

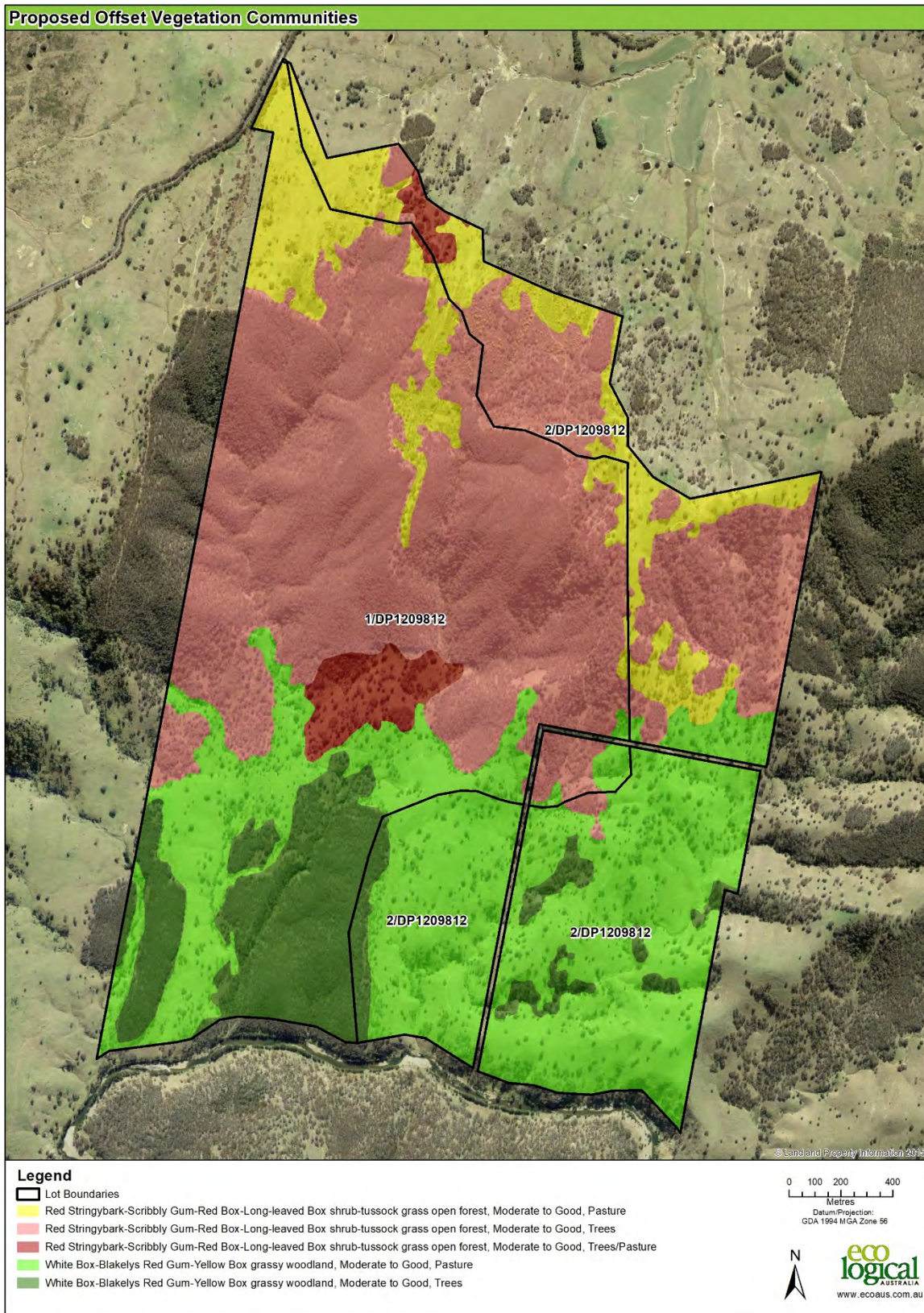
## **Appendix A – Biodiversity Offset**

*Prepared by:*  
Eco Logical Australia





## Appendix A: Biodiversity Offset



The Biodiversity Offset to be established in accordance with Appendix 5 of the Development Consent.



## **Appendix B – Coordinates of the 77 approved WTG Locations**

*Prepared by:*  
CWP Renewables



**Appendix B: Coordinates of the 77 approved WTG locations**

X	Y	ID	X	Y	ID	X	Y	ID
<b>751340.9</b>	<b>6356501</b>	<b>A1</b>	<b>749816.3</b>	<b>6352445</b>	<b>A32</b>	744555.9	6348109	A69
<b>751252</b>	<b>6356181</b>	<b>A2</b>	749438.5	6352205	A33	744411.5	6347845	A71
750744	6356219	A3	<b>749847.4</b>	<b>6352174</b>	<b>A34</b>	744287	6347414	A73
<b>750785.3</b>	<b>6355965</b>	<b>A4</b>	<b>749751.9</b>	<b>6351903</b>	<b>A35</b>	744169.2	6347131	A78
750747.5	6355699	A5	<b>749465.2</b>	<b>6351478</b>	<b>A38</b>	744104.8	6346867	A79
<b>749769</b>	<b>6356019</b>	<b>A6</b>	748769	6351494	A39	743960.3	6346658	A80
<b>749694</b>	<b>6355769</b>	<b>A7</b>	748418.4	6351294	A41	743791.4	6346425	A81
<b>749498.5</b>	<b>6355437</b>	<b>A8</b>	<b>749242.9</b>	<b>6351107</b>	<b>A43</b>	744318.1	6346529	A82
<b>749443</b>	<b>6355112</b>	<b>A9</b>	<b>747298.4</b>	<b>6351105</b>	<b>A44</b>	744447	6346218	A83
<b>751219</b>	<b>6355394</b>	<b>A10</b>	748231.8	6351058	A45	744407	6345956	A84
751560.9	6355219	A11	<b>748805.1</b>	<b>6350872</b>	<b>A47</b>	744529.3	6345707	A85
750780	6355333	A12	748447.3	6350632	A48	<b>744607.1</b>	<b>6345442</b>	<b>A87</b>
<b>750903.1</b>	<b>6355110</b>	<b>A13</b>	748167.3	6350470	A49	<b>744562.6</b>	<b>6345251</b>	<b>A89</b>
<b>750819</b>	<b>6354844</b>	<b>A14</b>	747918.4	6350276	A50	744233.7	6345142	A90
750133	6354974	A15	747529.5	6350198	A51	743246.9	6344785	A92
<b>749929.7</b>	<b>6354425</b>	<b>A17</b>	<b>746971.7</b>	<b>6350212</b>	<b>A52</b>	<b>744469.3</b>	<b>6344920</b>	<b>A94</b>
749994	6353969	A19	746873.9	6349929	A53	<b>744267</b>	<b>6344662</b>	<b>A95</b>
<b>750594</b>	<b>6354469</b>	<b>A20</b>	746889.4	6349701	A54	743944.8	6344318	A98
<b>750427.5</b>	<b>6354203</b>	<b>A21</b>	746429.4	6349692	A55	743491.4	6344182	A99
<b>750476.4</b>	<b>6353901</b>	<b>A22</b>	746391.6	6349423	A56	<b>743867</b>	<b>6344045</b>	<b>A100</b>
<b>750469</b>	<b>6353644</b>	<b>A23</b>	746267.2	6349169	A57	<b>743293.6</b>	<b>6343722</b>	<b>A102</b>
<b>750440.8</b>	<b>6353372</b>	<b>A24</b>	746109.4	6348909	A58	<b>743862.5</b>	<b>6343758</b>	<b>A103</b>
<b>749560.7</b>	<b>6353341</b>	<b>A26</b>	744635.9	6349234	A61	<b>743615.9</b>	<b>6343396</b>	<b>A104</b>
<b>750207.5</b>	<b>6352954</b>	<b>A29</b>	745051.5	6348607	A66	<b>743624.8</b>	<b>6343149</b>	<b>A105</b>
749598.5	6352703	A30	744631.5	6348563	A67	<b>743544.7</b>	<b>6342873</b>	<b>A106</b>
<b>750018.6</b>	<b>6352707</b>	<b>A31</b>	744607.1	6348365	A68			

Coordinates are as defined in the Development Consent. **Bold** text indicates the WTGs which will be constructed for the Project within the micro-siting restrictions of Development Consent schedule 2, condition 7.



## **Appendix C – Community Consultative Committee Presentations**

*Prepared by:*  
CWP Renewables





# Crudine Ridge Wind Farm

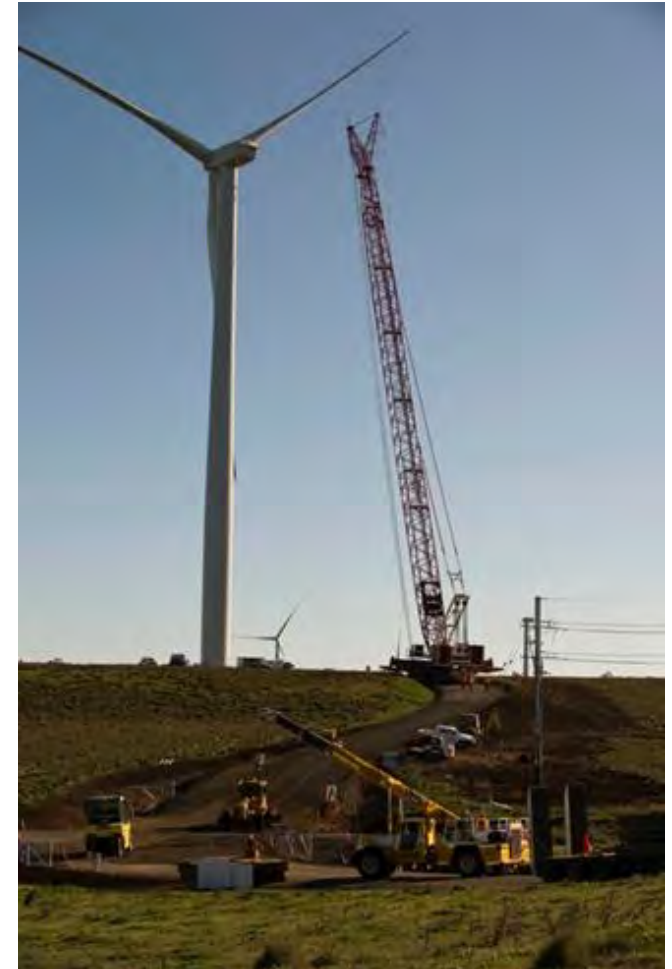
CCC Presentation September 2017





# Agenda

- Introductions
- Project update
- Community Enhancement Fund
- Pre-construction
  - Determining a Final Layout
  - Visual and Noise Mitigations
  - Management Plans
  - Road Upgrades
  - Aviation Obstacle Lighting
- Timeline to construction



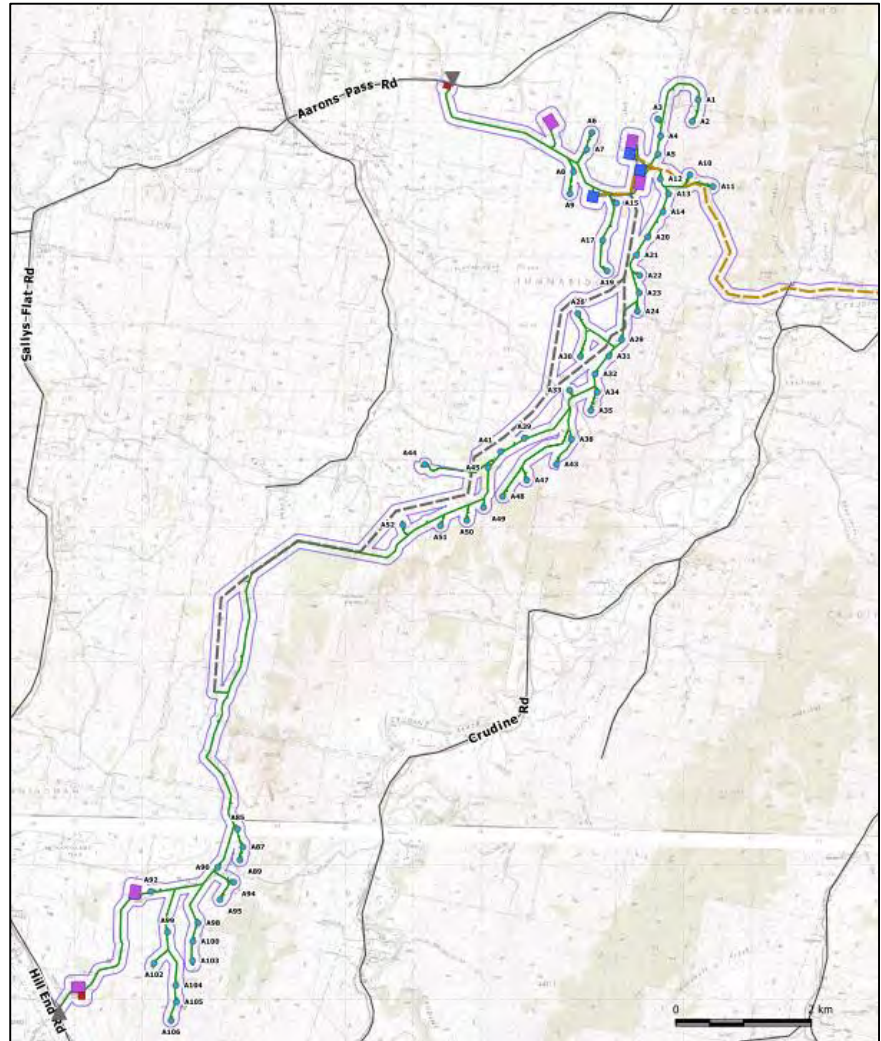
# Community Enhancement

- The Project will support community enhancement programs in Midwestern Regional Council (MWRC) and Bathurst Regional Council (BRC) via Voluntary Planning Agreements (VPAs).
- VPAs were endorsed by both Councils on August 16 at their general meetings, after 28 days of public exhibition.
  - *MWRC: \$1,250 per megawatt (MW) per annum as installed at the development within the Mid-Western Regional Council local government area over the operational life of the development*
  - *BRC: \$1,250 per megawatt (MW) per annum as installed at the development within the Bathurst Regional Council local government area over the operational life of the development*
- **Contributions are expected to exceed \$160,000 every year across the two Council areas, for the life of operation.**
- The funds will be contributed to Councils community fund and administered by Council in accordance with the Community Plans.
- The agreement does contain a commitment to manage and distribute the Development Contribution Amounts towards funding community projects in the area surrounding the site of the Development on the Land.



# Determining a Final Layout

- The Project is yet to finalise the construction layout for the wind farm.
- Currently the Project is engaged in detailed design, commercial and contracting negotiations, and until those are finalised, the layout can not be confirmed.
- The Project will consist of up to 37 turbines at the locations approved by the Commonwealth and NSW governments.
- Ancillary infrastructure such as roads, powerlines, construction compounds, batch plant, substation, switching station and O&M facilities will be constructed in accordance with the planning locations and micrositing allowances.
- A micrositing allowance of 100m is permitted for all project infrastructure in the Development Consent.
- Once the layout is confirmed, the Project will notify key stakeholders including the CCC.





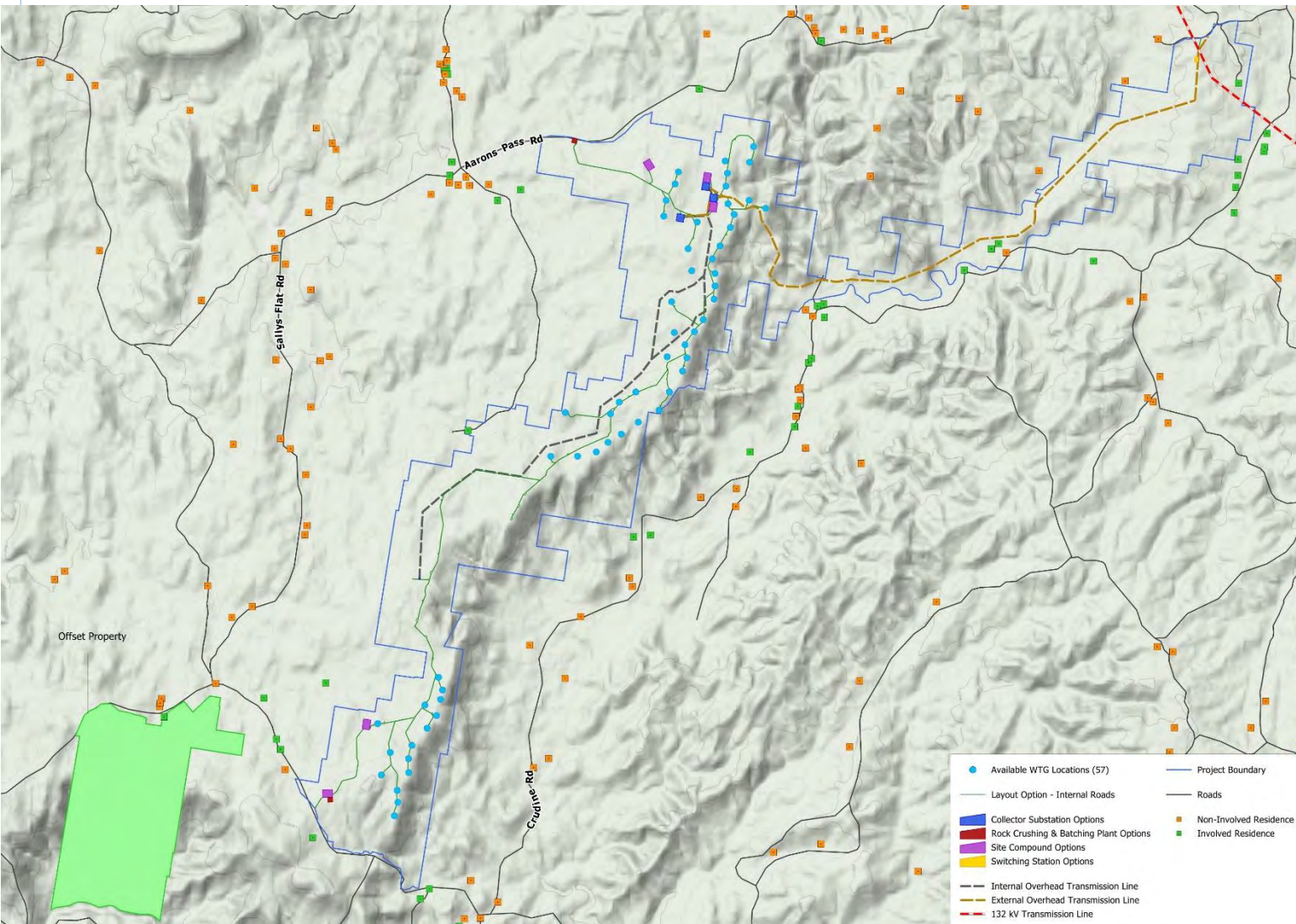
# Approved Project Infrastructure

57 locations shown here are available to select the optimal generating layout.

Up to 37 turbines will be constructed and operated.

