircraft, terrain, obstacles or other hazards. Specifically, the weather must be equal to or better than basic VFR weather minima. If the weather is worse than VFR minima, IFR qualified pilots operating an IFR qualified aircraft are able to operate under the IFR.

Visual Meteorological Conditions (VMC) are meteorological conditions expressed in terms of visibility, distance from cloud and ceiling, equal or better than specified minima.

Visual Segment Surface (VSS) A PANS-OPS design segment of a straight-in instrument approach procedure, which needs to be monitored and kept clear of any penetrations by obstacles.

Abbreviations

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table.

Abbreviation	Meaning
AC	Advisory Circular (document support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
ADS-B	Automatic Dependent Surveillance - Broadcast
AHD	Australian Height Datum
AIP	Aeronautical Information Publication
Airports Act	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALT	Altitude
AMSL	Above Mean Sea Level
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
BARO-VNAV	Barometric Vertical Navigation
BRA	Building Restricted Area
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DIT	Department of Infrastructure and Transport. (Formerly Dept. of Infrastructure, Transport, Regional Development and Local Government and Department of Transport and Regional Services (DoTARS))
DOTARS	See DIT above
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix

Abbreviation	Meaning
FAP	Final Approach Point
FAS	Final Approach Surface of a BARO-VNAV approach
ft	feet
GBAS	Ground Based Augmentation System (satellite precision landing system)
GNSS	Global Navigation Satellite System
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LLZ	Localizer
LONG	Longitude
LNAV	Lateral Navigation criteria
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NASAG	National Airports Safeguarding Advisory Group
NDB	Non Directional Beacon
NE	North East
NM	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North North East
NOTAM	NOtice to AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface

Abbreviation	Meaning
OLS	Obstacle Limitation Surface
PANS OPS	Procedures for Air Navigation Services – Aircraft Operations, ICAO Doc 8168
PBN	Performance Based Navigation
PRM	Precision Runway Monitor
QNH	An altimeter setting relative to height above mean sea level
REF	Reference
RL	Relative Level
RNAV	aRea NAVigation
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RTCC	Radar Terrain Clearance Chart
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SOC	Start Of Climb
STAR	STandard ARrival
SGHAT	Solar Glare Hazard Analysis Tool
TAR	Terminal Approach Radar
TAS	True Air Speed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
VNAV	Vertical Navigation criteria
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WAC	World Aeronautical Chart

Appendix G - Traffic and Transport Impact Assessment

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14 November 2018

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Boco Rock Stage 2 Wind Farm Project – Modification

Revised Transport Assessment

November 2018

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Appendices

A Proposed Wind Farm Layout Diagrams

1. Introduction

1.1 Project Background

Boco Rock Wind Farm (the Project) is classified as State Significant Development (SSD) under the *Environmental Planning and Assessment Act 1979* (the Act). The Project Approval was issued on 9th August 2010 permitting up to 122 wind turbines. Stage 1 of the Project commenced construction in 2013 and became operational in 2015, consisting of 67 turbines. The remaining 55 turbine locations in the Boco and Yandra clusters are yet to be constructed.

CWP Renewables (CWPR) is preparing a Modification under *Section 4.55* of the Act for Stage 2 of the wind farm. The purpose of the Modification is to contemporise Stage 2 of the Project to minimise impacts and maximise the efficiency of the Project design.

The proposed Modification will include changes to the Yandra cluster only including:

- Construction, operation and decommissioning of up to 20 wind turbine generators (WTGs).
- Increase in WTG tip height of up to 200 m.
- Increase in WTG rotor diameter within the revised tip height.
- Addition of a temporary construction compound within the Yandra Cluster.
- All road and ancillary infrastructure will be consistent with the previously approved project infrastructure, with the exception of a temporary construction compound within the Yandra cluster.

The 20 turbines (maximum) to be constructed at the 32 available locations within Yandra cluster will be selected following a detailed energy assessment and turbine tender process, after the Modification has been approved.

This report (prepared by *Samsa Consulting – Transport Planning and Traffic Engineering Consultants*) is a revised transport assessment that aims to provide a comparative evaluation of the Approved project against the proposed Modification to evaluate the appropriateness of the changes and identify any key transport and traffic risks associated with wind farm component and equipment haulage. The report relies on the previous Traffic and Transport Study (completed by Bega Duo Designs)[1] and Transport Management Plan (completed by Rex J Andrews – RJA)[2] for much of the site assessment but in addition, reviews and identifies preferred road network routes for the over-size / over-mass (OSOM) transportation of the larger turbine components between delivery ports to the Yandra cluster site access point.

The report will serve as a supporting background paper to the Project's Modification assessment document.

1. Bega Duo Designs "*Proposed Boco Rock Wind Farm – Traffic and Transport Study*", March 2009
2. RJA "*GE Boco Rock Windfarm, Transport Management Plan: Port of Eden to Boco Rock (Rev.1)*", 17/12/2013

1.2 Director General's & Other Authority Requirements

Planning NSW's Director General's Requirements (DGRs) for the Modification remain the same as those for Stage 1 of the Boco Rock wind farm project.

While the Stage 1 Boco Rock wind farm project fell within two Local Government Areas (LGAs), namely Cooma-Monaro Shire Council and Bombala Council, this Stage 2 Modification of the Project only affects Snowy Monaro Regional Council.

1.3 Assessment Scope & Methodology

The scope of the assessment included the following tasks:

- Review of project background information.
- Project discussions with the CWPR project team.
- Discussions with relevant transport contractors.
- Comparative evaluation of the Approved project against the proposed Modification to evaluate the appropriateness of the changes and identify any key transport and traffic risks related to OSOM transportation.
- Desktop assessment (using available mapping applications) of potential road network routes between delivery ports and the Stage 2 wind farm site access point.
- Assess the over-dimensional transport options for turbines specifications including blade lengths of up to 78 m.
- Comparative review of previous assessment including traffic generation during construction and operational phases of the Project, traffic distribution onto the surrounding local and regional road network and assessment of transport impacts on the surrounding road network including site access, road safety, road capacity and road conditions.
- Identify any additional required road upgrades, road furniture amendments, bridge upgrades or other infrastructure constraints which would need to be addressed in order to deliver the revised project equipment to site
- Discussion of mitigation measures to address potential additional transport impacts identified.
- Preparation of this Revised Transport Assessment Report to be used as part of the Project's Modification assessment document.

1.4 Report Structure

The remainder of this assessment report is presented as follows:

Chapter 2 provides an overall project description as well as general details of the wind farm equipment components.

Chapter 3 describes the potential transport modes as well as existing transport conditions including transport routes and site access locations.

Chapter 4 assesses the transportation impacts during the construction and operation phases of the Project.

Chapter 5 discusses mitigation measures to address potential transport impacts identified.

Chapter 6 provides a summary and conclusions to the assessment.

2. Project Details

2.1 Project Description

The Proponent seeks approval for a Modification to the Yandra Cluster only, which will comprise Stage Two of the Boco Rock Wind Farm Project. The purpose of the Modification is to accommodate larger but fewer wind turbine generators (WTGs) to reduce the cost of energy produced and minimise impacts on the surrounding community and environmental values. No changes to the operational Project or the Boco Cluster are proposed in the subject Modification.

The Project Approval currently permits two alternate layouts within the Yandra Cluster (refer to Project figures in *Appendix A: Proposed Wind Farm Layout Diagrams*):

- Layout Option 1: 32 WTG locations
- Layout Option 2: 27 WTG locations

In order to provide certainty to stakeholders, the subject Modification seeks only to address Layout Option 1 with Layout Option 2 no longer forming part of the Yandra Cluster.

The Yandra Cluster is proposed to be modified as follows (as shown in *Appendix A: Proposed Wind Farm Layout Diagrams*):

- Removal of two approved WTG locations, reducing the available WTG locations from 32 to 30 within Yandra Cluster.
- Construction, operation and decommissioning of up to 20 WTGs within these 30 locations.
- Increase in WTG tip height of up to 200m.
- Increase in WTG rotor diameter within the revised tip height.
- Addition of a temporary construction compound within the Yandra Cluster.

The Project Approval permits a wind farm with a total capacity of 270 megawatts (MW) and associated infrastructure, including up to 122 wind turbine generators with a maximum capacity of 3.3 MW and a maximum tip height of 152 m.

The subject Modification seeks to increase the size and capacity of turbines consistent with current industry standards and technology. Approval is ought for a turbine tip height of up to 200 m (48 m greater than the current approval) including an increased rotor diameter. It is anticipated that turbines will have a nameplate capacity of 4 MW or greater, as turbine technology continues to advance rapidly. The Modification seeks to remove the limit on the generating capacity of individual turbines, as the limits are counter-productive in lowering the levelized cost of energy.

The Stage 2 turbine specifications will be determined following a competitive tender process, which will involve detailed modelling to determine the most cost effective and energy efficient design for the selected turbine. For this reason, the Modification seeks flexibility to select up to 20 WTG locations to be constructed from 30 potential locations identified following approval of the Modification. The selected turbines will be constructed within the micro-siting allowance of 100 m from the approved turbine locations.

The subject wind farm would also consist of permanent and temporary ancillary infrastructure and equipment, which would be positioned in accordance with the existing approval. These will typically include:

- Access roads (internal site road network) connecting the public road network to the wind turbine locations and substations.
- Overhead and underground electrical cabling and control cables connecting to the main collector substation.
- Mobile concrete batching plant.
- Cleared areas to store construction materials and wind turbine components (construction laydown areas).
- Construction site offices, associated facilities and site parking.
- Appropriate wind farm signage both during the construction and operational phases of the proposed development.
- Crane hardstand areas for the erection, assembly, commissioning, maintenance, recommissioning and decommissioning of the wind turbines.

All ancillary infrastructure will remain within the approved development corridor as previously approved for Stage 1 of the project in 2010 and will be constructed within the 100 m micro-siting allowance permitted under the Project Approval. Given the reduction in turbine numbers, the on-ground impacts of ancillary infrastructure would be less than the balance of impacts permitted under the Project Approval.

Table 2.1 following, identifies the Project components and a provides a comparison between the parameters of the approved Project and the proposed Stage 2 Modification for Yandra Cluster.