Ancillary infrastructure options are also identified on the plan.

A microsite allowance of 100m is permitted for all infrastructure, subject to conditions.





# Visual and Noise Impacts

- On the basis of a 37 turbine layout, visual and noise impacts are expected to reduce significantly for neighbouring properties.
- Once a final layout is determined, visual and noise impacts will be re-evaluated for all residences identified as high, moderate and low in the Development Consent, and those within 4km of a wind turbine.
- Entitlements to visual screening will remain based on the approved conditions, our updated noise and visual assessments will assist in demonstrating a reduced impact and inform the landowners.
- The Development Consent identifies six residences which are entitled to request acquisition by the Project, within 5 years of the commencement of construction.

Acquisition Basis	Land	Cluster
Visual Impact	CR33, CR34	Sallys Flat (Turbines A61 to A106)
Visual Impact	CR15, CR18, CR24, CR41	Pyramul (Turbines A1 to A58)

- Each of these residences has been notified of their entitlements. Once a final layout is determined the owners will be notified of the anticipated impacts and consulted regarding their preference in relation to acquisition.
- Two of the residences, CR15 and CR41 (on a single property) have been acquired at the request of the owners. The Project was able to facilitate a property transaction to satisfy the owners so that they could move into a new property. CR15 and CR41 are now under a Neighbour Agreement.

# Management Plans

- Prior to the commencement of construction, the Project is required to prepare:
  - Environmental Management System
  - Biodiversity Management Plan
  - Aboriginal Heritage Management Plan
  - Transport Management Plan
- These management plans have been prepared by qualified and experienced consultants in each field and submitted to the relevant agencies for review and approval.
- The management plans address the requirements of both the NSW and Commonwealth approvals.
- Once the management plans are approved they will be published on the Project website.



# Transport and Road Upgrades

- The Project is currently engaged with MWRC regarding the upgrade of Aarons Pass Road and Bombandi Road, in accordance with the Development Consent.
- The upgrade works will be undertaken by MWRC Works Department.
- Design work is currently underway to provide the required specifications and schedule for the road upgrades.
- Traffic Control Plans will be developed in consultation with Council based on the agreed program for the upgrades.

# Aviation Obstacle Lighting

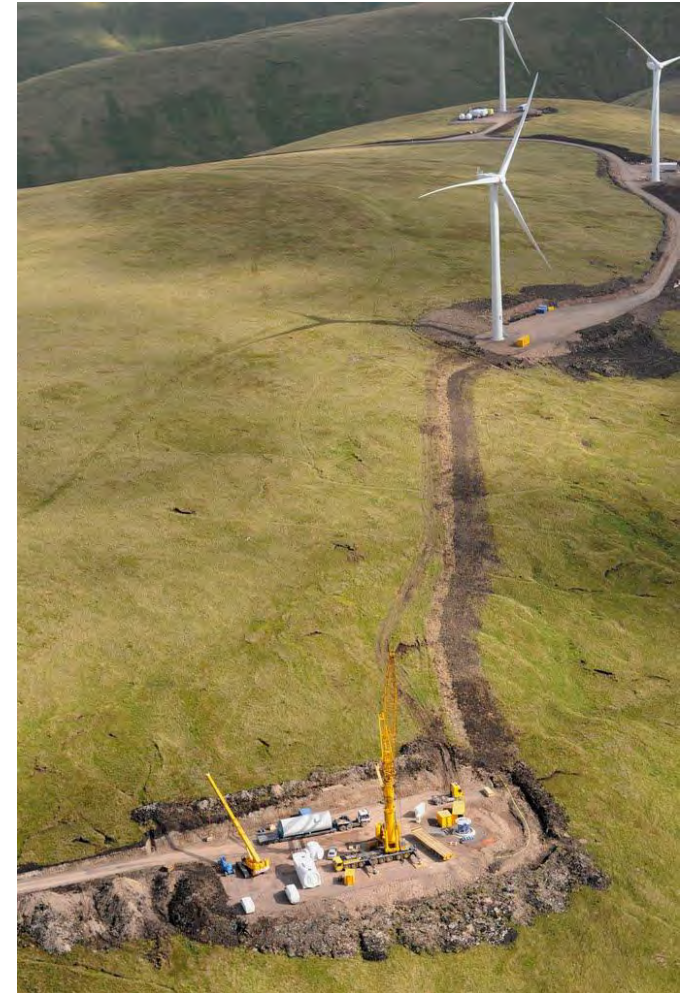
- The Development Consent requires that Aviation Authorities are consulted about lighting requirements, and notified of final turbine locations.
- Civil Aviation Safety Authority (CASA) invariably recommends obstacle lighting for wind farms with turbines in excess of 152m height.
- A draft Aviation Lighting Assessment has been prepared to define an Obstacle Lighting Plan which identifies up to 19 turbines which require obstacle lighting.
- Lighting would be:
  - steady, red, medium intensity obstacle lighting
  - shielded from emitting downwards (i.e. uplighting)
  - in accordance with the requirements of CASA MOS 139
  - operated at night and during periods of low visibility



Linear configuration

# Timeline to Construction

- VPAs - Endorsed by Council
- Management Plans - Submitted for Review
- Road Upgrade Design - Underway
- Construction contracting - Underway:
  - Wind Turbine Supply
  - Balance of Plant Contract
  - Switching Station Contract
- Grid Connection Agreement – Q4/Q1
- Due Diligence and Financing – Q4/Q1
- Detailed Design – Q4/Q1
- Pre-construction Minor Works – Q4/Q1
- Construction to commence - Q1/Q2 2018







Questions and discussion





# Crudine Ridge Wind Farm

CCC Presentation December 2017



# Agenda

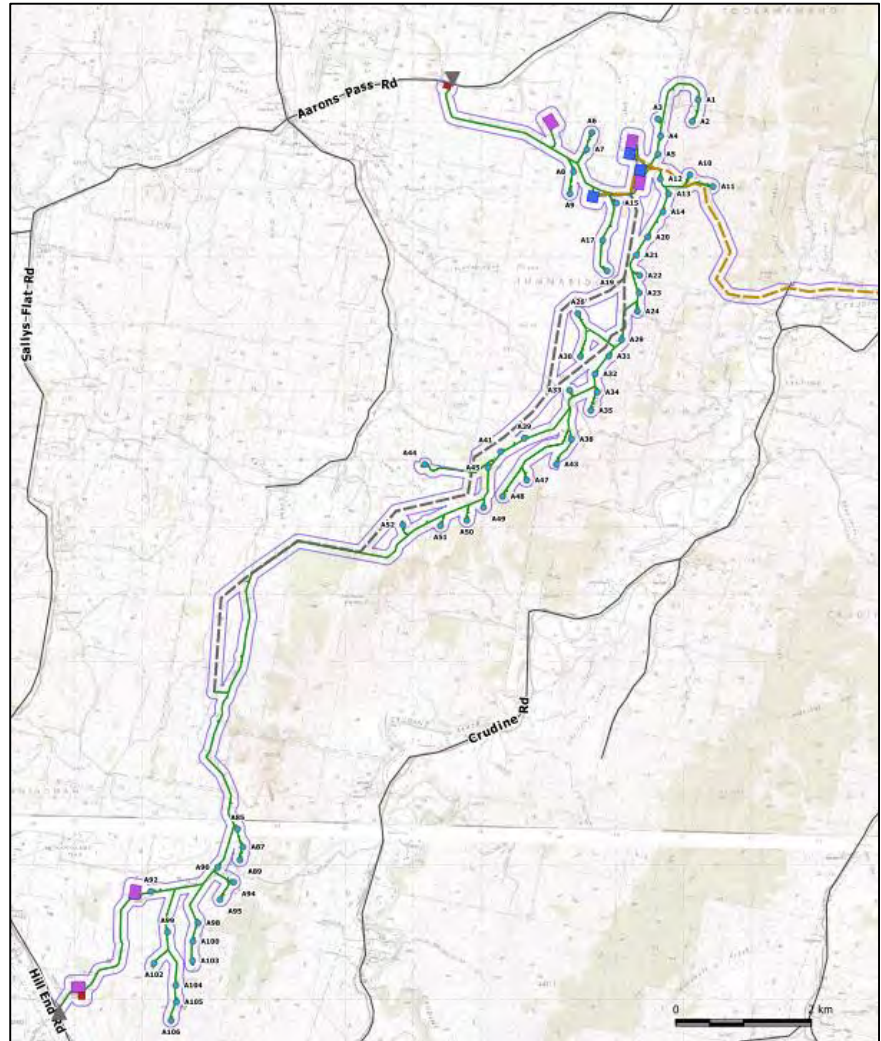
- General Update
- Pre-construction Update
  - Contracting
  - Road Design
  - Geotechnical study
  - Management Plans
  - Material Sourcing
- Timeline to construction





# General Update

- We are currently working through contracting and financing.
- Equity and Debt financing will likely be complete toward the end of Q1 2018.
- Aiming to start construction in Q2 2018, beginning with Aarons Pass Road upgrades.
- The Project is yet to finalise the layout for the wind farm because the turbine contracting is ongoing.
- Once the 37 turbine layout is confirmed, the Project will notify key stakeholders including the CCC.
- Visual and noise impacts of the final layout will be communicated with all residences identified as high, moderate and low in the Development Consent, and those within 4km of a wind turbine.

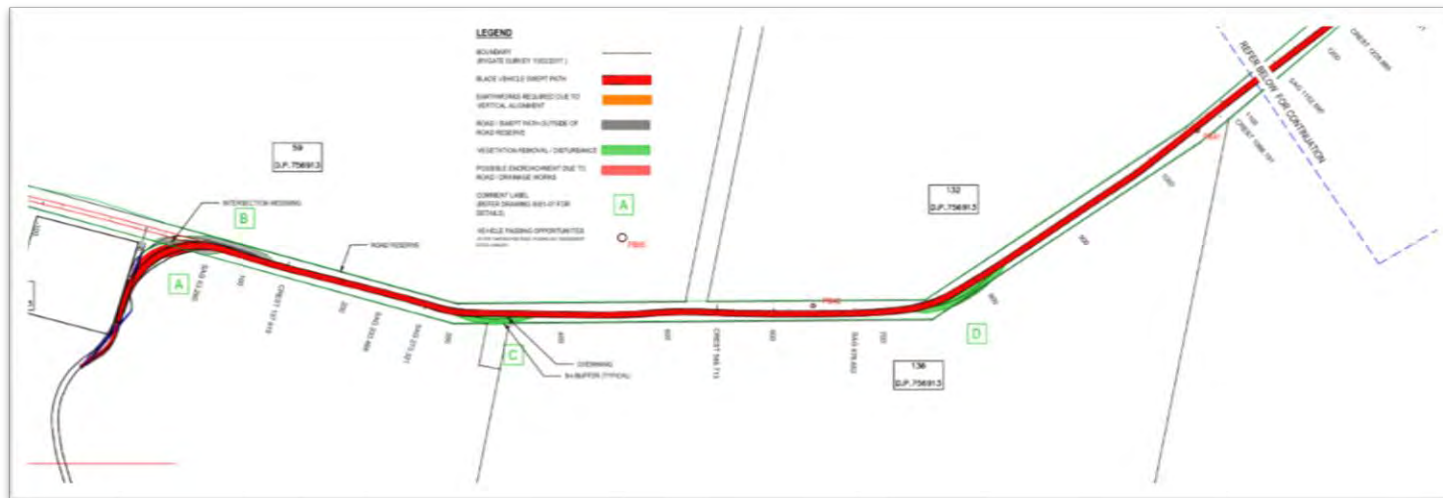


# Contracting

- Construction contracts are being negotiated with preferred suppliers:
  - Turbine Supply:  GE Renewable Energy
  - Balance of Plant:  Zenviron
  - Substation:  TransGrid
- Contracts are expected to be finalised at the end of Q1 2018
- An Early Works contract has been signed with Zenviron to deliver long-lead time items such as road design and geotechnical study.







# Geotechnical Study

- A geotechnical study is currently underway to assess rock and soil structure.
- A 30t excavator is being used to undertake small test pits which will be backfilled following works.
- Test pits will be conducted at:
  - Turbine footing and crane pad locations
  - Substation and compound areas
  - Along the access roads
- The works are being undertaken by the preferred contractor: Zenviron, and their subcontractor Daracon.





# Management Plans

- Prior to the commencement of construction, the Project is required to prepare:
  - Environmental Management Strategy
  - Biodiversity Management Plan including:
    - Biodiversity Offset Strategy
    - Bird and Bat Adaptive Management Plan
  - Aboriginal Heritage Management Plan
  - Transport Management Plan
- All management plans have been prepared in consultation with the relevant government agencies and local Councils.
- All management plans are currently with Department of Planning and Environment for their review and approval.
- Once the management plans are approved they will be published on the Project website.



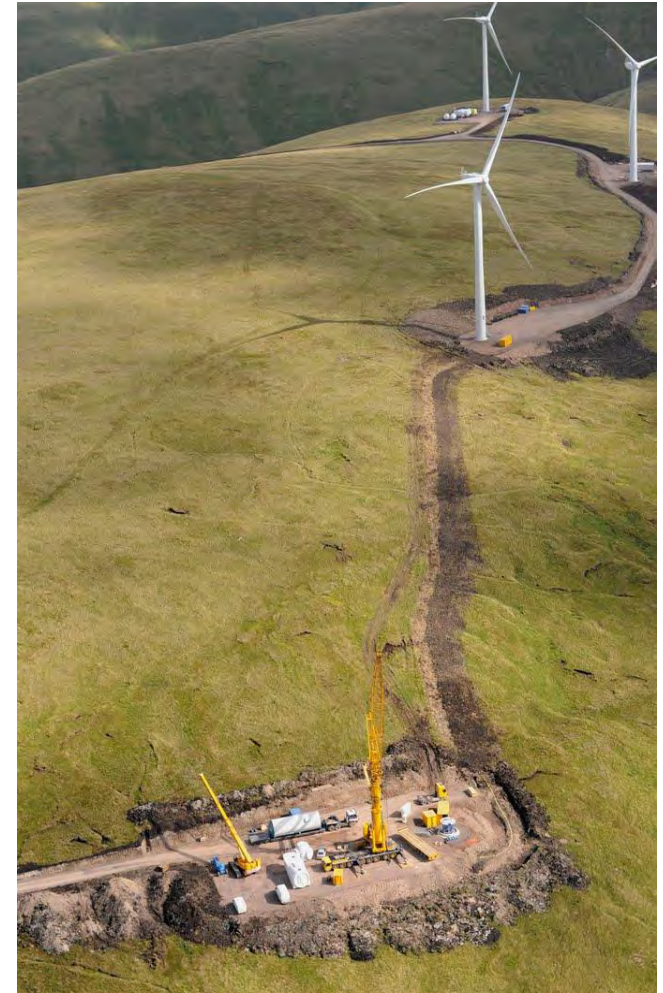
# Material Sourcing

- The Balance of Plant contractor has been investigating opportunities for sourcing hard rock, gravel and water within the Project area.
- The benefits of sourcing materials onsite include:
  1. Improved safety by reducing traffic, particularly along Aarons Pass Road and Hill End Road
  2. Reduced dust and noise for houses along the transport route
  3. Minimise damage to Council roads from heavy vehicle haulage
  4. Avoid existing quarries required for the ongoing Council road works program
- Australian Resource Development Group (ARDG) is a third party that has been assessing suitability and availability of construction materials:
  - Identified a number of potential quarry and water supply options onsite.
  - Development Applications are expected to be lodged in early 2018 through relevant Council process.
  - Water supply licences will be sought from the NSW Office of Water.
- ARDG are not a related entity to CWP or the Project.



# Timeline to Construction

- VPAs – Endorsed and signed by Council
- Management Plans – submitted for approval
- Road Upgrades
  - Survey completed
  - Further environmental studies completed
  - Detailed design underway
- Construction Contracting Underway
- Pre-construction Minor Works – Q4/Q1
- Grid Connection Agreement – Q4/Q1
- Due Diligence and Financing – Q4/Q1
- Detailed Design – Q1/Q2
- Construction to commence - Q2 2018





Questions and discussion





# Crudine Ridge Wind Farm

CCC Meeting 26/4/18



# Agenda

## ■ Project Update

- Design
- Contracting
- Community Benefits

## ■ Pre-construction Update

- Management Plans
- Road Upgrades
- Material Sourcing
- Noise Impacts
- Visual Impacts

## ■ Construction Timeline

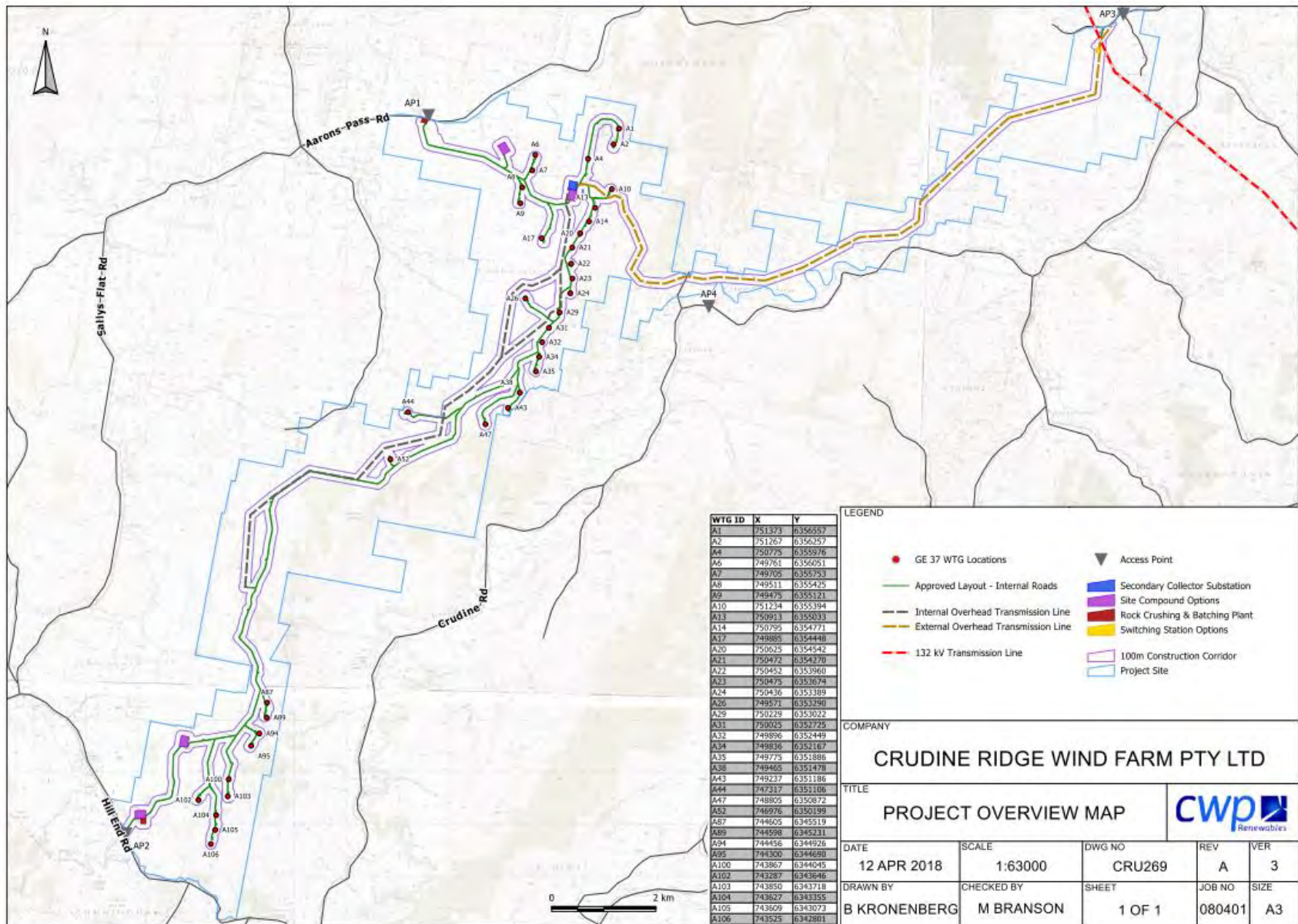




# Project Update: Design

- The Project secured a Power Purchase Agreement with Meridian Energy earlier this year and is expected to commence construction in May.
- The project will consist of:
  - 37 wind turbine generators
  - Each of 3.63 MW capacity
  - Project capacity of approximately 135MW
  - a maximum tip height of 160m
- 27 turbines will be constructed in the Mid-Western Regional Council area.
- 10 turbines will be constructed in Bathurst Regional Council area.
- Project Financing is underway using an equity and debt funding model and we expect to commence construction in May.







# Project Update: Contracting

- Construction contracts are being finalised with preferred suppliers:

- Turbine Supply:  GE Renewable Energy

- Balance of Plant:  Zenvion

- Substation:  TransGrid

- Contracts are expected to be finalised in April.
- An Early Works contract is underway to deliver long-lead time items:
  - Aarons Pass Road design
  - Geotechnical studies
  - Material and water procurement



# Project Update: Community Benefits

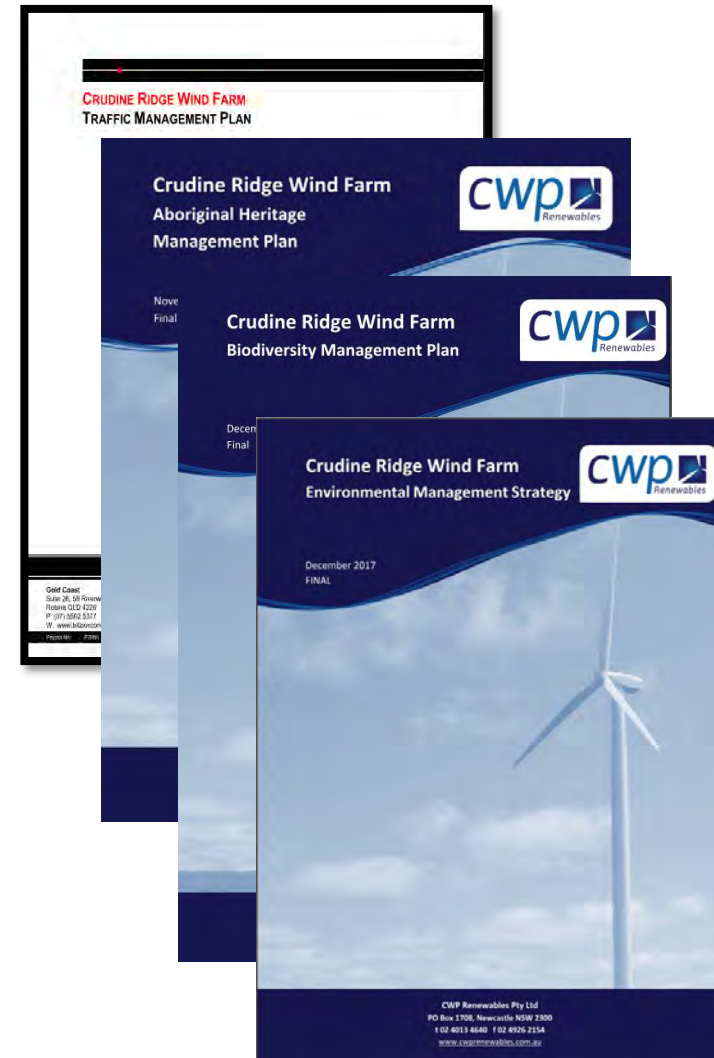
- The Project has an Australian Industry Participation Plan and Zenviron is using the Industry Capability Network to maximise the local workforce during construction.
- Construction contracts have been open for tender for the past two months.
- CWP has recently committed to contribute to help run Pyramul Hall.
- Community Benefits Funds will generate approx. \$167,000 for the region annually in contributions.
- Extensive road upgrades and maintenance program throughout the construction phase of the Project.





# Management Plans

- Following consultation with MWRC, management plans were approved by NSW Department of Planning and Environment in December 2017:
  - Environmental Management Strategy
  - Biodiversity Management Plan
  - Aboriginal Heritage Management Plan
  - Traffic Management Plan
- These plans provide the framework under which construction and operations must occur.
- The Project will conduct regular monitoring programs and will be externally audited for compliance against these plans.



# Road Upgrades

- The Project Approval requires upgrades to be undertaken to **Aarons Pass Road** and **Bombandi Road**.
- CWP has been engaged with MWRC for over twelve months in relation to the scope and design of the works program to ensure that it meets the needs of Council, the community and the Project.
- Detailed design has been prepared to address the design criteria required for project transport:
  - Supersedes the original concept plans prepared during the Environmental Assessment
  - Improves the safety of Aarons Pass Road, particularly in relation to blind corners and crests
  - Avoids and minimises impacts to threatened species and endangered ecological communities
  - Was provided to MWRC Works Dept. for review and for costing
- MWRC has advised us to tender the works for the road upgrades which is currently in progress.
- MWRC Works Dept. supervise and audit the works to ensure they meets council standards.
- The revised 3D design has been approved as a component of the **Traffic Management Plan** which was endorsed by both Mid-western and Bathurst regional councils, and **approved** by the Department of Planning and Environment in December 2017.





# Aarons Pass Road

- The Development Consent requires that the Project upgrades Aarons Pass Road to the satisfaction of MWRC.
- CWP engaged the experienced wind farm civil design team, iCubed, to design the road upgrades with multiple aims:
  - Improving safety of the road during project construction
  - Avoiding impacts to threatened species and endangered ecological communities
  - MWRC standards and project transport requirements.
- MWRC has reviewed and confirmed that the plans are to MWRC satisfaction.
- The approved Biodiversity Management Plan has guided the procedures to ensure that impacts to biodiversity are minimised and are within the limits of the Development Consent.
  - Additional biodiversity survey of Aarons Pass Road was undertaken and threatened species locations were identified by cadastral survey.
  - Detailed design of the road was prepared to ensure avoidance of threatened species.
  - Vegetation clearance will be within the limits permitted in the Development Consent.
- The project impacts will be offset with the establishment of the 674ha Stewardship Site in Hill End.





# Geotechnical Study

- Geotechnical surveys have been underway to assess rock and soil structure across the site:
  - Turbine footing and crane pad locations
  - Substation and compound areas
  - Along the access roads
- Geotechnical works are permitted under the Development Consent as defined as pre-construction minor works.
- Excavator test pits and drilling is being undertaken which will be backfilled following works.



# Material Sourcing

- The Balance of Plant contractor has been investigating opportunities for sourcing hard rock, gravel and water within the Project area.
- The benefits of sourcing materials onsite include:
  1. Improved safety by reducing traffic, particularly along Aarons Pass Road and Hill End Road
  2. Reduced dust and noise impacts on neighbouring residences
  3. Minimise damage to Council roads from heavy vehicle haulage
  4. Avoid existing quarries required for the ongoing Council road works program
- Australian Resource Development Group (ARDG) is a third party that has been assessing suitability and availability of construction materials:
  - ARDG has submitted three Development Applications for quarries to be used during project construction to minimise traffic and other impacts.
  - Water supply licences will be sought from the NSW Office of Water.
- ARDG are not a related entity to CWP or the Project, but would supply materials under a commercial contract.



# Water for Construction

- ARDG has been investigating availability of water for Project construction.
- 65ML of water is required for construction – this includes all direct and indirect consumption for the project.
- A Water Access Licence with a Zero Share Component is currently being procured from Water NSW.
- Once a WAL is established with zero units, water from another holder will be transferred on temporary basis after WaterNSW issues an approval. The WAL is to be traded within the Murray Darling Basin Fractured Groundwater Source.
- Landholders wishing to supply water to the project will need to provide an authority for utilisation of their bores, to be consented by WaterNSW under the terms of the WAL.
- Water supply options include:
  - Existing bores
  - Existing dams
  - Bulk water supply contracts as a back up
- Licence is planned for commencement on 1 July 2018, to be renewed annually during construction. There are no other approvals required by WaterNSW since the project is of 'State Significance'.
- ARDG are not a related entity to CWP or the Project, but would supply water under a commercial contract.

# Noise Impacts

- The Development Consent sets the limits of permissible noise impacts at neighbouring residences to the wind farm.
- Noise impacts are predicted to be significantly lower at neighbouring residences based on the 37 turbine layout, than the impacts predicted from the 77 turbine layout.
- An Environmental Protection Licence (EPL) is being prepared currently by the NSW EPA which will enforce the noise limits and set the monitoring and auditing procedures.
- The EPL is enforceable by the NSW EPA.
- The Development Consent requires that:
  - 12. *Within 3 months of the commencement of operations, the Applicant shall:*
    - a) *Undertaken noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and*
    - b) *Submit a copy of the monitoring results to the Department and the EPA.*

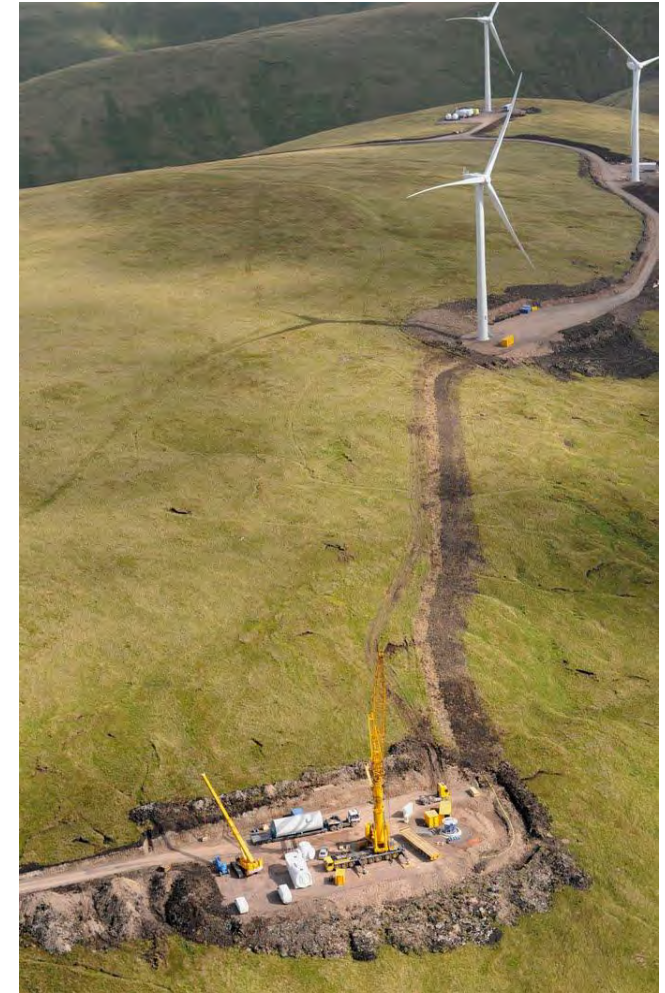


# Visual Impacts

- The visual impacts for all residences within 4km of a wind turbine, as well as individual residence listed in the Development Consent, are currently being revisited based on the final Project layout.
- Visual impacts have seen a significant reduction across the board because of the reduction in turbines from 77 to 37.
- Within one month of the commencement of construction, the project will contact each of those residences to inform them of the anticipated impacts, and their entitlements under the development consent.

# Construction Timeframe

- VPAs – Endorsed and signed by Council
- Management Plans – approved by DPE
- Road Upgrades
  - Biodiversity surveys completed
  - Detailed design and avoidance completed
  - Tendering underway
- Construction Contracting - underway
- Pre-construction Minor Works - underway
- Due Diligence and Financing - underway
- Construction period to commence in May
- First generation will commence ~ Q2 2019







Questions and discussion



## AARONS PASS ROAD (Aug 18 – Dec 18)

- 20km upgrade to facilitate oversized turbine deliveries
- Local community interaction focus: dust suppression, traffic control (design includes passing bays), and notification of delivery periods



## WIND FARM (Aug 18 – Oct 19)

- 37 Wind Turbines with capacity to power up to 55,000 homes
- **GEZ Consortium** to undertake construction of the site, which includes:
  - 34km of internal **access tracks**
  - Turbine **foundations** and crane pads
  - Electrical **collector networks**
  - Wind **turbine erection** and commissioning
- Quarries on the site will significantly reduce local road traffic



## SECTION 1 (completion : Jun 19)



## SECTION 2 (Completion: Jul 19)



## SECTION 3 (Completion: Sep 19)



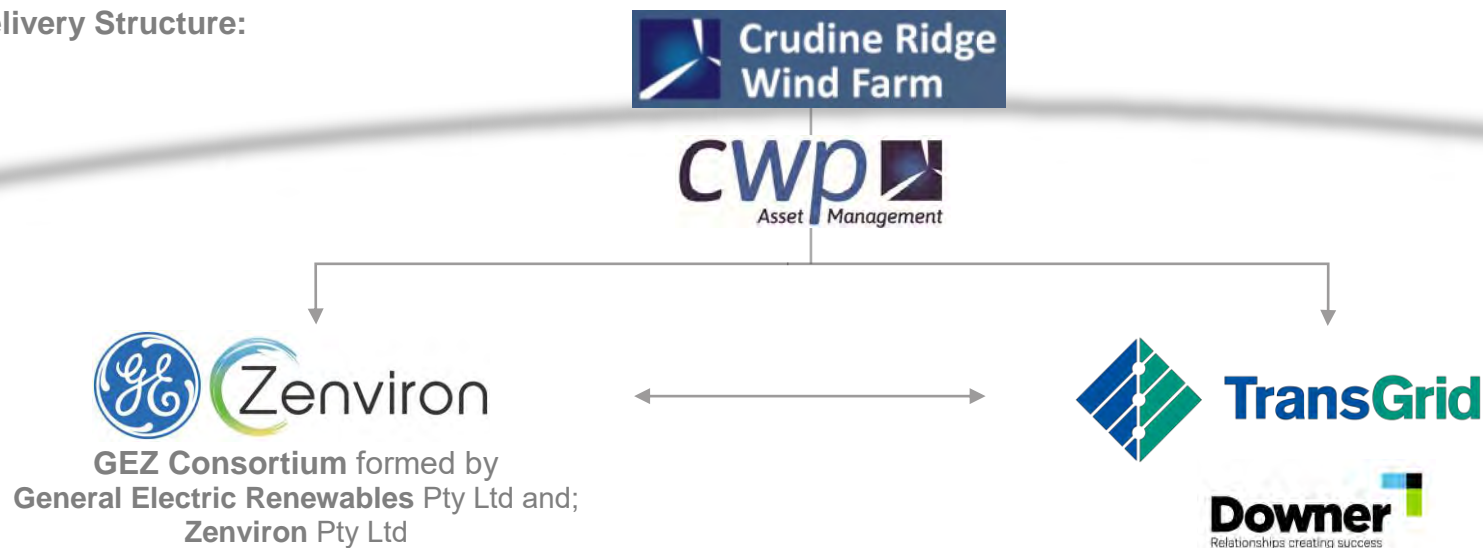
## SECTION 4 (Completion: Oct 19)





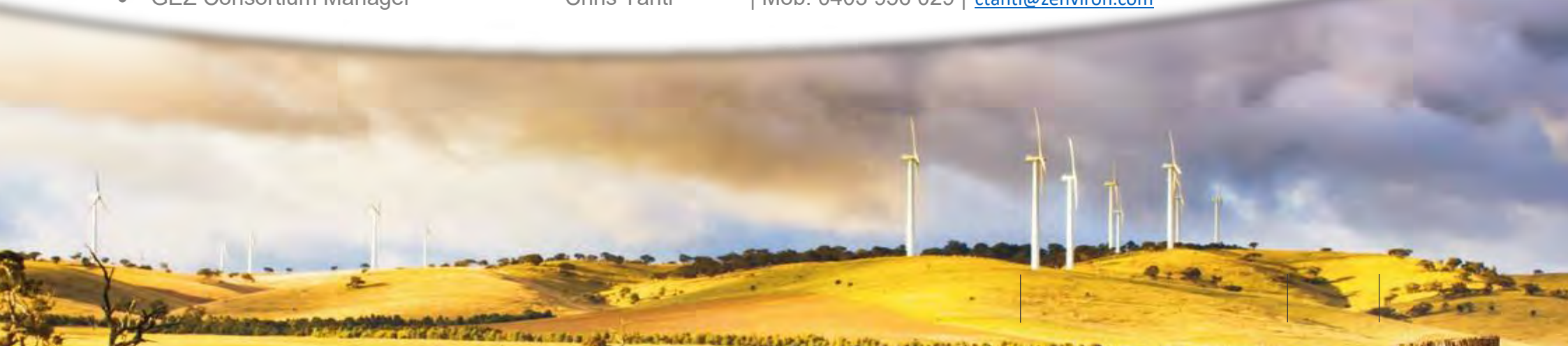


## CRWF Delivery Structure:



## Key Contacts:

• CWP Site Representative	Scott Pagett	Mob: 0407 913 432	<a href="mailto:scott.pagett@cwprenewables.com">scott.pagett@cwprenewables.com</a>
• GEZ Site Manger	Dallas Edwards	Mob: 0499 563 677	<a href="mailto:dredwards@zenviron.com">dredwards@zenviron.com</a>
• GEZ Civil Construction Manager	Dayne Stoneman	Mob: 0436 665 013	<a href="mailto:dstoneman@zenviron.com">dstoneman@zenviron.com</a>
• GEZ Consortium Manager	Chris Tanti	Mob: 0403 956 029	<a href="mailto:ctanti@zenviron.com">ctanti@zenviron.com</a>





## **Appendix D – Letter of Notifications Sent to Community (Examples)**

*Prepared by:*  
CWP Renewables





Mr. Lynn B. Peter Sobel

**"Bombardier!"**

276 Adams Park Rd

Carcalgong NSW 2850

Email: [neterr0bb55@hotmail.com](mailto:neterr0bb55@hotmail.com)

Dear [redacted] & Peter

I am writing to inform you that Crudine Ridge Wind Farm has recently secured finance and the construction phase has officially commenced. The first weeks of the program will be dominated by detailed design, including finalisation of the design works for Aarons Pass Road, with physical works ramping up from the end of June onwards. Works to upgrade Aarons Pass Road will progress over a period of months.