Table 2.1: Project Components in Yandra Cluster Only

Project Component	Current Project Approval	Modification	Comparison
Project Site Area of land within the cadastre boundaries of all properties subject to this Stage 2 Modification proposal	5,121 ha	5,121 ha	No change
Development Corridor Area within the Project Site within which the Stage 2 Development Footprint is contained	467 ha	457 ha	Reduced by 10 ha
Development Footprint Area of all *Permanent* and *Temporary* Stage 2 Project infrastructure including temporary disturbances within the Development Corridor	65 ha	63 ha	Reduced by 2 ha
Project Capacity	270 MW	270 MW	No change

Project Component	Current Project Approval	Modification	Comparison
Permanent Project Infrastructure			
Wind turbine generators (Yandra)	Up to 32	Up to 20	Reduced by 12
Tower height	Approx. 101.5 m	Approx. 130m	Increase of 28.5 m
Rotor diameter	Approx. 104 m	Approx. 160m	Increase of 56m
Tip height	Up to 152 m	Up to 200 m	Increase of 48 m
Hardstands (individual wind turbine)	1,250 sqm	1,250 sqm	No change
Footings (individual wind turbine)	400 sqm	625 sqm	Increase of 225 sqm
Road length	78 km	54 km	Reduced by 24 km
Road width	12 m	12 m	No change
Overhead electrical reticulation and control cables	16.6 km	16.6 km	No change
Temporary Project Infrastructure			
Earthworks alongside Permanent Infrastructure (cut and fill which also envelopes the Temporary Project Infrastructure detailed below) [3]	148.0 ha	75.5 ha	Reduced by 72.5 ha
Concrete batch plant	1 x 0.5 ha	1 x 0.5 ha	No change
Construction compound (additional) [3]	0	1	Increase of 1

1. *Included within permanent Development Footprint calculation and relates to the approximate area (per turbine) that will remain a permanent impact adjacent to the hardstand area. Temporary impacts associated with construction of the footings have been captured in the temporary earthworks area calculation.*
2. *Construction of the internal road and hardstand network will require earthworks that are beyond the limits of the permanent road impact however remain within the Development Corridor. This is required to level areas of steep gradient to a design suitable for safely transporting Project components into position. Detailed civil designs have been prepared for the Project that include impacts associated with permanent road, hardstand, footings and turning head areas in addition to the area considered the extent of the earthworks.*
3. *The construction compound will consist of a fenced-off area for the storage / lay-down of tools, vehicles, equipment, construction materials, turbine components, etc. Following construction, the compound may be retained as a permanent area for the operational life of the wind farm for component storage.*

The project site is currently used as rural farm land and this would continue to be the case after construction. Once the wind farm is operational it would be monitored remotely, with maintenance staff undertaking regular services in line with the selected wind turbine.

The life span of a wind farm is approximately 25 years, after which time there would be an option to either decommission the site, restoring the area to its previous land use with regard to consent conditions and lease requirements, or to upgrade the equipment and extend the wind farm's operational life.

2.2 Wind Farm Components

The wind turbine components generally comprise a nacelle and gearbox assembly, hub, three (3) blades and the tower in up to six sections. Transport of blades would be typically undertaken one at a time with a length of up to 78 m, however some newer turbine models involve a two-piece turbine blade meaning that the transport of blade lengths is less of a logistical constraint. The nacelle and gearbox assembly are transported separately to limit transport weights. To facilitate transportation and ease of installation the tower support structure would be manufactured in three sections.

The larger dimension wind turbine items such as the blades, nacelles and the larger diameter lower tower components may, when transported, exceed the road standard clearance restrictions and require special transportation permits. There is anticipated to be no issues for transporting the smaller sections of the smaller sized wind turbine components.

2.2.1 Turbine Rotor

Potentially, the turbines to be used for the Project would be three-bladed, semi-variable speed, pitch-regulated machines with rotor diameters up to 160 m.

Wind turbine blades are typically made from glass fibre reinforced with epoxy or plastic attached to a steel hub, and include lightning rods for the entire length of the blade. The blades typically rotate at about 12 rpm at low wind speeds and up to 18 rpm at higher wind speeds.

2.2.2 Towers

The supporting structure is comprised of a reducing cylindrical tower made out of either a welded steel shell or a concrete steel hybrid, fitted with an internal ladder or lift. The tower sections are approximately 5 m in diameter and range in length up to approximately 40 m. Coupled with the maximum blade length of 78 m, the maximum proposed blade tip height would be approximately 200 m. Alternative tower heights are also under consideration however, this is not exhaustive since new models and certified designs are continually entering the market place. The tower will be manufactured and transported to site in multiple sections for on-site assembly.

2.2.3 Nacelle

The nacelle is the housing constructed of steel and fibreglass that is mounted on top of the tower, with approximate dimensions of 12 m long x 4.5 m high x 4.5 m wide. It encloses the gearbox, generator, transformers (model dependant), motors, brakes, electronic components, wiring and hydraulic and lubricating oil systems. Weather monitoring equipment located on top of the nacelle will provide data on wind speed and direction for the automatic operation of the wind turbine.

2.2.4 Footings

Foundation types for the wind turbines will be considered pending geotechnical investigation of the ground conditions at the Project site.

Slab (gravity) foundations would typically involve the excavation of ground material to a depth of approximately 2.5 m. Some of this excavated material would, if suitable, be used as backfill around the turbine base. Remaining excavation material will be used for the on-site road infrastructure, where necessary. A slab foundation would involve installation of

shuttering and steel reinforcement, followed by the pouring of concrete.

If slab plus rock anchor foundations are required, the construction of the foundation for each machine would reduce the volume of excavated ground material, albeit to a similar depth of approximately 2.5 m. Slab plus rock anchor foundations require shuttering and steel reinforcement, drilling of rock anchor piles up to a depth of approximately 20 m, concrete pour, after which the rock anchors are stressed and secured once the concrete has cured sufficiently.

Detailed geotechnical surveys will be carried out during pre-construction work to determine the necessary foundation type per wind turbine. It is feasible that more than one type of foundation may be required for the Project, following the assessment of the individual wind turbine locations. New wind turbines are continually coming on to the market and it is possible that minor variations to these typical dimensions could occur prior to final wind turbine selection.

2.2.5 Crane Hardstand and Assembly Areas

Site access roads would have areas of hardstand (approximately 25 m by 60 m) adjacent to each wind turbine for use during component assembly and by cranes during installation. The clearing of native vegetation for the construction of access roads and hardstand areas will be avoided where possible.

The roads would be surfaced with local stone material to required load-bearing specifications. The nature and colour of surface stone would be selected to minimise visual impact prior to construction. The roads and hardstand areas would be maintained throughout the operational life of the Project and used principally for the periodic maintenance of the wind turbines.

2.2.6 Overhead and Underground Cabling

The electrical cables from the wind turbine sites will comprise a mix of underground and overhead cabling and will connect directly to an existing main collector substation.

The underground cable routes will generally be between the turbines and follow the route of the internal access roads. The final route will minimise vegetation clearing and avoid potential erosion and heritage sites, and will also depend on the ease of excavation, ground stability and cost. In some locations overhead line will be used to link clusters of turbines together and bring power back to the main collector substation.

Control cables will interconnect the wind turbine generators and the operation facilities building. Computerised controls within each wind turbine will automatically control start-up, speed of rotation and cut-out at high wind speeds and during faults. Recording systems will monitor wind conditions and energy output at each of the turbines. Remote monitoring and control of the Project will also be employed. Control cables will consist of optic fibre, twisted pair or multi-core cable and will be located underground within the groups of turbines.

The installation of buried earthing conductors and electrodes will also be required in the vicinity of the turbines, the facilities building and the sub-stations as required.

3. Existing Conditions

3.1 Transport Modes

The assessment of transportation of wind turbine components to site involves the separate consideration of the transport mode between:

- Australian ports for international imports and other local manufacturing plants located in Australia to the Boco Rock wind farm site;
- Transportation through towns / villages along the transport routes; and
- Site access off the public road network to the internal road network of the Boco Rock wind farm site.

The sea port of entry for imported wind turbine equipment and/or the location of manufacturing sites has not yet been fully resolved / confirmed. Therefore, this assessment evaluates all potential transport routes from all directions around NSW and beyond, if applicable.

Air, rail and road transport modes were considered for transporting the imported and locally manufactured wind turbine and sub-station transformer components during the previous assessment and Stage 1 project approval. Road transport was determined to be the only feasible option for transporting the larger wind turbine components and the heavy mass transformers.

All road routes to the Stage 2 project site (Nimmitabel area) are primarily by either National Routes or State Highways and, subject to statutory permit conditions, can accommodate the proposed wind turbine components generating OSOM vehicles, ie. the routes are part of the *NSW Oversize Overmass Load Carrying Vehicles Network Approved Roads* or the *ACT Oversize Vehicles Exemption Notice*.

A NSW Roads & Maritime Services (RMS) permit is required to be obtained for road access for OSOM vehicles along the NSW major road network (National Routes or State Highways) from areas of local component manufacture or international import to the Nimmitabel area. As per the Stage 1 project approval, the nominated transport contractor would be responsible for a detailed route assessment and subsequently obtaining all necessary transport permits, arranging escort services and any other third-party services as required by applicable regulations.

Transport of wind farm components manufactured elsewhere in Australia, would be by road via the national highway network, with the obvious transport routes being via the Monaro Highway / Snowy Mountains Highway. The road network has the flexibility to provide a single transportation mode from origin to the wind farm site without the need for additional loading and handling operations.

3.2 Road Transport Routes

3.2.1 Wind Farm Site Access Location

There is proposed to be a single site access point off the public road network serving all the wind turbine locations for the Yandra cluster portion of the Project – refer to *Figure 3.1* below. An internal site road network would allow access within the wind farm site linking the public road network (Yandra Road / Benbullen Road) with the wind turbine locations.

The site access is proposed to be via Yandra Road, which runs off the southern side of Springfield Road, approximately 5.8 km west of Monaro Highway / Snowy Mountains Highway.

3.2.2 Major Road Network Route Options

This transport assessment does not include a detailed route assessment for the transportation of the OSOM turbine and transformer components along the routes from the major manufacturing centres. This assessment would be required to be produced as part of the permit system by the haulage contractor and approved by the relevant roads authorities prior to the commencement of the construction phase, if required.

Two sea ports have been identified for importation of the major wind farm turbine components: Port of Eden on the NSW Far South Coast and Port Kembla in the NSW Illawarra Region. The main advantage of the Port of Eden is its relative proximity to the wind farm location while Port Kembla has advantages with respect to its size of operations and associated infrastructure. The potential major road network route options for both ports are described below. It should be noted that alternate ports of entry may be considered once the turbine tender is undertaken, the transport haulage provider is engaged and the port handling capacity is confirmed during the scheduled import and construction window.

Port of Eden

A detailed route assessment has been previously undertaken for the OSOM transport route between the Port of Eden and the Boco Rock wind farm project area for Stage 1 of the Project[3]. Approval was granted from Forestry NSW and Roads and Maritime Services (RMS) for the use of the relevant roads. It is noted that the assessment considered the Stage 1 wind farm components with blade lengths in particular, only being a maximum of 48.7 m long.

The detailed information is not repeated in this assessment but the route assessed was Edrom Road (from Port of Eden wharf), Princes Highway, Imlay Road, Monaro Highway (via Bombala town local roads – Maybe Street, Forbes Street, Mahratta Street) and onto Springfield Road.

The previous route assessed is some 167 km in length. A desktop assessment of this route up to Springfield Road has been undertaken as part of this report revision and an assessment of a site video was undertaken for the Springfield Road section. The subject route is considered to still be the best route between the Port of Eden and the Boco Rock wind farm site for component sizes used during Stage 1 of the Project but would be problematic for the longer 78 m blades that may potentially be used for Stage 2 of Boco Rock wind farm. Potential issues for transport of these longer wind farm components have been identified including:

3. RJA "*GE Boco Rock Windfarm, Transport Management Plan: Port of Eden to Boco Rock (Rev.1)*", 17/12/2013

- Navigation out of the port area onto Edrom Road.
- Relatively tight curve alignment between Imlay Road and Monaro Highway.
- Monaro Highway at Delegate Road – power pole on inside of curve.
- Travel through Bombala township especially at the Maybe Street / Forbes Street roundabout.

In any case, it is understood that the Port of Eden may not be able to accommodate the delivery and storage of longer blade lengths (up to 78 m) that potentially may be used for this Stage 2 of the Project because of storage area limitations. However it is noted that some turbines are now being manufactured and transported with two-piece blades, which will simplify storage and transport.

An alternative and similar length route using NSW Class 1 OSOM approved roads (via Princes Highway and Snowy Mountains Highway) has potential alignment concerns along sections of Snowy Mountains Highway (between approximately 38 km and 49 km west of Princes Highway), which may restrict the transport of the longer blades.

Port Kembla

Between Port Kembla and the Stage 2 Boco Rock wind farm project area at Yandra Road, there are a number of potential transportation routes. The most obvious (and preferred) route is via Princes Highway, Picton Road, Hume Highway, Federal Highway, Majura Parkway, Monaro Highway via Polo Flat Road (bypassing to the east of Cooma) and then continuing along Monaro Highway / Snowy Mountains Highway to Springfield Road via Nimmitabel township (approximately 404 km in length).

Apart from the relatively short section of Polo Flat Road bypassing Cooma to the east, the remainder of the route is along NSW Class 1 OSOM approved roads. The use of Polo Flat Road to bypass the Cooma urban area is considered to be preferable to using Monaro Highway and Bombala Street to travel through the Cooma urban area because of the numerous road furniture and alignment restrictions that would be encountered.

It is anticipated that Port Kembla will have the capacity to accommodate the delivery of longer blade lengths (up to 78 m) that potentially may be used for this Stage 2 of Boco Rock wind farm. Notwithstanding, for the preferred route described above, several restricted road network sections for transport of wind farm components of this length have been identified including:

- Tight curve alignments for transportation out of the port area onto Princes Motorway either via Five Islands Road interchange or via Springhill Road and Masters Road interchange.
- Relatively tight curve alignment between Mount Ousley Road and Picton Road.
- Relatively tight curve alignment with street light poles on inside of curve between Picton Road and Hume Highway.
- It is assumed that all underpasses along the major road network (ie. Princes Motorway, Mount Ousley Road, Hume Highway, Federal Highway, Majura Parkway and Monaro Highway) would have adequate height clearances.
- Travel between Polo Flat Road and Monaro Highway / Snowy Mountains Highway via eastern access road – travel through Cooma urban area is not feasible due to the relatively sharp turn at the Sharp Street (Monaro Highway) / Bombala Street roundabout.

It is noted that for the overall route, other relatively minor, localised intersection amendments may be required (eg. sign post relocations) as well as some temporary raising of power lines along Polo Flat Road and through Nimmitabel township. These matters would be identified and addressed in consultation with the relevant roads authorities during preparation of the Stage 2 Transport Management Plan.

An alternative route between Port Kembla and the Stage 2 Boco Rock wind farm project area would be to travel south from Port Kembla along Princes Highway before turning west onto Snowy Mountains Highway and Monaro Highway. While this route is slightly shorter (approximately 396 km), it has the same potential alignment concerns along sections of Snowy Mountains Highway (between approximately 38 km and 49 km west of Princes Highway), which may restrict the transport of the longer blades. Moreover, there are limited access locations for OSOM Class 1 transport vehicles approaching the North Narooma bridge crossing (across Wagonga Inlet) as well as south along Princes Highway from Narooma (between Old Highway junction and Cobargo).

The Princes Highway route also has potential transport restrictions across the Shoalhaven River bridge (North Nowra) and Clyde River bridge (Batemans Bay) as well as several assorted minor amendments required through urban township areas along the NSW South Coast, eg. Milton, Moruya, Narooma.

Other route options include transportation along roads that are not NSW Class 1 OSOM approved roads. These generally have restrictions / limitations along their routes including horizontal and vertical alignment restrictions, intersection restrictions and township / village impacts as well as surrounding land use impacts.

In order to minimise road upgrade works, transport routes are likely to focus on the shortest routes to the proposed site access point from the major road network. Therefore, the major and local road networks that would provide transport routes to the wind farm project site access location include Monaro Highway and Springfield Road as shown in *Figure 3.1* following.

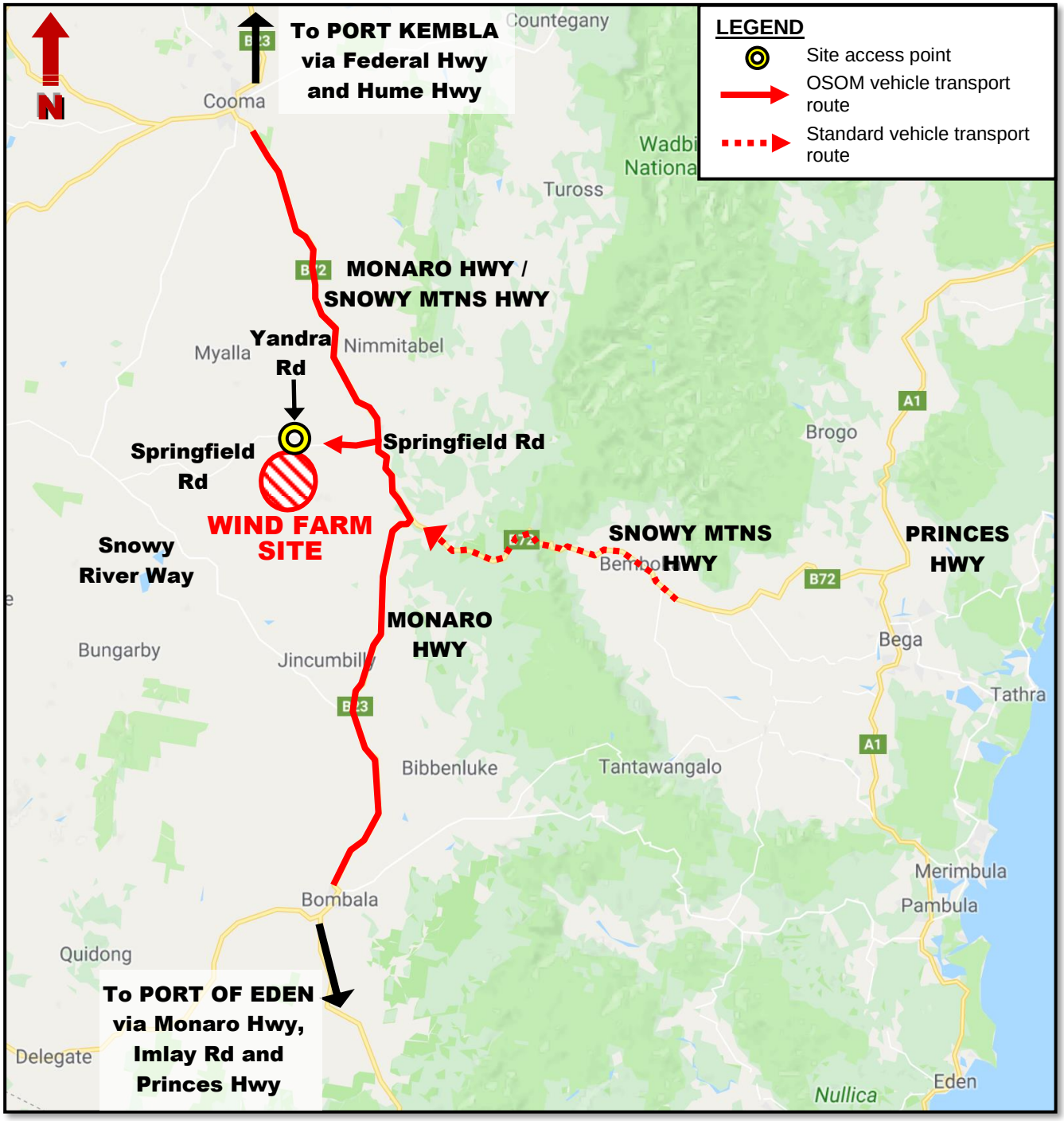


Figure 3.1: Regional Major Road Network & Transport Routes

3.2.3 Local Road Network Routes

Apart from the major road network described above, all other roads are maintained by Snowy Monaro Regional Council. This includes Springfield Road, which will be the access route to the site off Monaro Highway from nearby Nimmitabel.

Because of the relatively large increase in the number of vehicles using the local road network route, there are several impacts to be considered as follows:

- Larger vehicles required for OSOM loads would occupy most of the carriageway width at many locations increasing the potential for 'head-on' collisions.
- For nearby property owners, stock would need to be controlled from straying onto the roads that are not fenced, eg. Yandra Road.
- Structural damage may occur to some of the culverts, concrete causeway crossings and stock grids.
- Roadside trees and other road furniture / objects may obstruct the passage of longer / wider 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 should be noted that the above impacts would be temporary, as the equipment haulage is not a continuous program during the construction timeframe. Most of the heavy haulage would be in the form of convoys and would be managed through the mitigation measures contained in this report.

Transport Along Springfield Road

Springfield Road acts as a minor connecting route between Monaro Highway in the east and The Snowy River Way in the west. It intersects with Monaro Highway at a T-junction some 500 m south of Nimmitabel township. The intersection has adequate sight distance and turning movement radii.

In general, Springfield Road is of a consistently average condition and standard (for its road status) along its length with a width varying between approximately 5 m and 7 m. It has no centreline and edgeline markings and no street lighting. The pavement conditions are generally average apart from occasional rutting / potholes.

The general alignment for the subject section between Monaro Highway and Yandra Road is relatively gentle (larger radius) horizontal curves on a relatively flat terrain with some gentle undulations.

Current daily traffic volumes (estimated from the previous Bega Duo Designs assessment) are approximately 250 vehicles per day (vpd).

Increased usage by drivers unfamiliar with the Springfield Road route (eg. construction staff) could result in excessive speed through some of the curved sections especially during winter months when snow and frost occur. It is considered that there are no major deficiencies along the alignment for the transport of longer turbine components although minor, localised works may be necessary, eg. trimming roadside tree canopies, some localised widening on tighter curves.

The junction layout with Yandra Road has inadequate turning swept paths for the increased numbers of turning traffic and especially for the longer turbine components. Widening of the access across the cattle grid immediately off Springfield Road would be required. It is envisaged that a new, appropriately sized site entrance off Springfield Road onto Yandra Road would be designed in consultation with Council during pre-construction by the successful contractor.

Movement toward the side of the road to avoid oncoming heavy vehicles could result in excessive wear of the road shoulders. This edge wear can result in vehicles losing some steering control.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

Transport Along Yandra Road

Yandra Road is an unclassified local road providing access to three properties to the south of Springfield Road including 'Glenfinnan' property near the Springfield Road junction through to 'Yandra' property approximately 3.15 km from Springfield Road.