- In accordance with clause 3.1.2 of the Agreement, the **Construction Notification Date** will be May 25, 2017. Construction activities are expected to commence on your land from early July.
- You will soon receive the first of the Construction Period Fee payments accordance with Clause 3.2.3 of the Agreement.
- We also advise that Crudine Ridge Wind Farm Pty Ltd has assigned its rights, duties and obligations under the Agreement to CRWF Nominees Pty Ltd, which is the entity responsible for construction and operations. This has no material effect on the licence agreement.

Construction will be managed by our head contractor Zenviron under the supervision of the CWP Asset Management team, in close cooperation with Mid-western Regional Council. The Construction team will contact you in the near future to discuss timing and nature of works in more detail. Contact details for the key construction personnel are provided below.

Brendan McAvoy Project Director CWP Asset Management 0429 313 151 <a href="mailto:Brendan.McAvoy@cwpm.com">Brendan.McAvoy@cwpm.com</a>	Dallas Edwards Deputy Project Manager Zenviron 0499 563 677 <a href="mailto:dredwards@zenviron.com">dredwards@zenviron.com</a>
--	--

Sincerely,

Mark Branson  
Senior Development Manager  
CWP Renewables





22 August 2018

**Rodney Capon**  
1005 Aarons Park Rd  
Carcalgong NSW 2850

Dear **Mr Capon**,

**Crudine Ridge Wind Farm**

Following on from my letter dated the 19<sup>th</sup> June 2018 in relation to your residence (referred to as **PP03**), I am writing to inform you that construction officially commenced on the wind farm on Thursday 2 August 2018.

As previously discussed, under the NSW Development Consent (SSD-6697) you are entitled to request visual mitigations at your residence any time within a 5 year period from the commencement of construction, up until the date of Wednesday 2 August 2023.

I welcome the opportunity to discuss any questions you may have regarding the project and your entitlements and I am happy to meet up in person when I am visiting the project, alternatively I can arrange for my site representative (Scott Pagett) who is based in Mudgee to meet in person at short notice.

You can also stay up to date with the project by visiting our web site and joining our mailing list at:

[www.crudineridgewindfarm.com.au](http://www.crudineridgewindfarm.com.au)

Please contact me at any stage using the details below, or on our 24-hour phone number 1300 524 463

Yours Sincerely,

A handwritten signature in black ink, appearing to read "B. McAvoy", written over a light blue horizontal line.

**Brendan McAvoy**  
Project Director

**CWP Renewables Pty Ltd**  
Ground Floor, Block E,

34 Thynne Street, Bruce, ACT 2617, Australia

T: 02 6100 2122

W: [www.cwprenewables.com](http://www.cwprenewables.com)

## **Appendix E – Landscape and Visual Assessment Report**

*Prepared by:*  
Moir Landscape Architecture  
June 2018







# Crudine Ridge Wind Farm Layout Comparison Assessment

*Updated June 2018*

## Introduction

Moir Landscape Architecture have been engaged by CWP Renewables to undertake a comparative assessment of the potential alteration to the approved layout for Crudine Ridge Wind Farm from 77 WTGs to 37 WTGs.

The following was undertaken to complete the review:

- Desktop assessment of the revised wind farm layout using topographic maps and aerial imagery.
- Comparative assessment of the potential visual impact ratings from all residences listed within the development consent and located within 4km of each layout using topographic maps and available aerial imagery.

The following provides an overview of the findings for residences associated with the following roads:

## Aarons Pass Road

Residences associated with Aarons Pass Road are generally sited on the northern side of the road. The road runs along a ridgeline which combined with vegetation screens views to the proposal to the south. A combination of the topography and dense vegetation typical of the area screens views of both layouts from the majority of residences.

The distance to proposed WTGs associated with both layouts remains within close proximity to residences APR18 and APR21 (neither of which were previously assessed) and have been rated as having a low and moderate visual impact rating.

## Crudine Road

Residences associated with Crudine Road are located within close proximity to the proposed wind farm. The 77 WTG layout occupies a large extent of the ridgeline to the west of the road. The revised 37 WTG layout significantly reduces the spread of turbines along the ridgeline, therefore lessening the visual impact from Crudine Road. This is predominantly due to the reduction in the number of visible wind turbines and the increased distance between nearest visible turbines from residences.

Residences directly east of the proposal including residences CR28, CR33 - CR37 would have a significantly reduced visual impact as a result of the removal of WTGs. The visual impact ratings from these six residences have been lowered from moderate and high ratings to low or very low.

Residences CR15, CR18, CR21, CR24 and CR25 have previously been assessed as having a high visual rating and the revised layout has decreased these ratings to moderate. This is mainly due to a noticeable reduction of the number of WTGs in the northern cluster of the 37 WTG layout and the removal of the large portion of central turbines removed from the view.

The visual impact rating is likely to remain the same or in some cases slightly reduced for residences within close proximity to the northern and southern along Crudine Road.

### **Hill End Road**

Residences associated with Hill End Road are generally located to the south and south west of the wind farm. It was found that the visual impact rating from residences located to the south west of the wind farm including HER10 - HER16 would be lessened due to a significant reduction in the number of visible WTGs.

### **Prices Lane**

Changes to the proposed layout would result in no change to the potential visual impact from residences associated with the northern end of Prices Lane (PL01, PL02 & PL03). PL04 is likely to have a lower visual impact as a result of the removal of WTGs directly east and south east.

### **Pyramul Road**

The majority of residences associated with Pyramul Road are located in excess of 4km from both the 77 WTG and 37 WTG layouts. The reduction of turbines in the revised wind farm layout would result in less WTGs being visible to the south west. Due to a combination of screening factors including distance, existing screen planting, road side vegetation and existing buildings typical of Pyramul, the rating for both the 77 WTG and 37 WTG layouts remain very low from the majority of residences.

### **Sallys Flat Road**

Residences associated with Sally's Flat Road directly west of the proposal are likely to have a significant reduction in the potential visual impact rating as a result of the revised layout. In particular, the impact for residences SFR04, SFR05 and SFR08 has been reduced from moderate to very low. This is due to a combination of the increased distance to the nearest turbine and decreased number of visible turbines.

In addition, residences SFR06, SFR07, SFR09 - SFR14 and SFR18 which were previously rated as having very low to low visual impact would no longer have views to any of the proposed WTGs, resulting in no visual impact.

A slight reduction to the visual effect would result from the removal of WTGs for residences associated with the northern and southern ends of Sally's Flat Road (SFR 01 - 03, SFR15 -17 and SFR19 - 20) with views to both the northern and southern WTGs.

Overall, the revised 33 WTG layout would have a significantly reduced visual impact on residences associated with Sallys Flat Road.



## Summary

The previous 77 WTG layout occupied a large extent of the ridgeline to the west of Crudine Ridge and the east of Sallys Flat Road. The most significant reduction of visual impact would be from residences directly east and west of the proposal due to the removal of a large section of central wind turbines. In particular residences located close to the central section of the 77 WTG layout which previously had moderate and high ratings have now been attributed low to very low ratings.

The reduction of turbines associated with the southern portion of the layout would assist in reducing the potential visual impact from surrounding residences. A number of residences associated with Hill End Road (to the south of the wind farm) would have a reduced visual impact rating as a result of the removal of the central wind turbines and reduction of the number of WTGs in the southern section of the layout. Residences associated with the southern end of Crudine Road would also have a reduced visual impact as a result of the revised layout.

Where residences are located within close proximity to the northern cluster of wind turbines (particularly the northern parts of Crudine Road, Prices Lane and Sallys Flat Road), there is likely to be a slight reduction in visual rating due to the number of visible WTGs decreasing.

Overall, the proposed reduction in wind turbines from the 77 WTG layout to 37 WTG layout would have a positive impact on the overall visual impact of the proposal.

# Appendix A

## Layout Comparison Residences

- A1. Aarons Pass Road
- A2. Crudine Road
- A3. Hill End Road
- A4. Prices Lane
- A5. Pyramul Road
- A6. Sallys Flat Road

AARONS PASS ROAD		PREVIOUS 77 WTG LAYOUT		REVISED 37 WTG LAYOUT		Notes:
Residence	Involved?	Approx Distance to nearest WTG	Previous Visual Impact Rating	Approx Distance to nearest WTG	Revised Visual Impact Rating	
APR02	Licensor	2.84km	NIL	2.79 km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR03	No	2.96km	NIL	2.84km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR04	No	2.84km	NIL	2.70 km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR05	Licensor	2.68km	NIL	2.62km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR06	Licensor	2.73km	NIL	2.55km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR07	No	3.06km	NIL	3.01km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR08	No	3.26km	NIL	3.21km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR09	Licensor	3.57km	NIL	3.51km	NIL	Based on topography alone, views would be available to up to 10 of northern WTGs, however dense vegetation associated with Aarons Pass Road would Iscreen views. No change to visual impact rating.
APR10	No	3.24km	NIL	3.24km	NIL	Combination of vegetation and topography is likely to screen views. No change to visual impact rating.
APR11	Licensor	5.30km	NIL	5.30km	NIL	<i>Note: In excess of 4km from nearest WTG.</i> Topography screens views. No change to visual impact rating.
APR15	No	3.51km	Not previously assessed	3.38km	VERY LOW	Based on topography alone, views would be available to the majority of northern WTGs. Vegetation indicated on aerial imagery would likely screen views to most of the WTGs.
APR16	Licensor	3.61km	Not previously assessed	3.61km	NIL	A combination of topography and vegetation would screen views to the proposed WTGs from this location.
APR17	No	2.58km	Not previously assessed	2.58km	NIL	Based on topography alone - the tips of approx. 30% of the proposed WTG may be visible, however, dense vegetation indicated on aerial imagery is likely to screen views.
APR18	No	2.25km	Not previously assessed	2.57km	LOW	Based on topography alone it is likely the majority of WTGs would be visible to the west from this location. Existing vegetation is likely to fragment views.
APR19	No	4.37km	Not previously assessed	4.37km	NIL	<i>Note: In excess of 4km from nearest WTG.</i> Based on topography, approx 30% of the WTG tips would be visible, however dense vegetation indicated on aerial imagery would likely screen these views.
APR20	Licensor	5.24km	Not previously assessed	5.24km	NIL	<i>Note: In excess of 4km from nearest WTG.</i> Topography obstructs views.
APR21	Host	1.57km	Not previously assessed	1.59km	MODERATE	Based on topography alone - WTGs are located within close proximity to the residence. A slight reduction in the number of visible WTGs would not reduce the potential visual impact.
APR22	No	4.71km	Not previously assessed	4.71km	NIL	<i>Note: In excess of 4km from nearest WTG.</i> Based on topography alone - the tips of approx 30% of the proposed WTGs may be visible, however, dense vegetation indicated on aerial imagery is likely to screen views.

Orange: Visaul impact was not previously assessed from this residence.

Green: In excess of 4km

Highlight: Amended distance / description as per updated layout June 2018



CRUDINE ROAD		PREVIOUS 77 WTG LAYOUT		REVISED 37 WTG LAYOUT		Notes:
Residence	Involved?	Approx Distance to nearest WTG	Previous Visual Impact Rating	Approx Distance to nearest WTG	Revised Visual Impact Rating	
CR09	No	4.84km	Very Low	5.45km	Very Low	<i>Note: In excess of 4km from nearest WTG.</i> No change to view as a result of the layout revision from this location.
CR10	Host	4.68km	Low	5.09km	Very Low	
CR12	Host	4.31km	Very Low	4.69km	Very Low	<i>Note: In excess of 4km from nearest WTG.</i> Slight reduction of visible WTGs, visual rating has been reduced.
CR13	Host	2.27km	Moderate	2.27km	Moderate	<i>Note: In excess of 4km from nearest WTG.</i> Slight reduction of visible WTGs, no change to the potential visual impact rating.
CR14	Host	2.04km	Moderate	2.14km	Moderate	Slight reduction of visible WTGs, no change to the potential visual impact rating due to close proximity. Screening provided by ancillary buildings and vegetation (as indicated on aerial imagery)
CR15	Neighbour Agreement	2.07km	High	2.08km	Moderate	Slight reduction of visible WTGS, no change to the potential visual impact rating due to close proximity. Screening provided by ancillary buildings and vegetation (as indicated on aerial imagery)
CR16	Host	2.31km	Moderate	2.37km	Moderate	Slight reduction of visible WTGs, no change to the potential visual impact rating. Screening provided by vegetation (as indicated on aerial imagery)
CR17	Host	2.36km	Not previously assessed	2.36km	Moderate	Reduction of visible WTGs would slightly reduce the visual effect. Still a number of WTGs within close proximity. No revision to the visual impact rating. Vegetation likely to fragment views to W
CR18	No	2.36km	High	2.41km	Moderate	Assumed house is orientated to the north, a number of WTGs located on the ridge to the west are visible. No screening elements.
CR19	No	2.35km	Moderate	2.37km	Moderate	Slight reduction of visible WTGs to the west. Unlikely to significantly reduce the visual impact rating from this residence. Screen planting may assist in screening both layouts.
CR20	No	2.46km	Not previously assessed	2.46km	Moderate	Slight reduction of visible WTGs to the west, no change to the potential visual impact rating.
CR21	Host	2.40km	High	2.45km	Moderate	Revised layout results in a slight reduction of visible WTGs to the west, visual rating would be the same for both layouts.
CR22	No	2.49km	Not previously assessed	2.49km	Moderate	Slight reduction of visible WTGs to the west and south west.
CR23	Host	2.55km	Not previously assessed	2.55km	Moderate	Revised layout results in a slight reduction of visible WTGs to the west, visual rating would be the same for both layouts.
CR24	No	2.93km	High	2.97km	Moderate	Screen planting may screen views to the west. Revised layout results in a slight reduction of visible WTGs to the west, visual rating would likely be reduced as a result of the revised layout.
CR25	Host	2.06km	High	2.07km	Moderate	Revised layout would result in a reduced number of visible WTGs, particularly to the south west resulting in a slightly lower visual rating.
CR26	No	2.27km	Low	2.34km	Low	Revised layout results in a reduction of WTGs, resulting a lower visual impact.
CR27	No	2.49km	Moderate	2.62km	Moderate	Revised layout results in a reduction of WTGs, however due to the close proximity, the visual rating is unchanged.
CR28	No	2.44km	Moderate	2.00km	Very Low	Revised layout would result in a reduced number of visible WTGs, particularly to the south west resulting in a slightly lower visual rating.
CR29	Host	2.06km	Low	2.34km	Low	Majority of visible WTGs immediately west of the residence are likely to be reduced. Distance to nearest visible turbine is increased resulting in a lower visual impact rating.
CR30	Host	1.91km	Not previously assessed	2.77km	Low	WTGs to the north re likely to be screened by vegetation associated with creek. The tips of distant WTGs to the south west may be visible.
CR31	No	2.73km	Not previously assessed	3.62km	Low	Revision of proposed layout would significantly reduce the number of potentially visible WTGs (from approx 25 to 6)
CR32	No	3.06km	Low	3.79km	Very Low	Revision of proposed layout would significantly reduce the number of potentially visible WTGs to the north and south.
CR33	No	2.33km	High	3.20km	Low	Majority of visible WTGs immediately west of the residence are likely to be reduced. Vegetation is likely to screen both layouts.
CR34	No	1.99km	High	2.00km	Low	Majority of visible WTGs immediately west of the residence are likely to be reduced and an increased distance to the nearest WTG. Lower visual impact rating as a result.
CR35	No	2.48km	Moderate	2.50km	Low	Majority of visible WTGs immediately west of the residence are likely to be reduced. Slightly lower visual impact rating as a result.
CR36	No	2.31km	Moderate	2.29km	Low	Revised layout results in a slight reduction of visible WTGs to the west, visual rating would be the same for both layouts. Vegetation is likely to fragment views to both layouts.
CR37	No	2.85km	Moderate	2.75km	Low	Majority of visible WTGs immediately west of the residence are likely to be reduced. Slightly lower visual impact rating as a result.
CR39	No	2.54km	Not previously assessed	2.53km	Moderate	Reduction to number of visible WTGs to the north and north west. Screening provided by ancillary buildings and roadside vegetation (as indicated on aerial imagery).
CR40	Host	2.31km	Not previously assessed	2.31km	High	Slight reduction of visible WTGs, revised layout unlikely to change to the potential visual impact rating. No screening elements.

Orange: Visual impact was not previously assessed from this residence.

Green: In excess of 4km

Purple: Updated previous rating for 77 WTG layout

Blue: Updated previous rating as per Departments Assessment

HILL END ROAD		PREVIOUS 77 WTG LAYOUT		REVISED 37 WTG LAYOUT		
Residence	Involved?	Approx Distance to nearest WTG	Previous Visual Impact Rating	Approx Distance to nearest WTG	Revised Visual Impact Rating	Notes:
HER01	No	2.72km	Not previously assessed	2.72km	Low	Revised layout has slightly reduced number of visible WTGs, however the potential visual impact rating is likely to be consistent for both layouts.
HER02	Host	2.52km	Very Low	2.59km	Very Low	Property appears to be orientated to the north west, views would be limited to the tips of WTGs associated with the southern part of the layout with distant views to the northern turbines.
HER03	No	2.10km	Low	2.03km	Low	5 WTGs are likely to be visible on the hill to the north west. It is likely plantings surrounding the house (as indicated on aerial imagery) would reduce any potential visual impacts. The potential visual impact rating is likely to be consistent for both layouts.
HER04	Neighbourhood agreement	1.81km	Very Low	1.62km	Very Low	Based on topography alone, 10 WTGs are likely to be visible to the north west. A combination of screen planting and roadside vegetation (as indicated on aerial imagery) is likely to screen views. The potential visual impact rating is likely to be consistent for both layouts.
HER05	Neighbourhood agreement	1.74km	Not previously assessed	1.74km	Low	Located on a slight elevation. It is likely 10 of the proposed WTGs would be visible on the ridge to the north west. The potential visual rating is likely to be lower for the revised layout.
HER06	Host	1.84km	Moderate	1.73km	Low	The revised layout would result in a reduction of visible WTGs from this location. The potential visual impact would be reduced.
HER07	No	2.02km	Very Low	2.00km	Nil	Reduction of WTGs results in views towards the proposal being screened by vegetation surrounding the homestead.
HER08	Host	2.24km	Low	2.31km	Very Low	Revised layout would result in a reduction of visible WTGs to the north east. The majority of remaining WTGs would be screened by topography. Views towards the proposal would be fragmented by vegetation (as indicated on aerial imagery)
HER09	Host	4.42km	Not previously assessed	4.67km	Nil	Note: In excess of 4km from nearest WTG. A number of WTGs associated with previous layout would be visible. However, views to revised layout would be screened by topography.
HER10	No	4.63km	Very Low	4.83km	Nil	Note: In excess of 4km from nearest WTG. Views to revised layout would be screened by topography.
HER11	Host	4.74km	Very Low	4.83km	Nil	Note: In excess of 4km from nearest WTG. Views to revised layout would be screened by topography.
HER12	Host	1.37km	Not previously assessed	2.29km	Moderate	Approximately 10 WTGs would be visible on the ridge to the east.
HER13	No	3.44km	Not previously assessed	3.96km	Low	Approximately 10 WTGs associated with the revised layout would be visible on the ridge to the east.
HER14	No	4.50km	Not previously assessed	4.84km	Very Low	Note: In excess of 4km from nearest WTG. The tips of some WTGs associated with the revised layout may be visible, however the visual impact would be reduced when compared to the previous 77 WTG layout.
HER15	Host	2.10km	Not previously assessed	2.16km	Low	Approximately 10 WTGs would be visible on the ridge to the east. Ancillary buildings and vegetation may fragment views.
HER16	Host	2.42km	Not previously assessed	2.94km	Low	Approximately 10 WTGs would be visible on the ridge to the east. Ancillary buildings and vegetation may fragment views.
Orange: Visual impact was not previously assessed from this residence.						
Green: In excess of 4km						
Purple: Updated previous rating for 77 WTG layout						
Highlight: Amended distance / VIR as per updated layout June 2018						

PRICES LANE		PREVIOUS 77 WTG LAYOUT		REVISED 37 WTG LAYOUT		Notes:
Residence	Involved?	Approx Distance to nearest WTG	Previous Visual Impact Rating	Approx Distance to nearest WTG	Revised Visual Impact Rating	
PL01	No	3.68km	Low	3.64km	Low	Slight reduction in the number of visible WTGs, however the visual impact rating remains low
PL02	Neighbourhood agreement	3.43km	Moderate	3.43km	Moderate	Slight reduction in the number of visible WTGs, however the visual impact rating remains moderate.
PL03	Host	3.11km	Moderate	2.97km	Moderate	Slight reduction in the number of visible WTGs, however the visual impact rating remains moderate.
PL04	Host	1.63km	Moderate	2.02km	Low	Blades of 2 WTGs would be visible to the east, distant views to southern WTGs. The visual impact would be reduced to low.

Orange: Visual impact was not previously assessed from this residence.

Green: In excess of 4km

Blue: Updated previous rating as per Department



PYRAMUL ROAD		PREVIOUS 77 WTG LAYOUT		REVISED 37 WTG LAYOUT	
Residence	Involved?	Approx Distance to nearest WTG	Previous Visual Impact Rating	Approx Distance to nearest WTG	Revised Visual Impact Rating
PR01	No	4.97km	Very Low	4.66km	Very Low
PR02	No	5.13km	Not previously assessed	5.13km	Very Low
PR03	No	5.11km	Not previously assessed	5.11km	Very Low
PR04	No	5.37km	Very Low	5.17km	Very Low
PR05	No	5.37km	Very Low	5.16km	Very Low
PR06	Host	5.37km	Very Low	5.20km	Very Low
PR07	Host	5.37km	Very Low	5.18km	Very Low
PR08	No	5.19km	Not previously assessed	5.19km	Very Low
PR09	No	5.37km	Very Low	5.34km	Very Low
PR10	No	5.37km	Very Low	5.24km	Very Low
PR11	No	5.37km	Very Low	5.37km	Very Low
PR12	No	5.37km	Very Low	5.14km	Very Low
PR13	No	4.52km	Low	4.46km	Low
PR14	No	4.66km	Not previously assessed	4.66km	Very Low

Orange: Visual impact was not previously assessed from this residence.

Green: In excess of 4km

Notes:

Note: In excess of 4km from nearest WTG.

Views towards the northern most WTGs are screened by topography. Distant views of southern WTGs associated with the northern cluster (of both layouts) are visible at a distance.

Note: In excess of 4km from nearest WTG.

Views towards both layouts are likely to be screened by vegetation to the SW of the building.

Note: In excess of 4km from nearest WTG.

Views towards both layouts are likely to be screened by vegetation.

Note: In excess of 4km from nearest WTG.

A combination of existing buildings, vegetation and topography are likely screen views to both layouts.

Note: In excess of 4km from nearest WTG.

A combination of existing buildings, vegetation and topography are likely screen views to both layouts.

Note: In excess of 4km from nearest WTG.

A combination of existing buildings, vegetation and topography are likely screen views to both layouts.

Note: In excess of 4km from nearest WTG.

A combination of existing buildings, vegetation and topography are likely screen views to both layouts.

Note: In excess of 4km from nearest WTG.

A combination of existing buildings, vegetation and topography are likely screen views to both layouts.

Note: In excess of 4km from nearest WTG.

Several WTGs are likely to be visible at distance to the south west. No change to Visual Impact Rating.

Note: In excess of 4km from nearest WTG.

Reduction to the number of visible WTGs likely to be visible at distance to the south west. No change to Visual Impact Rating.

Note: In excess of 4km from nearest WTG.

Reduction to the number of visible WTGs, particularly to the south west. Views towards both layouts are likely to be screened by vegetation.

Note: In excess of 4km from nearest WTG.

A combination of existing buildings, vegetation and topography are likely screen views to both layouts.

Note: In excess of 4km from nearest WTG.

The revised layout results in a slightly reduced number of visible WTGs, however the visual impact rating remains low due to the number of visible WTGs to the west.

Note: In excess of 4km from nearest WTG.

A small number of WTGs to the south east would be visible in the distance. A band of vegetation to the east is likely to screen views to the proposal.

SALLY'S FLAT ROAD		PREVIOUS 77 WTG LAYOUT		REVISED 37 WTG LAYOUT		Notes:
Residence	Involved?	Approx Distance to nearest WTG	Previous Visual Impact Rating	Approx Distance to nearest WTG	Revised Visual Impact Rating	
SFR01	No	3.55km	Not previously assessed	4.57km	Very Low	<b>Note:</b> <i>In excess of 4km from nearest WTG.</i> Based on topography alone, a small number of WTGs would be visible to the south east. Vegetation surrounding the residence and associated with Sally's Flat Road would screen views to these turbines. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Vegetation surrounding the building is likely to screen views to the proposal. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> A combination of topography and vegetation is likely to screen views to the proposal. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Some distant views to WTGs associated with the northern cluster, however a considerable reduction to the number of potentially visible WTGs results in a revision of the visual impact rating. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Some distant views to WTGs blades associated with the northern cluster, however a considerable reduction to the number of potentially visible WTGs results in a revision of the visual impact rating. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Significant reduction in number of visible WTGs and increase in distance to nearest visible WTG, likely vegetation would screen views to WTGs. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Topography screens views to all WTGs in revised layout. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Some distant views to WTGs blades associated with the northern cluster, however a considerable reduction to the number of potentially visible WTGs results in a revision of the visual impact rating. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Reduction in number of visible WTGs and distance to nearest visible WTG, results in a reduced visual impact rating. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Some distant views to several WTGs tips associated with the northern cluster, likely to be screened by vegetation. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Reduction in number of visible WTGs and increase in distance to nearest visible WTG, vegetation is likely to screen revised layout. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Topography and vegetation is likely to screen views to all WTGs in revised layout. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Small number visible in the distance to the south based on topography alone. Updated layout has a significant reduction in the number of visible WTGs and increase in viewing distance. Vegetation likely to screen views. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Reduction in the number of potentially visible WTGs. Ancillary buildings likely to screen views to both layouts. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Slight reduction to number of potentially visible WTGs, northern turbines will be visible in the distance. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Slight reduction to number of potentially visible WTGs, northern turbines will be visible in the distance. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Slight reduction to number of potentially visible WTGs, northern turbines will be visible in the distance. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Northern WTGs are likely to be screened by vegetation associated with the homestead and Prices Lane. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Slight reduction to number of potentially visible WTGs, however many of the northern turbines will be visible in the distance. <i>Note:</i> <i>In excess of 4km from nearest WTG.</i> Slight reduction to number of potentially visible WTGs, however many of the northern turbines will be visible in the distance.
SFR02	No	4.18km	Not previously assessed	5.29km	Nil	
SFR03	No	3.19km	Not previously assessed	4.29km	Nil	
SFR04	No	2.05km	Moderate	4.22km	Very Low	
SFR05	No	2.08km	Moderate	4.34km	Very Low	
SFR06	No	2.20km	Very Low	5.26km	Nil	
SFR07	No	2.68km	Very Low	5.72km	Nil	
SFR08	No	2.87km	Moderate	6.56km	Very Low	
SFR09	No	2.77km	Very Low	5.05km	Nil	
SFR10	No	3.82km	Low	6.01km	Nil	
SFR11	No	3.37km	Low	5.15km	Nil	
SFR12	No	4.82km	Low	5.15km	Nil	
SFR13	No	4.65km	Low	5.84km	Nil	
SFR14	No	5.31km	Low	6.55km	Nil	
SFR15	Host	4.46km	Low	4.46km	Very Low	
SFR16	No	4.45km	Low	4.45km	Very Low	
SFR17	No	4.38km	Low	4.75km	Very Low	
SFR18	No	4.50km	Low	4.12km	Nil	
SFR19	No	4.55km	Low	4.03km	Low	
SFR20	No	4.82km	Low	4.82km	Low	
Orange: Visual impact was not previously assessed from this residence.						
Green: In excess of 4km						
Purple: Updated previous rating for 77 WTG layout						
Blue: Updated previous rating as per Departments Assessment						
Highlight: Amended distance / VIR as per updated layout June 2018						

# Appendix B

Assessment of Minor Layout Variation (June 2018)



## **Assessment of Minor Layout Variation Crudine Ridge Wind Farm (June 2018)**

### ***Aaron Pass Road***

The removal of WTG A11 would result in a slightly reduced distance to the nearest WTG from APR18. The variation would not alter the existing visual impact ratings from residences associated with Aarons Pass Road.

### ***Crudine Ridge Road***

The removal of WTG A11 from the northern cluster would result in a slightly increased distance to the nearest WTG for a number of residences associated with the north eastern end of Crudine Road.

The addition of WTG A47 would result in a slightly reduced distance to nearest WTG from residences CR28 and CR29.

The minor adjustment of WTG A87 would result in a negligible reduction in distance to the nearest WTG from CR33 and CR34.

There has been no adjustment to the visual impact rating from residences associated with Crudine Road.

### ***Hill End Road***

The distance to nearest wind turbine has been slightly reduced for a number of residences located to the west of the wind farm as a result of the placement of WTG A102. The number of visible WTGs from the majority of residences associated with Hill End Road has slightly increased from 8 WTGs to 10 WTGs.

The revision to the 37 WTG layout is minor and would not affect the visual impact ratings.

### ***Prices Lane***

No amendments have been made to the visual impact ratings from residences associated with Prices Lane.

### ***Pyramul Road***

No amendments have been made to the visual impact ratings from residences associated with Pyramul Road.

### ***Sallys Flat Road***

The distance to nearest wind turbine has been slightly reduced for a small number of residences located to the west of the wind farm as a result of the placement of WTG A102.

### ***Summary***

A review of the amended layout (June 2018) has been undertaken and found that the minor alterations would result in no variation to the assessment of visual impact ratings from residences undertaken in July 2017.

## **Appendix F – Supplementary Environmental Noise Assessment**

*Prepared by:*  
Sonus Pty Ltd  
May 2018



# Crudine Ridge Wind Farm

## Supplementary Environmental Noise Assessment

For CRWF Nominees (ACN 623 533 102) as trustee  
for CRWF Trust

S3736C18

May 2018

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**Author** : Chris Turnbull, MAAS 

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**TABLE OF CONTENTS**

**1 INTRODUCTION .....3**

**2 ASSESSMENT CRITERIA .....4**

**3 ASSESSMENT .....5**

    3.1 Noise Propagation Model and Inputs ..... 5

    3.2 Predicted Noise Levels ..... 6

**4 CONCLUSION .....9**

**APPENDIX A: COORDINATES OF WIND TURBINES .....10**

**APPENDIX B: CLOSEST RELEVANT RECEIVER COORDINATES .....11**

**APPENDIX C: MODELLED SOUND POWER LEVELS .....15**

**APPENDIX D: PREDICTED NOISE LEVELS AT ALL NON-ASSOCIATED RECEIVERS .....16**

## 1 INTRODUCTION

An environmental noise assessment was previously made of the proposed Crudine Ridge Wind Farm, located 45km south of Mudgee and 45km north of Bathurst, New South Wales. The assessment was detailed in the Sonus Report, *Crudine Ridge Wind Farm – Environmental Noise Assessment, S3736C5*, dated October 2012 (the 2012 Report).

The previous assessment was based on two planning layout options. The first option comprised 106 Acciona AW77 wind turbine generators (WTGs) and the second option comprised 77 Siemens SWT2.3-101 WTGs. The assessment determined that the noise from both layouts would achieve the relevant noise requirements at all identified noise receivers in the vicinity of the wind farm.

Since the previous assessment, the wind farm layout has been modified and a different WTG model has been selected. The final wind farm configuration consists of 37 GE 3.6-137 WTGs and a substation. The coordinates of WTGs and substation are provided in Appendix A. The coordinates of the relevant receivers are provided in Appendix B.

This supplementary environmental noise assessment summarises the predictions of noise from the final wind farm configuration and compares the predictions with the operational noise criteria of the Development Consent for Application Number SSD-6697 dated 10 May 2016.

## 2 ASSESSMENT CRITERIA

The Development Consent includes the following conditions:

### Operational Noise Criteria – Wind Turbines

11. The Applicant shall ensure that the noise generated by the operation of wind turbines does not exceed the relevant criteria in Table 4 at any non-associated residence.

Table 4: Noise criteria dB(A)

Residence No	Criteria (dB(A)) with Reference to Hub Height Wind Speed (m/s)													
	3	4	5	6	7	8	9	10	11	12	13	14	15	16
APR2, 3, 4, 5, 6, 7, 8, 9, 10 CR15	35	35	35	35	35	36	38	39	41	42	44	46	48	48
CR16, 18, 19, 20, 21, 24	35	35	35	35	35	35	36	37	38	40	42	44	47	47
CR26, 27, 28	35	35	35	35	35	35	35	35	36	38	41	43	45	45
CR32, 33, 34, 35, 36	35	35	35	35	35	35	37	40	42	45	47	50	52	55
CR37, HER3, 4, TR1, 2, 3, 4, 5, 6	35	35	35	35	35	35	35	36	38	39	40	41	41	41
HER10, 11, 13	35	35	35	35	37	39	41	43	45	46	46	46	46	46
PL1, 2, PR1, 3, 4, 9, 10, 11, SFR1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19	35	35	35	35	35	37	39	41	43	44	46	46	46	46
All other non-associated residences	The higher of 35 dB(A) or the existing background noise level (LA90 (10-minute)) plus 5 dB(A)													

Note: To identify the residences referred to in Table 4, see the applicable figures in Appendix 2.

Noise generated by the operation of the wind turbines is to be measured in accordance with the relevant requirements of the South Australian Environment Protection Authority's *Wind Farms – Environmental Noise Guidelines 2009* (or its latest version), as modified by the provisions in Appendix 4. If this guideline is replaced by an equivalent NSW guideline, then the noise generated is to be measured in accordance with the requirements in the NSW guideline.

### Operational Noise Criteria – Ancillary Infrastructure

12. The Applicant shall ensure that the noise generated by the operation of ancillary infrastructure does not exceed 35 dB(A) LAeq(15 minute) at any non-associated residence.

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy* (or its equivalent) as modified by the provisions in Appendix 4.

In accordance with the Development Consent, the assessment has been conducted based on the methodology of the South Australian Environment Protection Authority's (SA EPA) *Wind farms environmental noise guidelines* (the SA Guidelines) as modified by Appendix 4 of the Development Consent. It is noted that with the modifications of Appendix 4, the assessment is also in accordance with the NSW Planning and Environment document, "Wind Energy: Noise Assessment Bulletin for State significant wind energy development" December 2016.



### 3 ASSESSMENT

CRWF Nominees has identified 155 noise receivers in the vicinity of the wind farm, including associated and non-associated receivers. The closest non-associated receivers are approximately 1.6 kilometres from the nearest turbine. The coordinates of the receivers are detailed in Appendix B. Appendix B also identifies if the receivers are associated or non-associated receivers.

The assessment has been conducted based on the wind farm consisting of 37 GE 3.6-137 WTGs with 91.5m hub height, and a transformer at the substation having a maximum rating of 160 MVA. The coordinates of the WTGs and substation transformer are detailed in Appendix A.

#### 3.1 Noise Propagation Model and Inputs

Noise predictions were conducted using the CONCAWE propagation model in the SoundPlan noise modelling software. This noise propagation model is widely accepted as an appropriate model for the assessment of wind farms. The CONCAWE model takes into account the sound power level and position of the noise sources, topography, hardness of the ground, and atmospheric absorption at different meteorological conditions (such as temperature inversion or downwind conditions conducive to noise propagation).

The assessment has been based on model inputs as follows:

- 10°C temperature;
- 80% relative humidity;
- acoustically soft ground (finite acoustic impedance);
- barrier attenuation of no greater than 2 dB(A); and,
- 1.5m receiver height.

It is noted that the SA Guidelines provide a default prediction method which incorporates hard ground in the noise propagation model unless justification is provided for using another input. The CONCAWE propagation model separates ground attenuation into the categories of hard ground and ground with finite acoustic impedance. CONCAWE states that hard ground should be used for surfaces such as concrete or water and all other surfaces including grass or soil should be considered as finite acoustic impedance. The ground between the WTGs and receivers is not concrete nor water, and therefore a finite acoustic impedance (corresponding to grass or rough pasture within the CONCAWE model) has been used.

The noise from the WTGs has been modelled based on the sound power levels specified in the document with the title: *“GE Renewable Energy, Technical Documentation, Wind Turbine Generator Systems 3.6-137 - 50/60 Hz, Product Acoustic Specifications, Normal Operation according to IEC Incl. Octave and 1/3rd Octave Band Spectra”*.

The overall Sound Power levels specified in the document are summarised in the Table 1 below and the one-third octave bands are detailed in Appendix C. In accordance with the GE document, 0.8dB was added to the specified levels prior to input to the noise model to account for the uncertainty of the sound power levels.

**Table 1: Overall sound power level for GE 3.5-137 WTG**

Hub Height Wind Speed (m/s)	4	5	6	7	8	9	10	11	12	13	14 to cut out
Overall Sound Power Level (dB(A))	92.5	94.5	98.5	101.9	104.8	106	106	106	106	106	106

The one-third octave sound power level data indicate that the noise from the turbines is not tonal in accordance with Appendix 4 of the Development Consent. Therefore no penalty for tonality has been applied to the predictions.

The sound power level for the 160 MVA transformer has been based on the derived sound power levels for transformers from the *Australian/New Zealand Standard AS/NZS60076.10:2009, Power transformers - Determination of sound levels (IEC 60076-10, Ed. 1(2001) MOD)*, summarised in Table 2 below.

**Table 2: Overall sound power level for 160 MVA transformer**

Transformer Rating	SWL (dB(A)) for each Octave Band Centre Frequency								Total SWL (dB(A))
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2kHz	4 kHz	8 kHz	
160 MVA	75.9	84.0	91.5	93.9	86.1	83.3	76.1	72.0	96.9

### 3.2 Predicted Noise Levels

The predicted noise levels at all non-associated receivers within 8km of a turbine are detailed in Appendix D. The predictions indicate that the noise at all non-associated receivers will be no greater than 35 dB(A) and therefore the requirements of Development Consent Condition 11 are achieved.