Yandra Road is a low-speed, gravel access road of 3.0 m to 4.0 m width and intersects with an access to 'Benbullen' property approximately 1.5 km south of Springfield Road, which is proposed to provide access to all of the turbine sites within the subject Yandra cluster.

Both Yandra Road at Springfield Road and Yandra Road at Benbullen access are uncontrolled T-junctions. Sight distance along Springfield Road to / from Yandra Road is adequate. The turning radii are restricted by the proximity of the cattle grid to the edge of bitumen on Springfield Road.

Yandra Road is not fenced and there is a stock grid 3.0 metres wide at approximately 1.43 km from Springfield Road. There is no street lighting available.

Traffic volumes (from the previous Bega Duo Design assessment) are less than 30 vpd along Yandra Road, which would seem to still be realistically current considering the number of properties that the access road serves.

In general, the Yandra Road / Benbullen route alignment and road environment are considered to be conducive for the transport of wind farm components without the need for significant road upgrade works. However, minor localised widening and clearing works (to allow adequate swept turning paths for the longer turbine components through the tighter curve radii) as well as trimming of roadside tree canopies would be required. Site access roads will be designed by the project construction contractor and where they interact with Council-owned roads in this area, consultation with Council will be undertaken.

Refer to *Section 5.4* for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes.

3.3 Existing Traffic Flows

Existing traffic volumes were obtained from RMS data and the previous Bega Duo Designs transport assessment. In the study area surrounding the project site, RMS data was available along Monaro Highway, just north of Nimmitabel township[4]. This was from the RMS *Traffic Volume Viewer* website, which provides data in various formats including average daily traffic, weekday, weekend and public holiday traffic and hourly peak period traffic volumes. Existing traffic volumes in vehicles per day (vpd) and vehicles per peak hour (vph) for the surrounding road network are shown in *Table 3.1* below.

Table 3.1: Existing Traffic Volumes

Road Section	Vehicles Per Day (vpd)	Vehicles Per Hour (vph)	Traffic Volume Source
Monaro Highway: 450 m north of Mason Street, Nimmitabel	2,594	716	RMS *Traffic Volume Viewer* website (2018)
Springfield Road	250	35 *	2018 estimate based on previous Bega Duo Designs assessment
Yandra Road	30	5 *	Based on previous Bega Duo Designs assessment

* Peak hourly traffic flows have been estimated to be between 10% and 15% of daily traffic flows.

4. RMS permanent counter – Station ID: 08171

4. Impact Assessment

In general, construction of the wind farm would include the following activities:

- Transport of construction machinery and labour to the Project site.
- On-site civil works for internal access roads, crane pads, lay-down areas, wind turbine footings and cable trenching.
- Road upgrade works (as required) to the public road network to allow OSOM transportation.
- Transport of wind turbine infrastructure to the Project site.
- Transport of raw materials to the Project site including gravel, aggregate and cement.
- Installation of wind turbines on site using cranes.
- Restoration and revegetation of disturbed areas.

The Project Approval currently requires construction would to be limited to the following times:

- Monday to Friday, 7:00 am to 6:00 pm;
- Saturday, 8:00 am to 1:00 pm; and
- No construction on Sundays or public holidays.

4.1 Construction Vehicle Types

The type of construction vehicles proposed to access the Project site depends on the equipment and/or personnel being transported and their function on the site. Access to construction site offices and facilities buildings would generally be available for conventional two-wheel drive vehicles. Access to individual wind turbine locations may be restricted to four-wheel drive or multiple wheel drive vehicles depending on the internal road network conditions.

Due to the size and weight of the wind turbine components it is expected that many of the delivery vehicles would be ‘over-size’ (width and/or length), ‘over-mass’ or both. These vehicles would be regarded as restricted access vehicles (RAVs) and will require special RMS operating permits to allow them to travel on public roads.

‘Over-mass’ loads would be carried on trailers, or combinations of trailers, with sufficient axle groups to ensure compliance with point load and overall load limits for the road surface. As a point of reference, the heaviest load based on an assessment of current turbine specifications from a variety of turbine manufacturers is 125 tonnes (comprising the entire nacelle / gearbox configuration in one unit). Such loads are typically carried on trailers with 10-plus axles, with each axle having up to 8 tyres. Allowing for the weight of the trailers themselves, typical axle weights under such configurations are in the range of 12 to 13 tonnes, or less than 2 tonnes per tyre. This is less than a typical semi-trailer with 11 tonnes per axle but only 4 tyres per axle, resulting in 2.75 tonnes per tyre.

Over-size vehicles therefore incur less loading stress on the road surface, especially when run under escort with limited speed, than normal heavy vehicle traffic. Furthermore, both ‘over-size’ and ’over-mass’ vehicles feature trailers with steering on some or all rear axles.

This technology ensures improved manoeuvrability, minimises stress on the equipment and the load, and reduces or eliminates tyre scrubbing and the associated stresses on the road surface when cornering.

The fleet of vehicles engaged to deliver oversize components would typically consist of:

- Extendable blade trailers of standard semi-trailer width (2.5 m) with the ability to extend to 45 m with up to 4 rear axles, some or all of which will be steerable;
- Heavy duty low loaders, with up to 10-plus rear axles and with each axle having 8 or more tyres to spread the load of the heavier WTG components. These low loaders may have the ability to carry loads up to 30 m in length, and may widen up to 5 m to reduce pressures on the road surface. Depending on the extendable length of these trailers, some of the rear axles may be self-steering;
- Dolly / jinker arrangements to carry loads longer than 30 m, where permitted to do so by permits and the WTG supplier. The rear axle groups on the jinker arrangements are steerable; and
- A variety of high power prime movers, typically rated 130 to 200 tonnes gross combination mass (GCM), as required depending on the total combination weight, ie. WTG load + trailer + prime mover.

Refer to *Figure 4.1* following for typical transport vehicles that are used for wind farm component delivery.

Over-size vehicles are those over 19 metres in length, 2.5 metres in width and/or 4.3 metres in height and their operating permits would require one or more escort vehicles to accompany them. Over-mass vehicles are those with a gross mass greater than 42.5 tonnes.

As mentioned previously, each wind turbine generator comprises a nacelle (approximately 125 tonnes), hub (approximately 25 tonnes), three blades (approximately 7 tonnes each and up to 78 m long) and three tower sections (approximately 50 tonnes each).

The components would typically be carried on specially designed trailers with axles that extend up to 4.2 metres in total width to carry the hubs and nacelles. The blades, which may be up to 78 m long, are carried on specialised trailers which have steerable rear axles allowing negotiation of relatively small radius curves provided that the inside of the curve is clear of obstacles.

The standard design vehicle for swept path adequacy in the provision of intersections and the design of parking and turning areas would generally be (as a minimum) the Austroads single unit truck / bus of 12.2 m length. However, provision would be made, where possible, to allow for a 'B-double' swept path, which requires a wider area allowing for manoeuvring by semi trailers and over-size vehicles.

The design of access roads and junctions would need to allow for widths of up to 4.5 metres and weights complying with NSW Roads and Maritime Services (RMS) maximum loading.

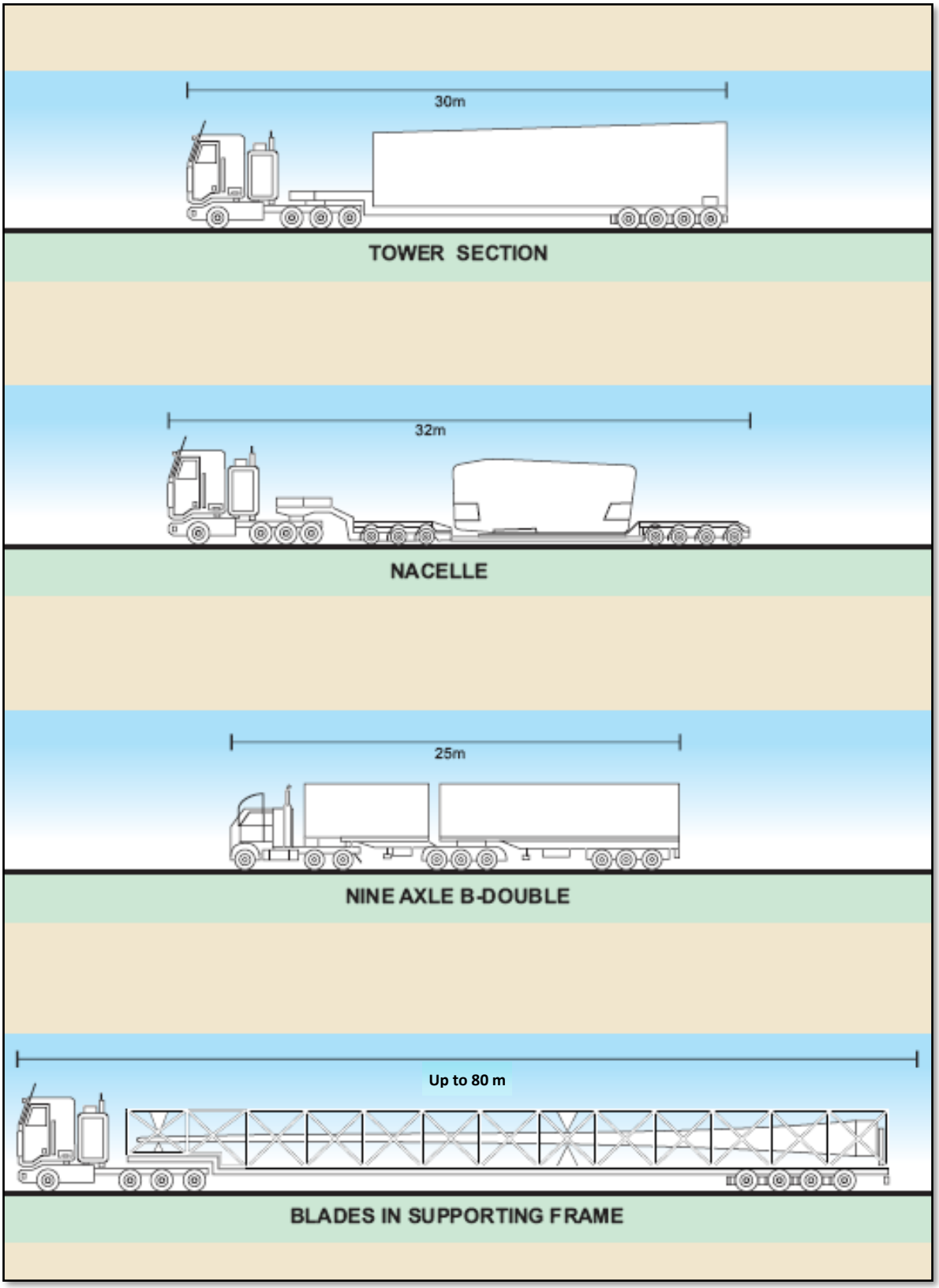


Figure 4.1: Typical Transport Vehicles

4.2 Construction Phase Traffic Generation

During the construction phase, which is expected to extend over twelve (12) months, several tasks would generate traffic. These are categorised as follows:

- Wind farm component delivery
- Construction material delivery
- Construction staff transport

Traffic-generating tasks include:

- Initial site set-up and access construction during the pre-construction period;
- Construction staff movements between the site and the local centres;
- Wind farm component deliveries (including OSOM transport);
- Concrete material deliveries and other general deliveries during construction works;
- Operational staff movements during operation and maintenance; and
- Decommissioning and reinstatement construction activities.

4.2.1 Transport of Construction Materials

Apart from the transport of OSOM turbine components, the major construction materials to be transported include gravel/road base for construction of site access roads, constituent materials for the on-site concrete batch plant, steel reinforcement deliveries for foundation construction, water for dust suppression activities and other miscellaneous materials deliveries for site offices and the like.

It is assumed that construction material trip distribution would be mainly from the Cooma area to the north although there could potentially be some material deliveries travelling from the south (Bombala area) and east (Bega area).

4.2.2 Construction Staff Traffic

For the majority of the 12-month construction period, it is anticipated that construction staff numbers would be approximately 60 staff. During peak construction periods, it is anticipated that construction staff numbers would increase to approximately 80 staff for an approximate four-month period coinciding with the turbine installation phase.

It is assumed that construction staff trip distribution would be mainly from the Cooma area to the north although there would potentially be some staff travelling from the south (Bombala area) and east (Bega area).

4.2.3 Traffic Generating Construction Activities

The transport of the various wind farm components and construction materials as well as construction staff to/from the sites would generate traffic from various sources. The traffic generation is based around a continuous pouring of a turbine footing in a single day and the installation of an average 2.5 towers per week. It has been based on information from the previous Bega Duo Designs assessment, which would still be relevant for this project assessment and is shown in *Table 4.1* following.

Table 4.1: Project Traffic Generation

Activity	Maximum Trips Per Day	Comments
Construction and management staff	54	Assuming an average of 3 employees per vehicle
Precinct set up	10	
Road construction	30	Includes delivery of gravel road base
Foundation construction	102	Includes delivery of constituent concrete materials, reinforcing steel delivery, etc.
Dust suppression	4	Assuming water is sourced locally
Internal Cabling	6	
Turbines erection	58	

The trips shown underlined in *Table 4.1* above, could be concurrent, resulting in a potential maximum of 218 vehicle trips per day (vtpd) split into 54 light vehicle trips (construction staff traffic) and 164 heavy vehicle trips (remainder of construction-related trips). This maximum would potentially occur during peak construction periods (eg. concrete pours) and is a conservative (high) scenario because it assumes that all construction activities would use the same routes into and out of the wind farm access point. In reality, construction staff and material deliveries are likely to arrive along a number of routes, which would dissipate the traffic generation.

The estimated maximum hourly trips generated is approximately 33 vehicle trips per hour (based on 15% of the maximum daily traffic generation) and would likely occur during peak construction activities such as concrete pours and the like. This peak traffic generation would be predominantly heavy vehicles and be split into three (3) light vehicle trips and 30 heavy vehicle trips.

4.3 Impacts of Construction Phase Traffic Generation

4.3.1 Road Capacity

In order to assess the potential impacts on road capacity, the Project traffic generation has been added to existing daily and peak hour traffic flows to obtain future traffic flows along the affected road network.

Future traffic volumes in vehicles per day and vehicles per hour for roads along the proposed access routes are shown in *Table 4.2* following. As mentioned previously, it should be noted that these future traffic volumes are conservative (high) because they assume that all construction activities would use the same routes into and out of the wind farm access point.

Table 4.2: Future Traffic Volumes

Traffic Scenario		Monaro Highway	Springfield Road	Yandra Road
Daily Traffic – vehicles per day				
Existing traffic[1]	LV	2,284	225	25
	HV	310	25	5
Wind farm traffic generation	LV	54	54	54
	HV	164	164	164
Combined future traffic	LV	2,338	279	79
	HV	474	189	169
Hourly (Peak) Traffic – vehicles per hour				
Existing traffic[1]	LV	630	30	4
	HV	86	5	1
Wind farm traffic generation	LV	3	3	3
	HV	30	30	30
Combined future traffic	LV	633	33	4
	HV	116	35	31

1. Existing traffic derived from *Table 3.1*. HV % assumed to be between 10% and 15% of total traffic volume.

Road capacity can be expressed and qualified along a section of the rural road network as its 'level of service' (LoS). Typically, the LoS is based on road capacity analysis as described in Austroads' "*Guide to Traffic Engineering Practice, Part 2 – Roadway Capacity*". Road capacity can be expressed in total vehicles per day and/or vehicles per hour.

The level of service descriptions are as follows:

LOS A: Free flow conditions, high degree of freedom for drivers to select desired speed and manoeuvre within traffic stream. Individual drivers are virtually unaffected by the presence of others in the traffic stream.

LOS B: Zone of stable flow, reasonable freedom for drivers to select desired speed and manoeuvre within traffic stream.

LOS C: Zone of stable flow, but restricted freedom for drivers to select desired speed and manoeuvre within traffic stream.

LOS D: Approaching unstable flow, severely restricted freedom for drivers to select desired speed and manoeuvre within traffic stream. Small increases in flow generally cause operational problems.

LOS E: Traffic volumes close to capacity, virtually no freedom to select desired speed or manoeuvre within traffic stream. Unstable flow and minor disturbances and/or small increases in flow would cause operational break-downs.

LOS F: Forced flow conditions where the amount of traffic approaching a point exceeds that which can pass it. Flow break-down occurs resulting in queuing and delays.

Road capacity for two-lane, two-way sections of a rural road network is largely based on a combination of design speed, travel lane and shoulder width, sight distance restrictions, traffic composition, directional traffic splits and terrain[5]. This provides a basic level of service and associated service flow rate under prevailing road and traffic conditions. For the minor unsealed roads, service flow rates are not applicable as they have significant variations in standards of formed lanes and carriageways.

Based on their road and traffic characteristics, the levels of service and flow rates for the affected sections of the rural road network along the relevant transport routes are shown in *Table 4.3* following.

Table 4.3: Rural Road Network Service Flow Rates

Road Section	Level of Service (LoS)				
	A	**B**	**C**	**D**	**E**
Monaro Highway	240 vph 2,400 vpd	470 vph 4,800 vpd	765 vph 7,900 vpd	1,260 vph 13,500 vpd	2,250 vph 22,900 vpd
Springfield Road	105 vph 1,050 vpd	260 vph 2,850 vpd	480 vph 5,250 vpd	730 vph 7,800 vpd	1,440 vph 13,800 vpd
Yandra Road	not applicable	not applicable	not applicable	not applicable	not applicable

Based on the above service flow rates and the existing and additional wind farm generated construction traffic volumes of the rural roads along the subject access routes, 'before and after' levels of service can be expected as shown in *Table 4.4* following.

Table 4.4: Rural Road Network – Existing and Future Levels of Service

Road Section	Existing LoS	Future LoS
Monaro Highway	B / C	B / C
Springfield Road	A	A
Yandra Road	not applicable	not applicable

From the above table, it can be seen that the relevant road network to be used has spare capacity and is operating at adequate levels of service. It is clearly evident that operating conditions (levels of service) along the road network would change insignificantly from existing conditions, even after the addition of a conservative (high) scenario of wind farm generated construction traffic.

For Yandra Road, which is effectively a minor unsealed property access, service flow rates are not applicable as it does not have formed lanes and carriageways. However, it would be operating at a high level of service with significant spare capacity, due to its very low existing traffic volumes (up to only 30 vpd). While the addition of construction-related traffic generation temporarily increases traffic volumes significantly along Yandra Road during the

5. Austroads "*Guide to Traffic Engineering Practice: Part 2 – Roadway Capacity*", Section 3

construction period, the controlled nature of existing traffic generation (from only a handful of rural properties) and its ample spare capacity would allow the wind farm traffic to be readily absorbed.

In summary, the addition of heavy vehicles and construction staff traffic during peak construction periods would not change the existing levels of service nor significantly affect road network operations and intersection performance pertaining to capacity issues. The temporary increase in traffic volumes due to construction-related activities is able to be readily absorbed by the subject road network with appropriate road infrastructure upgrades and construction traffic management.

4.3.2 Site Access and Road Safety

Construction traffic is proposed to access the wind turbine sites via an internal site road network off the Yandra Road / Benbullen site access point (described previously in *Section 3.2.1*).

Suitable on-site manoeuvring areas would be available so that larger vehicles are able to safely manoeuvre into the site off the public road network, around the site and out of the site onto the public road network. The location and layout of the Yandra Road site access junction with Springfield Road would be confirmed with the relevant road authorities considering set back of property boundaries and swept path turn radii for over-size (length) loads.

It is envisaged that for the OSOM vehicles to be used for wind farm component delivery, escort vehicles, transport restrictions and appropriate traffic management would be adopted to ensure safe passage from the public road network onto the site. These issues would be resolved in detail by the by the selected transport contractor when seeking approvals from relevant road authorities.

All vehicles would enter and exit the site to/from the public road network in a forward direction only. All vehicles generated by construction staff would be accommodated within on-site parking areas.

To ensure adequate road safety is maintained, a comprehensive Traffic Management Plan (TMP) would be prepared in conjunction with the successful transport contractor and relevant road authorities. The TMP would detail appropriate construction traffic controls and management measures and all aspects would be implemented in co-ordination with the Councils and RMS. It is acknowledged that on occasions local traffic will be inconvenienced. However, the management measures within the TMP would endeavour to mitigate any impacts. The TMP would include, but not be limited to, provisions for:

- Management of transport deliveries to minimise impacts on other transport operations, eg. school bus routes;
- Undertaking community consultation before and during all transport and haulage activities, including contact details to ensure community concerns are logged and addressed;
- Clear communication of road closures (if required);
- Letterbox drop along affected routes;
- Minimising disruption to local vehicles by ensuring average and maximum wait times due to project traffic along local roads are stipulated by the chosen transport contractor (typically an average maximum of 3 minutes wait time);

- Upgrading road infrastructure including designing and implementing temporary modifications to intersections and roadside furniture as appropriate;
- Managing transport operations including provision of warning and guidance signage, traffic control devices, temporary construction speed zones and other temporary traffic control measures;
- Preparation of a 'Transport Code of Conduct' for all staff and contractors detailing designated transport routes, road behavioural requirements, speed limits and local climatic conditions that may affect road safety, eg. snow / ice, fog, etc.;
- Procedure to monitor traffic impacts and respond to impacts rapidly; and
- Reinstatement of pre-existing road conditions after construction phase is complete.

4.3.3 Internal Access Roads

The construction and maintenance of the wind farm would require the construction of an internal site road network to reach each of the wind turbine locations. In some cases the site road network works would involve upgrading existing access tracks and in others constructing new ones. Route selection for the access roads has been determined taking into consideration topography, drainage and potential erosion impacts.