For reference, the predicted noise at all receivers specifically listed in Condition 11 is summarised in Table 3 below, along with the criteria.

**Table 3: Comparison of predicted noise levels and criteria at receivers listed in Condition 11**

Receiver	Predicted Noise Level, dB(A)												Criteria, dB(A)											
	Hub Height Wind Speed (m/s)												Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	4	5	6	7	8	9	10	11	12	13	14		
APR02*	15	16	20	24	27	28	28	28	28	28	28	45	45	45	45	45	45	45	45	45	45	46		
APR03	12	14	18	21	24	25	25	25	25	25	25	35	35	35	35	36	38	39	41	42	44	46		
APR04	13	15	19	22	25	26	26	26	26	26	26	35	35	35	35	36	38	39	41	42	44	46		
APR05*	14	15	19	23	25	26	26	26	26	26	27	45	45	45	45	45	45	45	45	45	45	46		
APR06*	14	16	20	23	26	27	27	27	27	27	27	35	45	45	45	45	45	45	45	45	45	46		
APR07	14	15	19	23	25	27	27	27	26	27	27	35	35	35	35	36	38	39	41	42	44	46		
APR08	11	12	16	20	23	24	24	24	24	24	24	35	35	35	35	36	38	39	41	42	44	46		
APR09*	11	13	17	20	23	24	24	24	24	24	24	45	45	45	45	45	45	45	45	45	45	46		
APR10	13	15	19	22	25	26	26	26	26	26	26	35	35	35	35	36	38	39	41	42	44	46		
CR15*	23	25	29	32	35	36	36	36	36	36	36	45	45	45	45	45	45	45	45	45	45	46		
CR16*	22	23	27	31	33	35	35	35	34	35	35	45	45	45	45	45	45	45	45	45	45	45		
CR18	21	23	27	30	33	34	34	34	34	34	34	35	35	35	35	35	36	37	38	40	42	44		
CR19	21	23	27	30	33	34	34	34	34	34	34	35	35	35	35	35	36	37	38	40	42	44		
CR20	21	22	26	30	32	34	34	34	33	34	34	35	35	35	35	35	36	37	38	40	42	44		
CR21*	20	22	26	29	32	33	33	33	33	33	33	45	45	45	45	45	45	45	45	45	45	45		
CR24	17	19	23	26	29	30	30	30	30	30	30	35	35	35	35	35	36	37	38	40	42	44		
CR26	19	21	25	28	31	32	32	32	32	32	32	35	35	35	35	35	35	35	36	38	41	43		
CR27	18	19	23	27	29	31	31	31	31	31	31	35	35	35	35	35	35	35	36	38	41	43		
CR28	20	22	26	29	32	33	33	33	33	33	33	35	35	35	35	35	35	35	36	38	41	43		
CR32	14	16	20	23	26	27	27	27	27	27	27	35	35	35	35	35	37	40	42	45	47	50		
CR33	14	16	20	23	26	27	27	27	27	27	27	35	35	35	35	35	37	40	42	45	47	50		
CR34	19	21	25	28	31	32	32	32	32	32	32	35	35	35	35	35	37	40	42	45	47	50		
CR35	18	20	24	28	30	32	32	31	31	31	32	35	35	35	35	35	37	40	42	45	47	50		
CR36	20	22	26	29	32	33	33	33	33	33	33	35	35	35	35	35	37	40	42	45	47	50		
CR37	16	17	21	25	28	29	29	29	29	29	29	35	35	35	35	35	35	36	38	39	40	41		
HER03	20	21	25	29	32	33	33	33	33	33	33	35	35	35	35	35	35	36	38	39	40	41		
HER04*	22	24	28	31	34	35	35	35	35	35	35	45	45	45	45	45	45	45	45	45	45	45		
HER10	7	9	13	16	19	20	20	20	20	20	20	35	35	35	37	39	41	43	45	46	46	46		
HER11*	7	9	13	16	19	20	20	20	20	20	20	45	45	45	45	45	45	45	45	46	46	46		
HER13	11	13	16	20	23	24	24	24	24	24	24	35	35	35	37	39	41	43	45	46	46	46		
PL01	14	15	19	23	25	26	26	26	26	26	27	35	35	35	35	37	39	41	43	44	46	46		
PL02*	15	16	20	24	26	28	28	28	27	28	28	35	35	35	35	37	39	41	43	44	46	46		
PR01	9	10	14	18	20	21	21	21	21	21	21	35	35	35	35	37	39	41	43	44	46	46		
PR03*	8	10	13	17	19	21	21	21	21	21	21	45	45	45	45	45	45	45	45	45	46	46		
PR04	8	9	13	17	19	20	20	20	20	20	20	35	35	35	35	37	39	41	43	44	46	46		
PR09	7	9	13	16	19	20	20	20	20	20	20	35	35	35	35	37	39	41	43	44	46	46		
PR10	7	9	13	16	19	20	20	20	20	20	20	35	35	35	35	37	39	41	43	44	46	46		



Receiver	Predicted Noise Level, dB(A)												Criteria, dB(A)											
	Hub Height Wind Speed (m/s)												Hub Height Wind Speed (m/s)											
	4	5	6	7	8	9	10	11	12	13	14	4	5	6	7	8	9	10	11	12	13	14		
PR11	7	8	12	15	18	19	19	19	19	19	19	35	35	35	35	37	39	41	43	44	46	46		
SFR01	10	11	15	19	21	22	22	22	22	22	22	35	35	35	35	37	39	41	43	44	46	46		
SFR04	9	11	15	18	21	22	22	22	22	22	22	35	35	35	35	37	39	41	43	44	46	46		
SFR05	9	11	15	18	21	22	22	22	22	22	22	35	35	35	35	37	39	41	43	44	46	46		
SFR06	8	9	13	16	19	20	20	20	20	20	20	35	35	35	35	37	39	41	43	44	46	46		
SFR07	6	8	12	15	18	19	19	19	19	19	19	35	35	35	35	37	39	41	43	44	46	46		
SFR08	6	8	11	15	17	18	18	18	18	18	18	35	35	35	35	37	39	41	43	44	46	46		
SFR09	7	8	12	15	18	19	19	19	19	19	19	35	35	35	35	37	39	41	43	44	46	46		
SFR10	4	6	10	13	16	17	17	17	17	17	17	35	35	35	35	37	39	41	43	44	46	46		
SFR11	7	8	12	15	18	19	19	19	19	19	19	35	35	35	35	37	39	41	43	44	46	46		
SFR12	7	8	12	15	18	19	19	19	19	19	19	35	35	35	35	37	39	41	43	44	46	46		
SFR13	4	5	9	12	15	16	16	16	16	16	16	35	35	35	35	37	39	41	43	44	46	46		
SFR16	11	13	16	20	22	24	24	24	24	24	24	35	35	35	35	37	39	41	43	44	46	46		
SFR17	11	13	17	20	23	24	24	24	24	24	24	35	35	35	35	37	39	41	43	44	46	46		
SFR18	11	13	17	20	23	24	24	24	24	24	24	35	35	35	35	36	38	39	41	42	44	46		
SFR19	12	14	18	21	24	25	25	25	25	25	25	35	35	35	35	36	38	39	41	42	44	46		
TR01	9	11	15	18	21	22	22	22	22	22	22	35	35	35	35	35	35	36	38	39	40	41		
TR02	9	11	15	18	21	22	22	22	22	22	22	35	35	35	35	35	35	36	38	39	40	41		
TR03	8	9	13	17	20	21	21	21	21	21	21	35	35	35	35	35	35	36	38	39	40	41		
TR04	7	9	13	16	19	20	20	20	20	20	20	35	35	35	35	35	35	36	38	39	40	41		
TR05	7	9	13	16	19	20	20	20	20	20	20	35	35	35	35	35	35	36	38	39	40	41		
TR06	6	8	12	15	18	19	19	19	19	19	19	35	35	35	35	35	35	36	38	39	40	41		

\* These residences have changed association status and now have different criteria to that specified in Condition 11.

The highest noise level at non-associated receivers is predicted at CR19, where 34 dB(A) is predicted at 9m/s and above. At this receiver, a C-weighted level of 49 dB(C) is predicted at these wind speeds. As this level is less than 60 dB(C), no penalty for low frequency is warranted in accordance with Appendix 4 of the Development Consent.

The highest noise level from ancillary infrastructure at non-associated residences is predicted to be less than 15 dB(A). This level is well below the requirements of Condition 12 of the Development Consent.

#### **4 CONCLUSION**

The noise from the final wind farm configuration for the proposed Crudine Ridge Wind Farm, comprising 37 GE 3.6-137 WTGs has been predicted for all non-associated receivers located in the vicinity of the wind farm, and all receivers listed within the development consent condition.

Based on the predictions, the noise levels at receivers do not exceed the noise criteria of Condition 11 or Condition 12 of the Development Consent.

## APPENDIX A: COORDINATES OF WIND TURBINES

Turbine ID	Coordinates (MGS84 Z55)	
	Easting	Northing
A1	751373	6356557
A2	751267	6356257
A4	750775	6355976
A6	749761	6356051
A7	749705	6355753
A8	749511	6355425
A9	749475	6355121
A10	751234	6355394
A13	750913	6355033
A14	750795	6354771
A17	749885	6354448
A20	750625	6354542
A21	750472	6354270
A22	750452	6353960
A23	750475	6353674
A24	750436	6353389
A26	749571	6353290
A29	750229	6353022
A31	750025	6352725
A32	749896	6352449
A34	749836	6352167
A35	749775	6351886
A38	749465	6351478
A43	749237	6351186
A44	747317	6351106
A47	748805	6350872
A52	746976	6350199
A87	744605	6345519
A89	744598	6345231
A94	744456	6344926
A95	744300	6344690
A100	743867	6344045
A102	743287	6343646
A103	743850	6343718
A104	743627	6343355
A105	743609	6343073
A106	743525	6342801
Substation Transformer	750486	6355460



## APPENDIX B: CLOSEST RELEVANT RECEIVER COORDINATES

Receiver	Type	Associated	Coordinates (MGA94 Z53)		Closest Turbine ID	Distance to Closest Turbine (m)
			Northing	Easting		
APR01	Shed	No	6358860	750432	A1	2488
APR02	House	Yes	6359220	752190	A1	2786
APR03	House	No	6359130	752552	A1	2830
APR04	House	No	6358920	752661	A1	2691
APR05	House	Yes	6358800	752688	A1	2600
APR06	House	Yes	6358650	752800	A1	2533
APR07	House	No	6358870	753268	A1	2990
APR08	House	No	6358830	753611	A1	3190
APR09	House	Yes	6358620	754189	A1	3491
APR10	Unknown	No	6357580	754419	A1	3213
APR11	House	Yes	6359480	755767	A1	5277
APR12	Shed	No	6361960	758853	A1	9227
APR13	House	No	6360930	760098	A1	9760
APR14	Unknown	No	6362810	761354	A1	11778
APR15	Unknown	No	6358730	753933	A1	3358
APR16	Unknown	Yes	6358860	754122	A1	3586
APR17	Unknown	No	6356820	753915	A1	2556
APR18	Unknown	No	6355830	753751	A1	2487
APR19	Unknown	No	6357390	755633	A1	4341
APR20	Unknown	Yes	6359290	755812	A1	5213
APR21	Shed	Yes	6357720	750246	A1	1619
APR22	Unknown	No	6357110	756017	A1	4677
BR01	House	No	6360470	759353	A1	8888
BR02	House	No	6358510	759801	A1	8651
BR03	House	Yes	6357550	761442	A1	10118
BR04	Shed	No	6357660	759090	A1	7795
CAR01	Shed	No	6353580	762754	A10	11662
CAR02	House	No	6353440	762781	A10	11711
CAR03	House	No	6353500	762158	A10	11087
CH01	Unknown	No	6360560	762347	A1	11681
CH02	House	No	6359880	762382	A1	11500
CH03	House	No	6359760	762678	A1	11750
CH04	House	No	6359680	762668	A1	11719
CH05	Shed	Unknown	6359550	762336	A1	11364
CH06	House	No	6359050	762747	A1	11644
CH07	House	No	6357480	762808	A1	11472
CH08	House	Unknown	6357850	763161	A1	11859
CH09	Shed	Unknown	6357390	763514	A1	12170

Receiver	Type	Associated	Coordinates (MGA94 Z53)		Closest Turbine ID	Distance to Closest Turbine (m)
			Northing	Easting		
CH10	House	No	6357190	763387	A1	12031
CH11	Shed	Unknown	6356450	763637	A1	12264
CH12	House	No	6356570	763814	A1	12441
CH13	House	No	6355880	764370	A1	13015
CH14	House	Unknown	6355570	765390	A1	14052
CH15	Unknown	Unknown	6355150	766024	A1	14718
CH16	Unknown	Unknown	6355260	766225	A1	14909
CH17	Shed	Unknown	6356330	764763	A1	13392
CR01	Shed	Yes	6356500	762007	A1	10634
CR02	House	Yes	6356220	761950	A1	10582
CR03	House	Yes	6356120	761935	A1	10571
CR04	Shed	Yes	6355980	761393	A1	10037
CR05	Shed	Yes	6355650	761375	A1	10043
CR06	House	Yes	6355400	761325	A1	10019
CR07	House	Yes	6354870	761281	A1	10051
CR08	House (to be built)	No	6353960	758336	A10	7245
CR09	House	No	6354180	756531	A10	5434
CR10	House	Yes	6354260	756223	A10	5116
CR11	House (Derelict)	Yes	6354370	756379	A10	5246
CR12	House	Yes	6353840	755649	A10	4681
CR13	House	Yes	6353210	752713	A24	2284
CR14	House	Yes	6353170	752583	A24	2158
CR15	House	Yes	6352970	752481	A24	2087
CR16	House	Yes	6352090	752430	A24	2380
CR17	House (Derelict)	Yes	6352010	752370	A29	2368
CR18	House	No	6351500	752181	A35	2437
CR19	House	No	6351470	752139	A35	2400
CR20	House	No	6351240	752175	A35	2485
CR21	House	Yes	6351110	752121	A35	2471
CR22	House (Derelict)	No	6350910	752081	A35	2504
CR23	Church (Derelict)	Yes	6350690	752047	A35	2568
CR24	House	No	6350250	752263	A35	2978
CR25	Abandoned House	Yes	6350200	751106	A38	2080
CR26	House	No	6349450	750808	A43	2341
CR27	House	No	6349080	750783	A43	2613
CR28	House	No	6349290	750058	A47	2018
CR29	House (Derelict)	Yes	6348530	749002	A47	2350
CR30	Shed	Yes	6348500	748645	A47	2377
CR31	Shed	No	6347660	748541	A52	2983

Receiver	Type	Associated	Coordinates (MGA94 Z53)		Closest Turbine ID	Distance to Closest Turbine (m)
			Northing	Easting		
CR32	House	No	6347480	748594	A52	3164
CR33	House	No	6346890	747508	A87	3210
CR34	House	No	6346320	746436	A87	1999
CR35	House	No	6343980	746774	A94	2504
CR36	House	No	6343790	746451	A94	2296
CR37	House	No	6341040	745643	A106	2754
CR38	House	No	6355850	757251	A1	5920
CR39	Unknown	No	6345620	747154	A87	2551
CR40	Unknown	Yes	6352940	752718	A24	2326
CR41	Unknown	Yes	6353100	752336	A24	1922
HER01	Derelict	No	6340720	745274	A106	2718
HER02	House	Yes	6340560	744824	A106	2590
HER03	House	No	6341500	745093	A106	2037
HER04	House	Yes	6341350	744229	A106	1613
HER05	House (Derelict)	Yes	6341150	744039	A106	1729
HER06	House	Yes	6342470	741840	A106	1717
HER07	House	No	6343880	741306	A102	1995
HER08	House	Yes	6344510	741137	A102	2317
HER09	Shed	Yes	6345030	738819	A102	4677
HER10	House	No	6345320	738745	A102	4841
HER11	House	Yes	6345240	738730	A102	4828
HER12	Abandoned House	Yes	6345650	742188	A102	2286
HER13	House	No	6345700	739908	A102	3954
HER14	Unknown	No	6345410	738778	A102	4842
HER15	Unknown	Yes	6344300	741221	A102	2167
HER16	Unknown	Yes	6345370	740900	A102	2944
PER01	Unknown	Unknown	6359880	764655	A1	13691
PER02	Unknown	Unknown	6359710	765707	A1	14677
PL01	House	No	6355860	745823	A8	3714
PL02	House	Yes	6355520	745999	A9	3499
PL03	House	Yes	6355730	746483	A8	3043
PL04	House	Yes	6350780	745271	A52	1801
PR01	House	No	6357800	745203	A6	4882
PR02	Church	No	6357980	744938	A6	5194
PR03	House	Yes	6358150	745031	A6	5175
PR04	House (weekender)	No	6358160	744972	A6	5233
PR05	House	Yes	6358220	745000	A6	5232
PR06	House	Yes	6358230	744964	A6	5269
PR07	House	Yes	6358280	745018	A6	5241



Receiver	Type	Associated	Coordinates (MGA94 Z53)		Closest Turbine ID	Distance to Closest Turbine (m)
			Northing	Easting		
PR08	School	No	6358270	744956	A6	5293
PR09	House	No	6358370	744875	A6	5408
PR10	House	No	6358430	745024	A6	5301
PR11	House	No	6358670	745006	A6	5429
PR12	House	No	6358190	745018	A6	5203
PR13	House	Yes	6356340	745070	A8	4534
PR14	Unknown	No	6357680	745319	A6	4731
SFR01	House	No	6347050	740274	A102	4546
SFR02	Shed	No	6347710	739792	A87	5288
SFR03	House (Derelict)	No	6347260	740702	A87	4274
SFR04	House	No	6348720	741830	A87	4236
SFR05	House	No	6348910	741876	A87	4353
SFR06	House	No	6349960	741882	A52	5100
SFR07	House	No	6350500	741576	A52	5408
SFR08	House	No	6350720	741380	A52	5620
SFR09	House	No	6351350	742023	A52	5085
SFR10	House	No	6352340	741321	A52	6047
SFR11	House	No	6352300	742239	A52	5182
SFR12	House	No	6352390	742431	A52	5046
SFR13	House	No	6353780	742076	A44	5884
SFR14	House	No	6354320	741566	A44	6588
SFR15	House (Derelict)	Yes	6356060	745019	A8	4537
SFR16	House	No	6355910	745012	A8	4525
SFR17	House	No	6355860	745194	A8	4339
SFR18	House	No	6356020	745358	A8	4195
SFR19	House	No	6355850	745424	A8	4109
SFR20	Unknown	No	6355690	744620	A9	4888
TR01	House	No	6339920	745716	A106	3619
TR02	House	No	6339870	745581	A106	3580
TR03	House	No	6338800	744967	A106	4253
TR04	House (Derelict)	No	6338400	744176	A106	4449
TR05	House	No	6338380	744167	A106	4467
TR06	House	No	6338110	744132	A106	4730
WR01	House	No	6353100	759067	A10	8162
WR02	House	No	6353180	759360	A10	8422
WR03	House	No	6351530	759652	A10	9262
WR04	House	No	6351100	759380	A10	9208
WR05	House	No	6351010	759497	A10	9354
WR06	Shed	No	6350570	759792	A24	9771