The internal site road network would consist of private roads and will not be accessible to the public. Access would be controlled by locked gates. The internal site access roads would generally be 6.0 m wide with regular passing bays and turning heads to accommodate construction vehicles and the crane required to assemble the wind turbines. Hardstand areas would be required around each turbine site for the safe operation of large cranes. These areas would also provide turning opportunities for delivery vehicles.

The roads would be an all-weather graded surface. Ongoing operational maintenance of on-site roads would be undertaken by the wind farm operator.

4.3.4 Road Condition Maintenance

There are a number of public road works that would be required to enable transport of components and materials to the wind farm sites. These have been identified in general previously in this assessment but would be confirmed and resolved in detail by the successful transport contractor when seeking approvals from relevant road authorities.

The condition and maintenance of roads used for transport of major wind farm components would be covered by existing conditions and requirements of the current Project approval. This would provide the basis for identifying any road damage and subsequent restoration works after the construction period is complete. Regular inspections would be undertaken and any significant damage resulting from construction traffic, except that resulting from normal wear and tear, would be repaired to pre-existing conditions.

A permit system requires transport contractors to state the registration details of the trucks / trailers used for each load, so the link between permissions and equipment is very tight.

Trucks being used for all escorted loads are given an inspection by the escort at the start of every trip, while other trucks are required to meet regulated maintenance requirements and these procedures are regularly audited to ensure compliance. Under these operating procedures, there would be no further actions required by local Councils to ensure that trucks are fit for purpose. Notwithstanding, the transport contractor would be expected to comply with any additional requirements from any party (ie. Councils, RMS, etc.), if requested to do so.

4.4 Operational Phase Traffic Generation

Traffic generation during operations would be relatively minor. The operational / maintenance staff are likely to be based in the local area and it is envisaged that the majority would be from the currently operating Stage 1 of the Project. Aspects of the Project operation to be dealt with by on-site staff would include safety management, environmental condition monitoring, landowner management, routine servicing, malfunction rectification and site visits. Other remote monitoring functions would typically include turbine performance assessment, wind farm reporting, remote re-setting and maintenance co-ordination.

It is understood operational traffic would consist of 4WD-type service vehicles travelling between individual wind turbine sites along the internal road network off Yandra Road / Benbullen access. It is envisaged that this would amount to up to an additional 10 trips per day, which would readily be absorbed into the spare capacity of the existing road network. This additional trip generation is conservative (high) because, as mentioned previously, it is likely that the majority of staff would be from the currently operating Stage 1 of the Project.

There is the possibility that the operational wind farm may attract tourist traffic along the roads surrounding the sites. However, it is considered that this would not significantly increase traffic volumes or cause any unfavourable impacts.

4.5 Effect of Operation Phase Traffic Generation

Based on the relatively minor traffic generation during operations described above, traffic and road network impacts would be negligible. The current road network has significant spare capacity and is used by 4WD-type vehicles, which are proposed to be used for servicing the various sites.

All vehicles generated by operations staff would be accommodated within on-site parking areas.

4.6 Cumulative Impacts

At present there is a proposed nearby major project (wind farm) at Granite Hills that may potentially result in cumulative impacts to the Boco Rock Stage 2 wind farm project. The Granite Hills wind farm project has received SEARs but has not yet lodged an Environmental Assessment. The precise timing for construction and operation is unclear at this stage, however it is expected to occur later than Stage 2 of Boco Rock wind farm.

Notwithstanding, it is understood that the Granite Hills wind farm project proposes to use the major and minor road network in the surrounding area, some of which is similar to the transport routes proposed to be used for the Boco Rock Stage 2 wind farm project, eg. Monaro Highway. This has the potential to exacerbate any traffic and transport impacts if both projects proceed simultaneously.

Once progression of the Granite Hills wind farm project is confirmed, other possible major developments in the surrounding area are determined, and also when the construction dates / timetables are finalised for the Boco Rock Stage 2 wind farm project, the cumulative impact of any simultaneous development would need to be considered with respect to transport and traffic operations. Possible mitigation measures may include scheduling of

construction activities and deliveries to minimise road transport movements, region-wide traffic management and/or shared road upgrades, for example.

5. Mitigation Measures

5.1 General Management of Potential Impacts

The management of potential impacts caused by the proposed wind farm project would cover the construction, operation and decommissioning phases of the Project. With respect to the potential traffic impacts during the decommissioning phase, these essentially mirror the construction phase impacts, although would occur over a shorter time period.

For management of potential impacts during the construction phase, the following general measures would need to be undertaken:

- Engage a licensed and experienced transport contractor with experience in transporting similar wind farm component loads. The contractor would be responsible for obtaining all required approvals and permits from the RMS and local Councils and for complying with conditions specified in the approvals. Transport contractors would also conduct any dilapidation surveys and arrange for detailed pavement and infrastructure inspections (eg. bridge loading adequacy) to ensure all access routes are suitable prior to carrying out the transport tasks.
- Develop a Traffic Management Plan (TMP) in conjunction with the transport contractor and relevant road authorities and implement all aspects of the TMP in co-ordination with the local Councils and RMS. Refer to previous *Section 4.3.2* for typical details to be included in the TMP.
- Undertake road infrastructure upgrade works to allow OSOM transport along the proposed transport routes to access the site, as required. Details of specific upgrade works follow in *Section 5.3* below.
- There are some locations along the relevant transport routes (eg. Springfield Road) where road alignments and/or narrow carriageway widths would require over-size vehicles to use the full carriageway width. This would require traffic management in the form of temporary, short-term full road closures ('rolling' road closures as vehicles pass critical locations) aided by escort vehicles.
- Identification of any significant road damage and subsequent restoration works after the construction period is complete.
- Consider establishing a 'car pool' initiative for construction staff from nearby centres to minimise construction staff trips.
- For decommissioning, similar general measures would be necessary as those detailed for construction. However, the TMP for decommissioning would need to be revised to address traffic operation and volume changes in the future years during the decommissioning phase.

For management of potential impacts during the operations phase, the following general measures would need to be undertaken:

- Establish a procedure to ensure the ongoing maintenance of the internal on-site access roads during the operation phase. This maintenance would include sedimentation and erosion control structures, where necessary.

5.2 Road Authority Approvals

The use of licensed and experienced contractors for transporting wind farm equipment is essential to ensure the minimisation of any impacts on the road network and traffic operations. There are a number of transport contractors who are experienced in the specialised transport of OSOM loads. These contractors operate closely with road authorities and are able to arrange all required permits for undertaking the transport tasks. They would also carry out detailed transport route assessments and confirm the requirement for any road infrastructure upgrades and/or bridge strengthening works.

NSW RMS would typically have the following requirements for transporting OSOM loads:

- Generally, the wider and longer over-size transport would require two pilot vehicles and contact with NSW Police for further guidance (pilot vehicles).
- Over-size permits are required to be 'specific' permits for each vehicle if they would be travelling along designated roads or locations. Additional and specific over-size permits may be required for loads with greater dimensions than covered by a General Class 1 Oversize Notice.
- A specific permit:
  - prescribes the travel conditions that apply to a particular vehicle;
  - identifies the vehicle to which the permit applies; and
  - identifies the registered operator of the vehicle.
- The permit may also specify conditions to secure payment for:
  - damage caused to roads, bridges or other property by the over-size vehicle;
  - road work that must be conducted before the vehicle can travel on a particular route; or
  - costs incurred by the RMS to evaluate the proposed route or provide any special escort services.
- An over-mass permit will be required for each nacelle component.
- An over-size (length) permit will be required for each blade component. The requirement for over-mass permits for blade components will depend on the type of vehicle used to transport them. However, preliminary assessment indicates that over-mass permits may not be required for blade components.
- Transport of blade components will most likely utilise a rear-end steering system on a trailer or low loader.
- An over-mass permit will be required for each tower component.
- An over-mass permit will be required for each crane.
- Night transport is generally available along the major road network (between 1 am and sunrise or 6 am, whichever is earlier).
- Transport through the any urban areas must generally occur during daylight periods. It is recommended that if the transport routes pass through any school zones or adjacent to any schools, transport also be restricted to outside school drop-off and pick-up times (8:00 am to 9:30 am and 2:30 pm to 4:00 pm) to prevent conflicts with these activities.
- As part of the transport permit process, the RMS and local Councils are likely to require a detailed sufficiency assessment of all bridges and other structures along the transport route to identify and specify strengthening requirements, if any. This may

apply to a number of bridge / causeway crossings along Monaro Highway / Snowy Mountains Highway.

5.3 Potential Road Infrastructure Upgrades

As well as the construction of an internal on-site road network that links up the various wind turbine sites and associated wind farm infrastructure, road upgrade works are likely to be required at a number of locations to accommodate the increased heavy vehicle volumes and OSOM transport vehicles. The latter issue would be confirmed by a licensed transport contractor as part of their transport route assessment based on specific vehicles to be used.

The potential road infrastructure upgrades that may be required and/or would need to be considered by the successful transport contractor include the following (refer to *Section 5.4* below for typical examples of upgrade works and other risk mitigation measures along OSOM transport routes).

Monaro Highway (north of Springfield Road)

- Adjustment works including some temporary raising of power lines for the route between Polo Flat Road and Monaro Highway / Snowy Mountains Highway via the eastern access road.
- Possible adjustment of overhead power lines through Nimmitabel township.

Monaro Highway (south of Springfield Road)

- Adjustment / relocation of power pole and other intersection signage and road furniture at the Delegate Road junction, south of Bombala.
- Potential significant works for over-size transport through Bombala township especially at the Maybe Street / Forbes Street roundabout, Bombala River bridge crossing and at the Mahratta Street junction for longer wind farm components.

Springfield Road

- Some minor signage adjustments at the Monaro Highway junction area to allow over-size vehicle transport.
- At a number of locations, trimming of roadside tree canopies and foliage is likely to be required to allow over-size vehicle transport, eg. possible locations include (with distances west of Monaro Highway) at 800 m, between approximately 3.1 km and 3.5 km, at 3.9 km and between approximately 5.1 km and 5.3 km.
- There are a number of small culverts running under the road along the route, which would need to be checked for structural adequacy from heavier loads.

Yandra Road

- The intersection at Springfield Road will need some widening work to allow adequate swept path for longer vehicles entering Yandra Road. This will include adjustments to a cattle grid near the site entry at Yandra Road.

5.4 Typical Transport Route Upgrade & Risk Mitigation Measures

Full structural road upgrades are not normally required for the routes intended to provide wind farm access. Exceptions include where access is via an under-rated bridge or where there are obstructions that overhang the road or limit the width of the vehicle / load that can pass. Mitigation strategies typically comprise the following.

Road Surface

As a general rule, ground clearances as low as 300 mm should be considered for over-mass trailers. Depending on the details of the transport equipment to be used, road camber, rise, fall and undulations may require review. Placing limits on vehicle speed ensures that even with heavy loads, the stresses on the road surface can be minimised. Whilst a sealed road surface is ideal, the vehicles are designed to and capable of travelling on unsealed surfaces such as those found on wind farm sites during construction – see *Figure 5.1* below. Therefore, temporary surfaces of crushed rock or similar material are normally adequate, on the basis that any such surface is properly drained to prevent loaded vehicles becoming bogged. There is not anticipated to be any significant impacts to road safety and/or traffic operations as a result of this type of road surfacing measure.

Figure 5.1: Typical unsealed access road within wind farm site

Road width

Larger WTG loads require a road width of up to 5 m, which is sometimes more than the width of minor roads that service remote wind farm sites, eg. Yandra Road. Consideration needs to be given to ensure adequate road width for over-size transport, although it is not normal to increase the width of a sealed surface if it already exists at less than 5 m. Where the road width is restricted (be it sealed or unsealed), the common approach is to clear sufficient vegetation from the sides of the road to allow shoulders of crushed rock to be laid. The level of the surface of any such preparation needs to match the edge of the existing road, to prevent tyre damage (and in the case

of sealed roads, the break-up of the edge of the sealed section) when the vehicle is required to run wide for corners or to move over for on-coming traffic – see *Figure 5.2* below for increased unsealed road width.

Figure 5.2: Typical unsealed increase in width of (public) road

Intersection Layouts

Swept path analysis is generally undertaken once the WTG has been determined for the project, to ensure that any obstacles such as ditches, signage or traffic furniture can be identified and remedied ahead of time. Where further road modifications are required to allow for 'cutting in' of vehicle rear wheels, crushed rock in-fill is normally sufficient on the basis that the vehicles are travelling slowly enough on the curves / turns to ensure minimum road stresses. Where temporary or crushed rock road surfaces are used, a regime of regular maintenance should be employed when OSOM vehicles are travelling to / from the wind farm site.

Once construction is complete, any temporary modifications can be removed and/or reinstated to ensure the intended swept path and traffic control devices of the road for typical usage are maintained, ie. to maintain safe operations. This could include reinstatement of temporary infill areas and relocation of road furniture, signage, etc.

Overhead obstacles

Over-size vehicles can travel with a combined total height of 5.2 m without the need for an overhead pilot. Any obstructions or height risks such as low bridges, overhead power lines, hanging wires or tree branches would be identified. Where there is a bridge risk, detailed calculations would be done to ensure the loads as specified by the selected WTG manufacturer do not present any risk of a bridge strike. If this is possible, alternative route(s) should be sought. Overhanging wires can be provided with additional temporary support if required, whereas any overhanging tree branches would be cut back or restrained away from the path of the vehicle.

Bridges and culverts

In the event that there are bridges and/ or culverts which are deemed not strong or wide enough (typically less than 5 m travel path width) to support WTG transport equipment, the options are as follows:

- Build a temporary diversion with a structure to provide the necessary support, whilst leaving the original structure in place.
- Reinforce the existing structure by means of steel plates / girders as required to provide the necessary support. Reinforcement can be provided either below the structure, or as additional support on top of the existing road surface.
- As a last resort, if other options are not feasible or practicable, consideration may be given to the replacement of the bridge / culvert with a structurally suitable permanent upgrade to support the projected wind farm component loads.

The selection of any of the above options is dependent on a full technical assessment from a qualified structural engineer which typically occurs during the detailed design phase of the project, once the dimensions and loads are known precisely.

6. Summary & Conclusions

The following pertinent issues summarise the transport impact assessment for the proposed Stage 2 of the Boco Rock Wind Farm project:

- The wind farm would consist of up to 20 wind turbines within a single cluster to be located on rural land approximately 6 km south-west of Nimmitabel township and approximately 35 km south of Cooma, NSW.
- Road transport is the preferred method of transport. Rail transport has been considered but is not feasible.
- The preferred transport route for over-size / over-mass (OSOM) vehicles is via Monaro Highway / Snowy Mountains Highway and Springfield Road to the site access location at Yandra Road.
- The minor road network of Springfield Road and Yandra Road / Benbullen access have significant spare capacity along the road network.
- There is proposed to be a single site access point off Springfield Road at Yandra Road serving the Yandra cluster location and some other ancillary facilities.
- All wind turbine locations and ancillary infrastructure would be able to be accessed from the site access point via the internal road network.
- During the construction phase, several tasks would generate traffic including wind farm component delivery, construction material delivery, concrete pours and construction staff transport. The potential maximum daily traffic generation would be 54 light vehicle trips and up to 164 heavy vehicle trips per day. This maximum would potentially occur during peak construction periods only and is a conservative (high) scenario because it assumes that all construction activities would use the same routes to access the Project site. In reality, construction staff and material deliveries are likely to arrive along a number of routes, which would dissipate the traffic generation.
- During peak construction activities, all affected roads on the road network would maintain their levels of service and adequately absorb construction-generated traffic.
- It is proposed that during peak traffic generation activities such as concrete pours and for OSOM vehicles to be used for wind farm component delivery, escort vehicles and appropriate traffic management would be adopted to ensure safe passage from the public road network onto the site.
- Traffic generation during operations would be minimal resulting in up to an additional 10 trips per day. Consequently, traffic and road network impacts would be negligible during the operational phase.
- For the OSOM transport routes, road infrastructure upgrades are likely to be required at a number of locations along Monaro Highway, Polo Flat Road, Springfield Road and Yandra Road / Benbullen access to accommodate the increased heavy vehicle volumes and/or OSOM transport vehicles.
- Along the OSOM transport routes via the minor road network, where vehicles may require the use of the full carriageway width, traffic management would be required in the form of temporary, short-term full road closures ('rolling' road closures as vehicles pass critical locations) aided by escort vehicles.

- A Traffic Management Plan (TMP) would be prepared in conjunction with the transport contractor and relevant road authorities and all aspects would be implemented in co-ordination with the local Council and RMS. The TMP would typically address:
  - Management of transport deliveries to consider other transport operations;
  - Community consultation and issue logging;
  - Clear communication of road closures (if required);
  - Letterbox drop along affected routes;
  - Minimising disruption to local vehicles by ensuring average and maximum wait times due to project traffic along local roads;
  - Road infrastructure upgrade requirements;
  - Traffic management of transport operations;
  - Preparation of a 'Transport Code of Conduct' for all staff and contractors;
  - Procedure to monitor traffic impacts and respond to impacts rapidly; and
  - Reinstatement of pre-existing road conditions after construction is complete.
- The use of licensed and experienced contractors for transporting wind farm components would ensure a minimisation of transport impacts. They would arrange required OSOM vehicle permits, carry out a detailed transport route assessment and confirm the requirement for any road / bridge infrastructure upgrades.

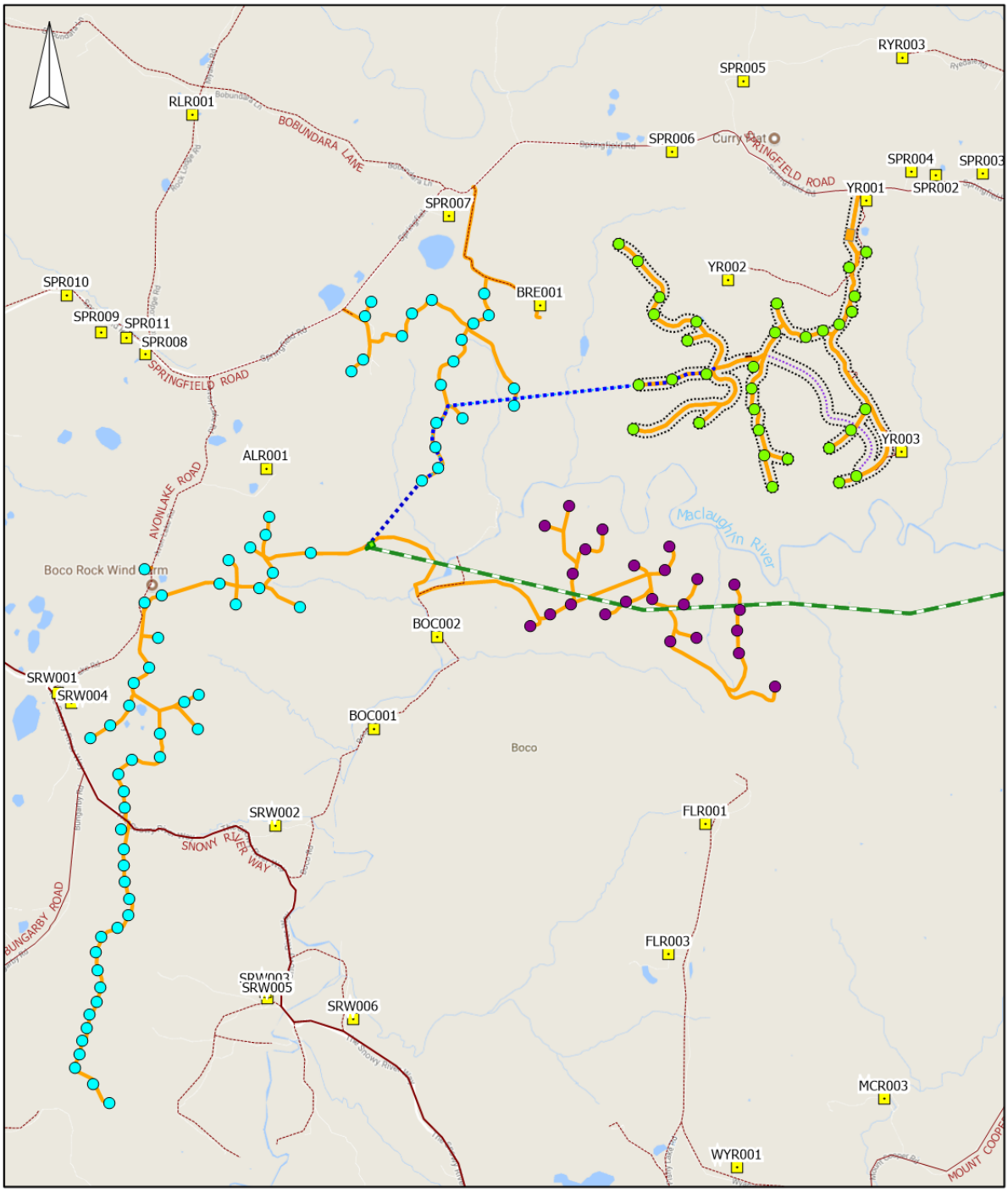
This Transport Assessment has addressed Planning NSW's Director General's Requirements (DGRs), for the construction and operational impacts of the project as follows:

- Details of light and heavy vehicle traffic volumes generated during construction and operation – refer to *Section 4.2* (specifically *Tables 4.1* and *4.2*) and *Section 4.4*.
- Details of transport routes during construction and operation – refer to *Section 3.2*.
- Assess potential impacts on road network function (including intersection level of service) and road safety – refer to *Section 4.3.1* and *Section 4.3.2*.
- Assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including OSOM vehicles) during construction (refer to *Section 4.3.1*) and operation (refer to *Section 4.5*), including full details of any required upgrades to roads, bridges, site access provisions (for safe access to the public road network) or other road features (refer to *Section 5.3*).
- Details of measures to mitigate and/or manage potential impacts – refer to *Section 5*, particularly *Section 5.3*.
- Details of internal site access roads and connections to the existing public road network, including ongoing operational maintenance for on-site roads – refer to *Section 3.2.1*, *Section 4.3.2* and *Section 4.3.3*.
- Consideration of relevant Council traffic / road policies – refer to *Section 1.2*
- Any cumulative impacts from other proposed and approved developments in the surrounding area – refer to *Section 4.6*.