## APPENDIX C: MODELLED SOUND POWER LEVELS

### GE 3.6-137 WTG sound power levels

One-third Octave Band Frequency (Hz)	Sound Power Level (dB(A)) by Hub Height Integer Wind Speed										
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s to cutout
13	35.1	36.9	40.8	44.1	47	48.7	48.8	48.9	48.9	48.8	48.7
16	42.3	43.8	47.6	50.8	53.7	55.3	55.4	55.4	55.4	55.3	55.2
20	48	49.4	53.1	56.3	59	60.6	60.7	60.7	60.7	60.7	60.6
25	53.2	54.4	58.1	61.2	63.9	65.4	65.5	65.6	65.6	65.6	65.5
32	57.8	59	62.6	65.7	68.4	69.9	70	70.1	70.1	70.1	70
40	62	63.2	66.8	69.8	72.4	74	74	74.2	74.2	74.2	74.1
50	65.4	66.5	70.1	73.1	75.7	77.3	77.4	77.5	77.5	77.5	77.5
63	69.7	70.7	74.3	77.3	79.9	81.6	81.6	81.7	81.7	81.7	81.7
80	73.5	74.6	78.2	81.2	83.8	85.4	85.4	85.5	85.5	85.5	85.4
100	76.3	77.5	81.2	84.2	86.7	88.2	88.3	88.4	88.3	88.3	88.3
125	78.5	79.9	83.6	86.6	89.1	90.3	90.4	90.5	90.5	90.4	90.4
160	80	81.6	85.4	88.5	91.1	92.1	92.2	92.3	92.2	92.1	92.2
200	80.7	82.5	86.4	89.7	92.3	93.1	93.2	93.1	93	93	93
250	81.3	83.1	87.1	90.6	93.3	94	94	93.9	93.7	93.7	93.8
315	81.6	83.5	87.6	91.1	94	94.8	94.7	94.6	94.4	94.4	94.5
400	81.7	83.6	87.8	91.4	94.4	95.3	95.2	95.1	95	95.1	95.1
500	81.7	83.6	87.8	91.4	94.5	95.6	95.6	95.5	95.5	95.6	95.7
630	81.9	83.8	87.9	91.4	94.5	95.9	95.8	95.8	95.9	96	96.1
800	82	83.8	87.9	91.4	94.5	95.9	95.9	95.9	96.1	96.2	96.3
1000	82.1	83.9	87.9	91.2	94.4	95.8	95.8	95.9	96.1	96.2	96.3
1250	81.7	83.6	87.5	90.8	93.8	95.3	95.3	95.4	95.6	95.6	95.6
1600	80.4	82.7	86.5	89.7	92.6	94	94.1	94.2	94.4	94.3	94
2000	78.1	81.6	85.2	88.4	91.2	92.6	92.7	92.9	92.8	92.4	91.9
2500	75.3	79.7	83.4	86.5	89.1	90.6	90.6	90.7	90.1	89.4	88.9
3150	71.9	76.1	80.6	83.8	86.2	87.6	87.6	87.1	86.1	85.6	85.4
4000	67.5	71.3	75.4	79.1	81.9	82.6	82.4	81.4	80.6	80.4	80.3
5000	62.3	66	69.6	72.9	76.1	76.2	76	74.9	74	73.6	73
6300	55.2	58.3	61.8	64.8	67.4	67.7	67.5	66.3	64.7	64.2	63.6
8000	43.9	46.9	50.5	53.5	56.2	55.9	55.7	54.2	52.8	52.4	51.5
10000	28.7	31.9	35.9	39.1	42	42	41.8	40.4	39.4	37.8	36.6
L <sub>WA</sub>	92.5	94.5	98.5	101.9	104.8	106	106	106	106	106	106

**APPENDIX D: PREDICTED NOISE LEVELS AT ALL NON-ASSOCIATED RECEIVERS (WITHIN 8KM)**

Receiver	Predicted Noise Level, dB(A)										
	Hub Height Wind Speed (m/s)										
	4	5	6	7	8	9	10	11	12	13	14
APR01	18	19	23	27	29	31	31	31	30	31	31
APR03	12	14	18	21	24	25	25	25	25	25	25
APR04	13	15	19	22	25	26	26	26	26	26	26
APR07	14	15	19	23	25	27	27	27	26	27	27
APR08	11	12	16	20	23	24	24	24	24	24	24
APR10	13	15	19	22	25	26	26	26	26	26	26
APR15	11	13	17	20	23	24	24	24	24	24	24
APR17	17	19	23	26	29	30	30	30	30	30	30
APR18	19	21	25	28	31	32	32	32	32	32	32
APR19	9	11	15	18	21	22	22	22	22	22	22
APR22	9	10	14	17	20	21	21	21	21	21	21
BR04	0	1	5	8	11	12	12	12	12	12	12
CR08	4	5	9	12	15	16	16	16	16	16	16
CR09	8	9	13	16	19	20	20	20	20	20	20
CR18	21	23	27	30	33	34	34	34	34	34	34
CR19	21	23	27	30	33	34	34	34	34	34	34
CR20	21	22	26	30	32	34	34	34	33	34	34
CR22	20	22	26	29	32	33	33	33	33	33	33
CR24	17	19	23	26	29	30	30	30	30	30	30
CR26	19	21	25	28	31	32	32	32	32	32	32
CR27	18	19	23	27	29	31	31	31	31	31	31
CR28	20	22	26	29	32	33	33	33	33	33	33
CR31	15	16	20	24	26	27	27	27	27	27	28
CR32	14	16	20	23	26	27	27	27	27	27	27
CR33	14	16	20	23	26	27	27	27	27	27	27
CR34	19	21	25	28	31	32	32	32	32	32	32
CR35	18	20	24	28	30	32	32	31	31	31	32
CR36	20	22	26	29	32	33	33	33	33	33	33
CR37	16	17	21	25	28	29	29	29	29	29	29
CR38	4	6	9	13	15	17	17	17	17	17	17
CR39	17	18	22	26	29	30	30	30	30	30	30
HER01	15	17	21	24	27	28	28	28	28	28	28
HER03	20	21	25	29	32	33	33	33	33	33	33
HER07	20	22	26	29	32	33	33	33	33	33	33
HER10	7	9	13	16	19	20	20	20	20	20	20
HER13	11	13	16	20	23	24	24	24	24	24	24



Receiver	Predicted Noise Level, dB(A)										
	Hub Height Wind Speed (m/s)										
	4	5	6	7	8	9	10	11	12	13	14
HER14	7	9	13	16	19	20	20	20	20	20	20
PL01	14	15	19	23	25	26	26	26	26	26	27
PR01	9	10	14	18	20	21	21	21	21	21	21
PR02	8	10	13	17	19	21	21	21	21	21	21
PR04	8	9	13	17	19	20	20	20	20	20	20
PR08	8	9	13	16	19	20	20	20	20	20	20
PR09	7	9	13	16	19	20	20	20	20	20	20
PR10	7	9	13	16	19	20	20	20	20	20	20
PR11	7	8	12	15	18	19	19	19	19	19	19
PR12	8	9	13	17	19	20	20	20	20	20	20
PR14	9	10	14	18	20	22	22	22	22	22	22
SFR01	10	11	15	19	21	22	22	22	22	22	22
SFR02	7	9	13	16	19	20	20	20	20	20	20
SFR03	10	11	15	19	21	23	23	23	22	23	23
SFR04	9	11	15	18	21	22	22	22	22	22	22
SFR05	9	11	15	18	21	22	22	22	22	22	22
SFR06	8	9	13	16	19	20	20	20	20	20	20
SFR07	6	8	12	15	18	19	19	19	19	19	19
SFR08	6	8	11	15	17	18	18	18	18	18	18
SFR09	7	8	12	15	18	19	19	19	19	19	19
SFR10	4	6	10	13	16	17	17	17	17	17	17
SFR11	7	8	12	15	18	19	19	19	19	19	19
SFR12	7	8	12	15	18	19	19	19	19	19	19
SFR13	4	5	9	12	15	16	16	16	16	16	16
SFR14	4	6	9	13	15	16	17	17	16	16	17
SFR16	11	13	16	20	22	24	24	24	24	24	24
SFR17	11	13	17	20	23	24	24	24	24	24	24
SFR18	11	13	17	20	23	24	24	24	24	24	24
SFR19	12	14	18	21	24	25	25	25	25	25	25
SFR20	10	11	15	18	21	22	22	22	22	22	22
TR01	9	11	15	18	21	22	22	22	22	22	22
TR02	9	11	15	18	21	22	22	22	22	22	22
TR03	8	9	13	17	20	21	21	21	21	21	21
TR04	7	9	13	16	19	20	20	20	20	20	20
TR05	7	9	13	16	19	20	20	20	20	20	20
TR06	6	8	12	15	18	19	19	19	19	19	19

## **Appendix G - Noise Compliance Test Plan**

*Prepared by:*  
Sonus Pty Ltd  
May 2018



# Crudine Ridge Wind Farm

## Noise Compliance Test Plan

May 2018

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**Author** : Chris Turnbull, MAAS



**Reviewer** : Jason Turner, MAAS



## Contents

<b>GLOSSARY .....</b>	<b>3</b>
<b>1 INTRODUCTION.....</b>	<b>4</b>
<b>2 NEAR FIELD AND INTERMEDIATE TESTING .....</b>	<b>4</b>
<b>3 RESIDENTIAL LOGGING .....</b>	<b>5</b>
3.1 <i>Locations</i> .....	5
3.2 <i>Equipment</i> .....	7
3.3 <i>Data</i> .....	7
3.4 <i>Supplementary Assessments</i> .....	8
3.5 <i>Special Audible Characteristics – Tonality</i> .....	9
3.6 <i>Special Audible Characteristics – Low Frequency Noise</i> .....	10
3.7 <i>Ancillary Infrastructure</i> .....	10
3.8 <i>Testing Schedule</i> .....	11
<b>APPENDIX A – RELEVANT CONDITIONS OF THE PROJECT APPROVAL.....</b>	<b>12</b>

## GLOSSARY

A weighting	Frequency adjustment representing the response of the human ear.
Associated Residences	Residences included in a commercial agreement with the wind farm.
C weighting	Frequency adjustment which places emphasis on the low frequency range
dB(A)	A weighted noise level measured in decibels.
dB(C)	C weighted noise level measured in decibels.
Intermediate Position	A sound level meter location between the wind farm and a receptor location. The Intermediate Position will be selected to minimise noise from sources other than the wind farm (such as wind in trees and road traffic). The Intermediate Position will be located within 30° of the line between the receptor and the closest wind turbine.
L <sub>A90</sub>	The A weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. The L <sub>A90</sub> measured over a 10 minute time period is commonly termed “background sound level” and “post-installation sound level” with respect to wind farms.
L <sub>Aeq</sub>	The A weighted equivalent continuous noise level – the energy-average of noise levels occurring over a measurement period.
L <sub>C90</sub>	The C weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured.
Non-Associated Residences	Residences not included in a commercial agreement with the wind farm.
Pre-Construction Noise Monitoring	Noise monitoring conducted prior to the operation of the wind farm, which is used to determine the existing component of noise without any contribution from the wind farm.
Post-Construction Noise Monitoring	Noise monitoring conducted during the operation of the wind farm, which is used to determine the total noise from the wind farm and other noise sources. The contribution of noise from the wind farm is determined by subtracting the Pre-Construction Noise from the Post-Construction Noise.
Project Approval	Project Approval for application SSD-6697 dated 10 May 2016
Project Approval Conditions	Operational noise related conditions of the Project Approval, as detailed in Appendix A.
Residential Logging Locations	Locations where noise loggers are placed at residences

## 1 INTRODUCTION

This Noise Compliance Test Plan provides the proposed procedure for determination of compliance with the Project Approval Conditions, which are consistent with the *New South Wales Wind Energy: Noise Assessment Bulletin for State significant wind energy development December 2016* (the Bulletin). The Project Approval Conditions are detailed in Appendix A.

The procedure has been designed to overcome the inherent difficulty of measuring noise from a wind farm in the presence of noise (often higher in level) from sources such as wind in trees and insects. This is achieved by measuring the noise in the near field and at intermediate distances and using the measured level and character to assist in isolating the noise contribution of the wind farm.

Prior to the operation of the wind farm, background noise monitoring will be conducted at the following four locations (subject to permission being granted) in accordance with the Bulletin:

Receiver	Type	Associated	Coordinates (MGA94 Zone 55)	
			Northing	Easting
CR19	House	No	6351470	752139
CR28	House	No	6349290	750058
HER03	House	No	6341500	745093
HER15	Unknown	Yes	6344300	741221

The locations have been selected to represent the residences where the predicted noise level is closest to the noise criterion.

## 2 NEAR FIELD AND INTERMEDIATE TESTING

Near field and intermediate testing is proposed for the purpose of determining the character of the noise from the turbines and enabling noise from other sources to be excluded from the noise at Residential Logging Locations.

### Near Field

The near field measurements at two representative turbines will be in general accordance with IEC61400-11 Edition 3.0 (2012) including measurement locations.

The tonality calculation will be conducted in accordance with Appendix 4 of the Project Approval for representative time periods at each integer wind speed.

The measured sound pressure levels will be used to determine the wind speed at which the highest level is emitted from the turbines. If the noise at Residential Logging Locations continues to increase at wind speeds above the wind speed of highest noise emission, this will indicate that the noise is from sources other than the turbines (most commonly wind in trees for high wind speed conditions).

The tonality assessment is used to assist in determining the wind speeds and frequencies of potential tones at Residential Logging Locations.



## **Intermediate**

Loggers will be placed at Intermediate Positions between the turbines and receptors. These loggers would operate at the same time as the residential loggers and would assist in determining the contribution of noise from the wind farm as well as providing a calibration point to validate noise modelling. As part of the monitoring, an accessible (on public land) intermediate point would be nominated to allow future validation of the noise model.

## **3 RESIDENTIAL LOGGING**

The near field and intermediate test data will be used to support the following Post-Construction Noise Monitoring regime, to satisfy the Project Approval Conditions.

### **3.1 Locations**

Compliance testing will be conducted at the same Residential Logging Locations listed in the introduction, subject to permission for access being granted. Where permission is not granted and a practical alternative exists (where background noise monitoring has been conducted), the alternative location will be used. As noted above, the locations have been selected to demonstrate compliance at noise sensitive locations where the landowner does not have an agreement with the developer (Non-Associated Residences). These locations have also been overlaid on a noise contour plan in Figure 1. The data collected at HER15 will be used to assess noise levels at HER07.

The location of the equipment will be consistent with the positions documented in the Pre-Construction Noise Monitoring, subject to any changes to the local conditions that might result in modified results such as the construction of structures, change in vegetation or the installation of pumps or air conditioning units. The changes will be documented and the rationale provided for any alternative location.



### 3.2 Equipment

Sound level meters with a noise floor no greater than 20 dB(A) will be used. The equipment will be either Class 1 or Class 2 sound level meters in accordance with the Australian Standard *AS 1259-1990 Acoustics – Sound Level Meters* and *IEC 61672.1-2004 Electroacoustics – Sound Level Meters* as relevant.

A wind shield with a diameter of at least 100mm will be used to minimise noise on the microphone.

A calibrated reference sound source will be used before and after the compliance testing regime.

### 3.3 Data

The compliance testing will collect  $L_{A90}$  data made continuously over 10 minute intervals.

Data filtering will remove time periods:

- (i) affected by rain, hail or wind based on a weather logger placed at an equivalent location to one of the noise loggers. Data is adversely affected where precipitation occurs in a 10 minute period or where a wind speed greater than 5 m/s is exceeded for 90% of a 10 minute period;
- (ii) when WTGs close to the noise loggers have not been connected to the grid during the current 10 minute period;
- (iii) considered abnormal, such as during local construction or maintenance activities; and
- (iv) where the wind direction is not within 45° either side of the direct line between the nearest WTG and the relevant receiver (if sufficient data points can be collected using this method).

Further data filtering may remove time periods or frequency content where noise data collected at a Near Field or Intermediate Position confirms that the source of the noise at a receptor is not the wind turbines. For example, noise data collected in a particular 10 minute interval at a receptor may be removed:

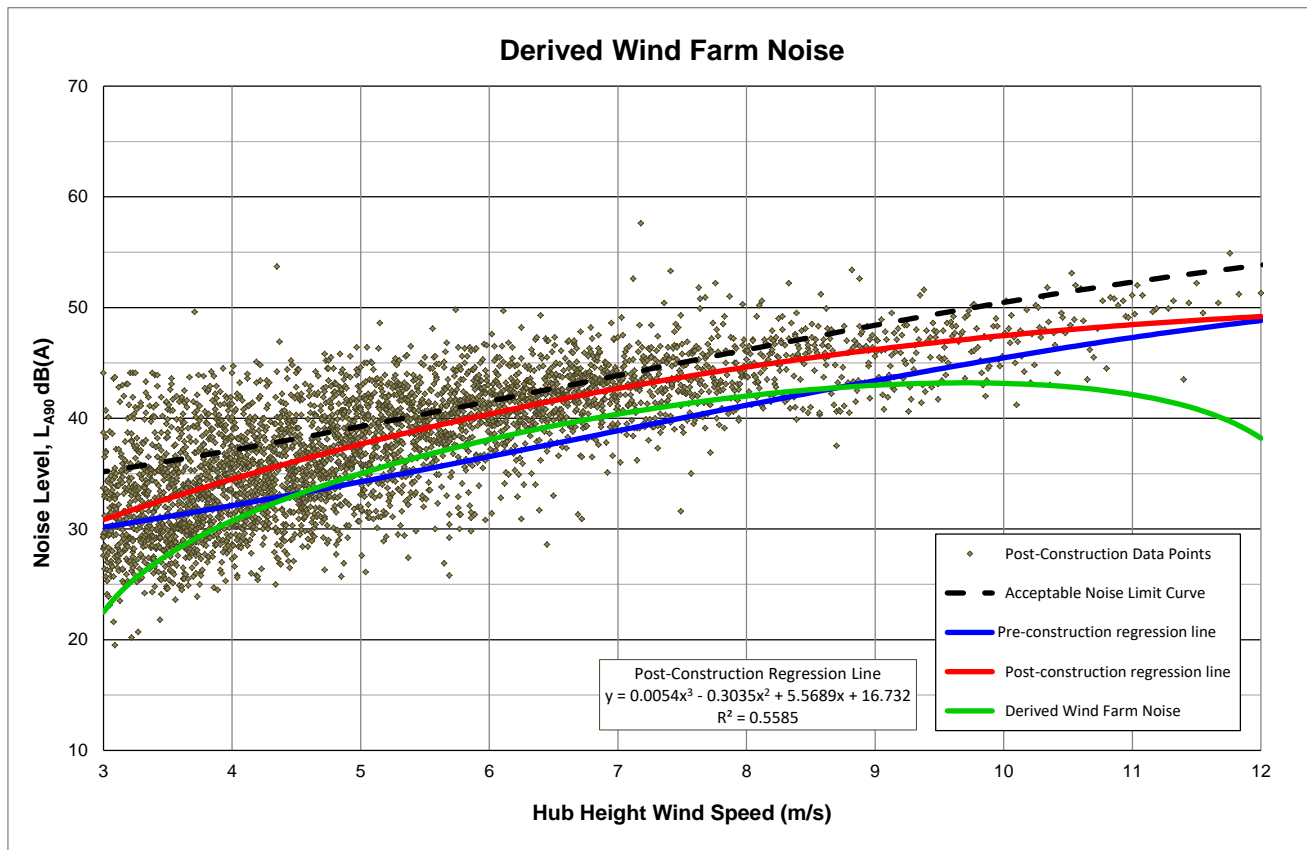
- if the noise measured in the same period at the Intermediate Position (closer to the turbines) is a lower level;
- if the frequency content of the noise at the receptor is not consistent with the frequency content at the Intermediate Position; or
- if the noise at a receptor continues to increase with an increase in wind speed above the wind speed at which the maximum sound power level is recorded at the near field position.