In conclusion, it is considered the proposed Boco Rock Stage 2 Wind Farm Project would not create any significant adverse impacts with respect to transport issues such as traffic operations, road capacity on the surrounding road network, site access and road safety. The management of heavy vehicle movements during construction would be appropriately covered by a TMP to be prepared prior to construction starts, while the use of a specialised and licensed transport contractor would ensure that the transport of OSOM wind turbine components would be carried out in an appropriate manner.

Appendix A

Proposed Wind Farm Layout Diagrams

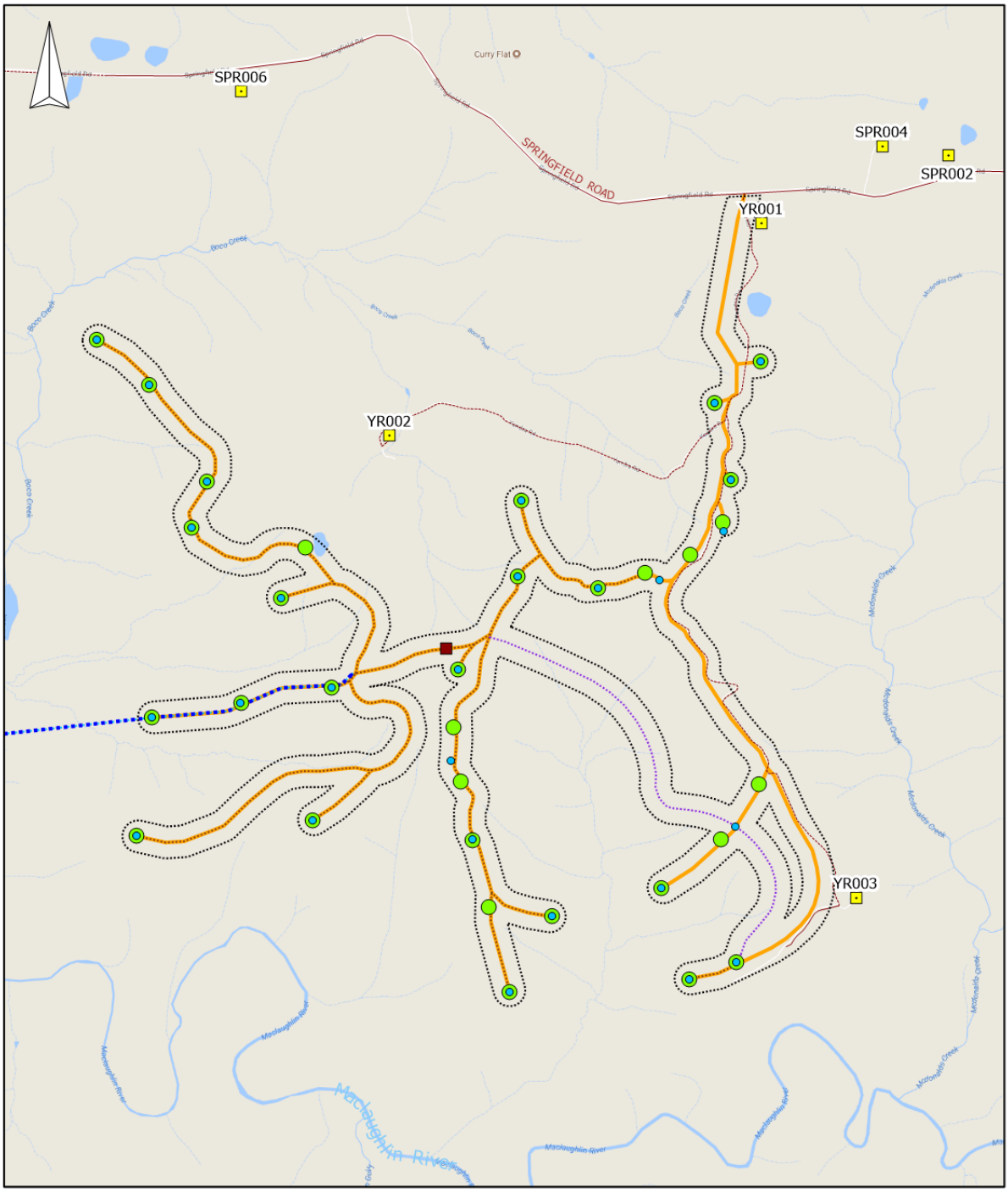


LEGEND

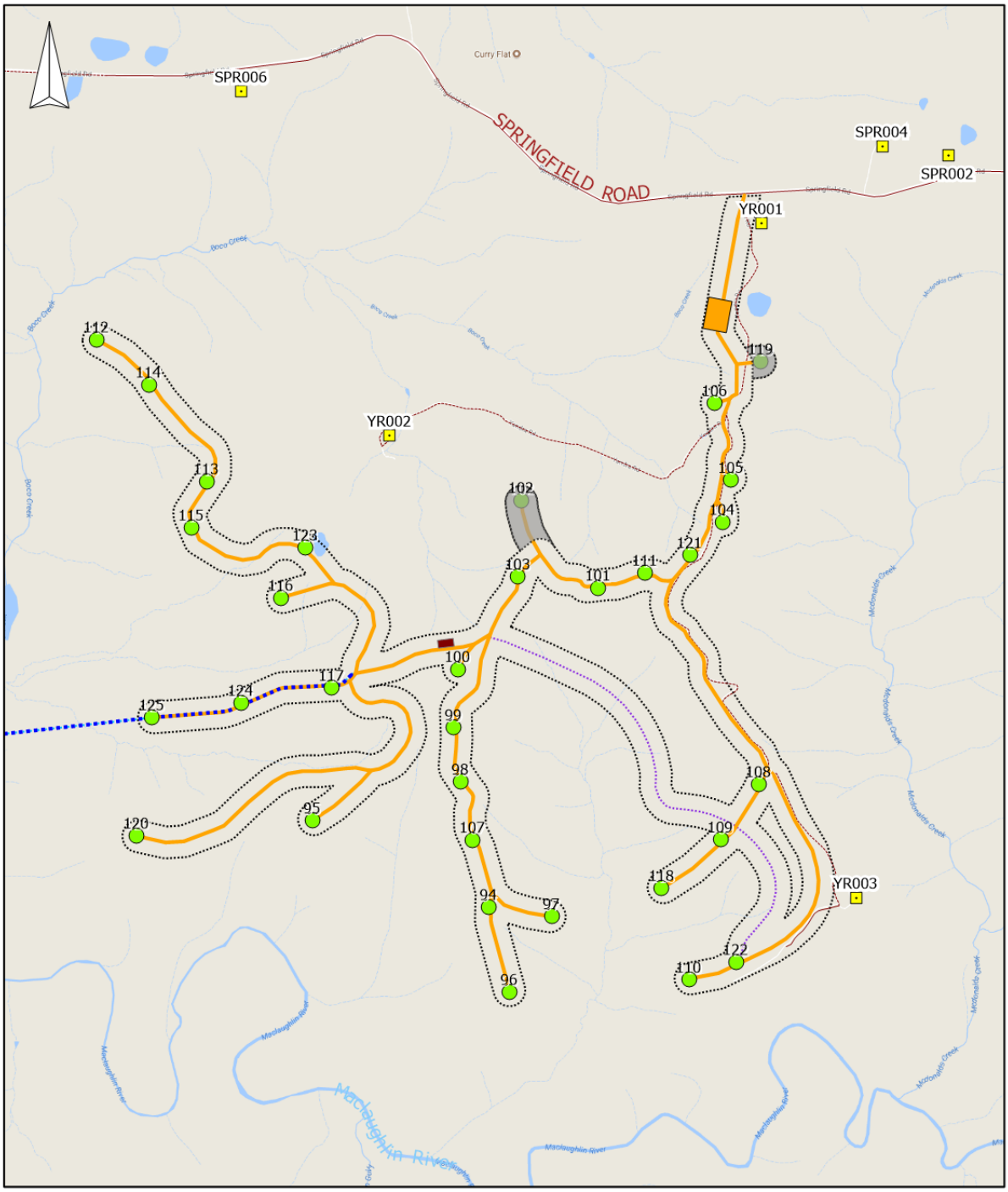
- Stage 1 As Constructed - 67 WTG
- Stage 2 (Yandra Cluster) - 32 WTG
- Boco Cluster - 23 WTG
- Dwellings
- Substation
- Concrete Batching Plant
- Temporary Construction Compound
- 100m Development Corridor
- Internal Road Layout
- Existing Sealed Rd
- Existing Unsealed Rd
- 132kV Double Circuit TL (existing)
- Cables (approved):
- Overhead Cables
- Underground or overhead

SCALE BAR 0 5 km

COMPANY				
BOCO ROCK STAGE TWO PTY LTD				
TITLE				
Figure 1: PROJECT OVERVIEW				
DATE	SCALE	DWG NO	REV	VER
30 Aug 2018	1:110000	BRST013	A	3
DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
J PETERSEN	M BRANSON	1 OF 1	130607	A4



LEGEND						
Layout Option 1:	100m Development Buffer	COMPANY	BOCO ROCK STAGE TWO PTY LTD			cwp Renewables
32 WTG Locations	Cables (approved)	TITLE	Figure 2: YANDRA CLUSTER AS APPROVED			
Layout Option 2:	Overhead Cables	DATE	SCALE	DWG NO	REV	VER
27 WTG Locations	Underground or overhead	30 AUG 2018	1:42000	BRST014	A	1
Dwelling	Roads	DRAWN BY	CHECKED BY	SHEET	JOB NO	SIZE
Internal Road Layout	Sealed Road	J PETERSEN	M BRANSON	1 OF 1	130607	A4
Concrete Batching Plant	Unsealed Road					
SCALE BAR 0 1 km						



LEGEND					
30 Wind Turbine Locations	Internal road layout	COMPANY	BOCO ROCK STAGE TWO PTY LTD		cwp Renewables
Dwelling	Sealed Road				
100m Development Buffer	Unsealed Road	TITLE	Figure 3: PROPOSED MODIFICATION OF YANDRA CLUSTER		
Turbine locations removed	Cables (approved):				
Temporary construction compound	Overhead Cables	DATE	SCALE	DWG NO	REV / VER
	Underground or overhead	30 Aug 2018	1:42000	BRST015	A / 1
Concrete Batching Plant		DRAWN BY	CHECKED BY	SHEET	JOB NO / SIZE
SCALE BAR 0 1 km		J PETERSEN	M BRANSON	1 OF 1	130607 / A4