Following removal of the data defined above and application of applicable penalties for special audible characteristics (refer below), all of the remaining noise data for the full monitoring period will be correlated with the corresponding hub height wind speed data for each Residential Logging Location.

If the Intermediate position has not been used to remove data points, the wind farm noise contribution at the dwelling will be derived by logarithmically subtracting the background noise curve (from the Pre-Construction Noise Monitoring) from the curve generated by the Post-Construction Noise Monitoring correlation.



An example of a wind farm noise contribution line derived from the post-construction measured noise regression line and background noise curve is shown in the figure below.



Where the regression demonstrates that the criteria are achieved at all wind speeds, the noise from the wind farm will be deemed to be in compliance with the criteria at this location.

### 3.4 Supplementary Assessments

The residential logging method described above cannot be used in all circumstances to demonstrate compliance. This is primarily related to changes in local conditions or extraneous noise sources when compared to the conditions and noise sources that existed at the time of the original testing regime. Where the regression analysis does not demonstrate compliance, further investigations will be conducted to determine if the recorded noise is from the wind farm or from another source. The investigation will include the consideration of:

- Noise at intermediate locations and/or at locations not affected by other noise sources (such as birds, insects and wind in trees). The consideration will assess whether it is possible that the noise at the residence is from the wind farm, given the level of noise at the alternative locations. This will include a comparison of the measured noise at the intermediate location against the noise model to determine if the noise model can be verified as well as an assessment of the variation between the intermediate location and the residence. Where the analysis determines that the excessive noise is



from a source other than the wind farm, the noise from the wind farm will be deemed to be in compliance with the criteria at this location.

- The shape of the regression curve. Where the noise is dominated by the noise from the wind farm, the shape of the curve at the residence will be similar to the shape of the curve at an intermediate point or close to the turbines. A different regression curve shape indicates that the noise is from another source. An indication that the noise is not from the wind farm might occur, for example, where the noise at the residence increases significantly at high wind speeds but the noise close to the turbines levels out or reduces at high wind speeds. In this circumstance, the noise recorded at residences at high wind speeds (above the wind speed where the noise levels out) will be deemed to be from another source.

Where the above processes cannot verify the noise modelling, “on/off” compliance testing will be conducted as follows:

- Only at Residential Locations where the logging cannot be used to demonstrate compliance;
- Only at integer wind speeds where the logging cannot be used to demonstrate compliance
- With the noise monitoring equipment at the same position where the logging had been conducted, or if that position is considered to be a factor in the inability of the logging to demonstrate compliance, at an equivalent position with respect to turbine noise at the Residential Logging Location, but which has a higher turbine to background noise level ratio;
- Conducted under a downwind condition. A downwind condition is defined as the wind direction at the relevant wind mast being within 45 degrees of the direct line from the closest turbine to the dwelling;
- Over a minimum interval of 2-minutes with the wind farm operational, then a measurement over the same interval with the wind farm shut off to obtain the background noise level;
- Monitoring the wind speed and direction over the measurement intervals to identify the comparable “on” and “off” measurements.
- Repeating the above “on” and “off” process to collect at least 3 intervals with comparable wind speed and direction conditions at each integer wind speed of interest.

### 3.5 Special Audible Characteristics – Tonality

Tonality testing at Non-Associated Residential Logging Locations will only be conducted if tonality is found in a near field test at any wind speed. The testing will be conducted;

- in accordance with Appendix 4 of the Project Approval;
- for the specific tonal frequencies identified in the near field tests;
- for each 10 minute period at the wind speeds where the tonal adjustment was greater than 0 dB in the near field tests.
- at the closest Non-Associated Residence where the landowner has granted permission to place the equipment.

Where the occurrence of excessive tonality from the wind farm is greater than 10% for a particular wind speed or period (day or night) (and there is no evidence that the tone is from a source other than the wind farm), 5 dB(A) will be added for each wind speed where tonality is identified after correlation with wind

speed. This increase will be applied to other Non-Associated residences (at the same wind speeds), unless there is evidence that the tone(s) are not audible at the other residences.

### 3.6 Special Audible Characteristics – Low Frequency Noise

The primary test for low frequency noise will be conducted:

- At the Non-Associated residential logging location where the highest noise level is predicted;
- At the integer wind speed where the difference between the predicted noise level and the project criteria is the least;
- Conducted under a downwind condition at night;
- Over a 10 minute interval with the wind farm operational;
- Collecting at least 5 measurement intervals where the wind farm is audible;
- Comparing the C-weighted  $L_{90}$  noise level with the criterion of 60 dB(C) ;

Where the level is consistently less than 60 dB(C), no adjustment shall be made for low frequency noise and no further low frequency testing shall be made.

A secondary analysis will be conducted if the contribution of the wind farm to the  $L_{90}$  is greater than 60 dB(C) during the primary test and a detailed internal low frequency noise assessment has not demonstrated compliance with the proposed criteria for the assessment of low frequency noise disturbance (UK Department for Environment, Food and Rural Affairs (DEFRA, 2005)) for a steady state noise source.

The secondary test will be conducted at the closest residence (and/or an intermediate location) by analysing the measured (or extrapolated) C-weighted level at the same residence over the full logging period. Where the occurrence of excessive low frequency from the wind farm is greater than 10% for a particular wind speed or period (day or night) (and there is no evidence that the low frequency is from a source other than the wind farm), 5 dB(A) will be added for each wind speed where low frequency is identified after correlation with wind speed. This increase will be applied to other Non-Associated residences (at the same wind speeds), unless there is evidence that the excessive low frequency content is not present at the other residences.

### 3.7 Ancillary Infrastructure

The noise from the substation will be measured at an intermediate distance between the substation and the closest residence during normal operation. This measurement will be used to predict the noise at the closest residence under the meteorological conditions specified in the Project Approval Conditions.

Where the predicted noise level is no greater than 35 dB(A) at any Non-Associated Residence (after any adjustment in accordance with the *Noise Policy for Industry 2017*), the noise from the substation will be deemed to be compliant with the Conditions of Project Approval and no further measurements will be conducted.

Where the predicted adjusted level is greater than 35 dB(A), further measurements will be conducted at the closest residence and any necessary treatment measures will be applied to achieve a level of 35 dB(A) at the closest residence.

### **3.8 Testing Schedule**

Testing will commence as soon as practical following the commencement of operations (i.e. following the commissioning of the final turbine). A report will be submitted to the Department and the EPA within 3 months following the commencement of operations. This report will provide an interim assessment of compliance with the operational noise criteria within the Project Approval.

Data will be collected for at least 6 weeks at each residential location. Following completion of all testing outlined in this Test Plan a report will be submitted, which provides a detailed assessment of the noise compliance testing and compliance with the operational noise criteria within the Project Approval.

## APPENDIX A – RELEVANT CONDITIONS OF THE PROJECT APPROVAL

### Operational Noise Criteria – Wind Turbines

11. The Applicant shall ensure that the noise generated by the operation of wind turbines does not exceed the relevant criteria in Table 4 at any non-associated residence.

Table 4: Noise criteria dB(A)

Residence No	Criteria (dB(A)) with Reference to Hub Height Wind Speed (m/s)														
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
APR2, 3, 4, 5, 6, 7, 8, 9, 10 CR15	35	35	35	35	35	36	38	39	41	42	44	46	48	48	
CR16, 18, 19, 20, 21, 24	35	35	35	35	35	35	36	37	38	40	42	44	47	47	
CR26, 27, 28	35	35	35	35	35	35	35	35	36	38	41	43	45	45	
CR32, 33, 34, 35, 36	35	35	35	35	35	35	37	40	42	45	47	50	52	55	
CR37, HER3, 4, TR1, 2, 3, 4, 5, 6	35	35	35	35	35	35	35	36	38	39	40	41	41	41	
HER10, 11, 13	35	35	35	35	37	39	41	43	45	46	46	46	46	46	
PL1, 2, PR1, 3, 4, 9, 10, 11, SFR1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19	35	35	35	35	35	37	39	41	43	44	46	46	46	46	
All other non-associated residences	The higher of 35 dB(A) or the existing background noise level (L <sub>A90</sub> (10-minute)) plus 5 dB(A)														

Note: To identify the residences referred to in Table 4, see the applicable figures in Appendix 2.

Noise generated by the operation of the wind turbines is to be measured in accordance with the relevant requirements of the South Australian Environment Protection Authority's *Wind Farms – Environmental Noise Guidelines 2009* (or its latest version), as modified by the provisions in Appendix 4. If this guideline is replaced by an equivalent NSW guideline, then the noise generated is to be measured in accordance with the requirements in the NSW guideline.

### Operational Noise Criteria – Ancillary Infrastructure

12. The Applicant shall ensure that the noise generated by the operation of ancillary infrastructure does not exceed 35 dB(A) LAeq(15 minute) at any non-associated residence.

Noise generated by the development is to be measured in accordance with the relevant requirements of the *NSW Industrial Noise Policy* (or its equivalent) as modified by the provisions in Appendix 4.

### Noise Monitoring

13. Within 3 months of the commencement of operations, the Applicant shall:
- undertake noise monitoring to determine whether the development is complying with the relevant conditions of this consent; and
  - submit a copy of the monitoring results to the Department and the EPA.
14. The Applicant shall undertake further noise monitoring of the development if required by the Secretary.



#### APPENDIX 4 NOISE COMPLIANCE ASSESSMENT

##### PART A: SOUTH AUSTRALIAN WIND FARMS: ENVIRONMENTAL NOISE GUIDELINES 2009 (MODIFIED)

South Australian *Wind Farms: Environmental Noise Guidelines 2009* (Modified) refers to the South Australian EPA document modified for use in NSW. The modifications are as follows:

##### Tonality

The presence of excessive tonality (a special noise characteristic) is consistent with that described in *ISO 1996.2: 2007 Acoustics — Description, measurement and assessment of environmental noise – Determination of environmental noise levels* and is defined as when the level of one-third octave band measured in the equivalent noise level  $L_{eq}(10\text{minute})$  exceeds the level of the adjacent bands on both sides by:

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

If tonality is found to be a repeated characteristic of the wind turbine noise, 5 dB(A) should be added to measured noise levels from the wind farm. If tonality is only identified for certain wind directions and speeds, the penalty is only applicable under these conditions. The tonal characteristic penalty applies only if the tone from the wind turbine is audible at the relevant receiver. Absence of tone in noise emissions measured at an intermediate location is sufficient proof that the tone at the receiver is not associated with the wind farm's operation. The assessment for tonality should only be made for frequencies of concern from 25 Hz to 10 KHz and for sound pressure levels above the threshold of hearing (as defined in *ISO 389.7: 2005 Acoustics - Reference zero for the calibration of audiometric equipment - Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions*).

##### Low Frequency Noise

The presence of excessive low frequency noise (a special noise characteristic) [i.e. noise from the wind farm that is repeatedly greater than 65 dB(C) during the day time or 60 dB(C) during the night time at any relevant receiver] will incur a 5 dB(A) penalty, to be added to the measured noise level for the wind farm, unless a detailed internal low frequency noise assessment demonstrates compliance with the proposed criteria for the assessment of low frequency noise disturbance (UK Department for Environment, Food and Rural Affairs (DEFRA, 2005)) for a steady state noise source.

##### Notes:

- For the purposes of these conditions, a special noise characteristic is defined as a repeated characteristic if it occurs for more than 10% of an assessment period. This equates to being identified for more than 54 minutes during the 9 hour night from 10pm – 7am, or for more than 90 minutes during the 15 hour day from 7am – 10pm. This definition refers to verified wind farm noise only.
- The maximum penalty to be added to the measured noise level from the wind farm for any special noise characteristic individually or cumulatively is 5 dB(A).
- Notwithstanding conditions F7 and F8 of this project approval, the noise limits specified under these conditions do not apply to any residence where a noise agreement is in place between the Proponent and the owner(s) of those residences in relation to noise impacts and / or noise limits. For this condition to take effect, the noise agreements shall satisfy the relevant requirements of *Guidelines for Community Noise* (WHO, 1999).

##### PART B: NOISE COMPLIANCE ASSESSMENT

##### Applicable Meteorological Conditions – Wind Turbines

1. The noise criteria in Table 4 of the conditions are to apply under all meteorological conditions.

##### Applicable Meteorological Conditions – Other Facilities

2. The noise criteria in condition 15 are to apply under all meteorological conditions except the following:

- wind speeds greater than 3 m/s at 10 m above ground level; or
- temperature inversion conditions between 1.5°C and 3°C/100m and wind speeds greater than 2 m/s at 10m above ground level; or
- temperature inversion conditions greater than 3°C/100m.

## **Appendix H - Biodiversity Development Assessment Report**

*Prepared by:*  
Eco Logical Australia  
November 2018



A stylized topographic map with green contour lines is positioned on the left side of the page, extending from the top left towards the bottom left.

# Crudine Ridge Wind Farm Modification Biodiversity Development Assessment Report

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**CRWF Nominees Pty Ltd**

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DOCUMENT TRACKING

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## Executive Summary

Eco Logical Australia (ELA) was engaged by CRWF Nominees Pty Ltd (the Proponent) to prepare a Biodiversity Development Assessment Report (BDAR) for a proposed upgrade to Aarons Pass Road to facilitate the movement of turbines associated infrastructure and access for the Crudine Ridge Wind Farm (CRWF). Aarons Pass Road consists of a linear strip of native vegetation adjoined by neighbouring properties that are used for sheep and cattle grazing and have a history of pasture improvement.

Aarons Pass Road was subject to previous ecological assessments by ELA in 2013 for the CRWF Project Approval (SSD-6697). The road design has since been improved in consultation with Mid-Western Regional Council (MWRC) to address detailed design changes and provide long term benefit to the surrounding community. The additional impact area subject to the current BDAR (herein referred to as the development site) includes the new proposed road design, temporary disturbance areas associated with civil works required for the road construction, and the blade swept path, which will require pruning of vegetation in areas to allow for the passage of the blade components of the wind turbines.

Field surveys identified approximately 6.47 ha of native vegetation to be cleared within the development site within the current road design, including 0.95 ha which meets the listing criteria for Endangered Ecological Communities (EEC) under the NSW *Biodiversity Conservation Act 1999* (BC Act) and/or Critically Endangered Ecological Communities (CEEC) under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), located toward the western end of the development site. The 6.47 ha of native vegetation clearing will comprise 4.98 ha of permanent clearing for the construction of the road, 1.06 ha of temporary disturbance for civil works, and 0.43 ha of disturbance for pruning in the blade swept path to allow for transportation of the WTG blades.

The CRWF Project Approval (SSD-6697) allows for clearing of 1.54 ha of native vegetation on Aarons Pass Road (including 0.28 ha of EEC). Improvements to the road design have resulted in inconsistencies in alignment with the existing approval; however, given the like-for-like vegetation communities present within the Aaron's Pass Road road reserve, this BDAR has been prepared upon consideration that the approved 1.54 ha of native vegetation approved for clearing along Aaron's Pass Road can be directly exchanged for the same area within the development site. An area of 0.12 ha has been cleared at the eastern end of the development site in association with the commencement of road construction, which occurs outside of the current road design. This area was not considered as part of this assessment, however, it was considered to have been cleared under the existing CRWF Project Approval (SSD-6697).

Therefore, the additional area of native vegetation clearing for the development site requiring approval is 5.05 ha.

This BDAR has been prepared using the 5.05 ha of disturbance and has considered total removal of the vegetation within all categories of disturbance proposed (permanent clearing, temporary disturbance and the blade swept path). The 5.05 ha assessed in the BDAR was assigned to two Plant Community Types (PCT):

1. PCT 277 - Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (0.67 ha)

2. PCT 290 - Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion (4.38 ha).

The entire area of PCT 277 (0.67 ha) meets the criteria for EEC listed under the BC Act, with smaller patches totaling 0.32 ha meeting the CEEC listing criteria under the EPBC Act:

- White Box Yellow Box Blakely's Red Gum Woodland (listed as EEC under the BC Act)
- White Box Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (listed as CEEC under the EPBC Act).

Nine threatened flora species were identified from the data audit as known, likely or having the potential to occur within the development site area, with two of these identified and confirmed during the field survey. *Acacia meiantha*, listed as Endangered under both the BC Act and EPBC Act was identified, along with *Pomaderris reperta* (Denman Pomaderris), which is listed as Critically Endangered under the BC Act and EPBC Act. *Acacia meiantha* occurs throughout a 1.5 km section of the development site area, whilst the Denman Pomaderris is confined to a single corner of the development site, covering approximately 70 m. These species have been considered within the CRWF Biodiversity Management Plan approved by Department of Planning and Environment on 15 December 2017. 59 individual *A. meiantha* have been identified for removal as part of the development site. Three *P. reperta* individuals are within the blade swept path of the road upgrade and will not be directly impacted by vegetation clearing. Only one individual *P. reperta* will be impacted by the development.

Thirty-one threatened fauna species were identified from the data audit as known, likely or having the potential to occur within the development site area, with three of these identified and confirmed during the field survey. *Artamus cyanopterus cyanopterus* (Dusky Woodswallow), *Daphoenositta chrysoptera* (Varied Sittella) and *Petroica boodang* (Scarlet Robin) were identified, all are listed as Vulnerable under the BC Act and identified as ecosystem credit species within the BAMC. Threatened fauna habitat was assessed, comprising mainly 150 individual hollow-bearing trees to be removed for the development site. Ten threatened species credit species (derived from BAMC) were presumed to occupy the extent of Aarons Pass Road and will be impacted by the development site. These species include the Bush stone curlew, Gang-gang Cockatoo, Glossy Black-Cockatoo, Eastern Pygmy Possum, Squirrel Glider, Brush tailed Phascogale, Powerful Owl, Barking Owl, Masked Owl and Koala.

Potential Koala habitat was assessed in accordance with the *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44). The impact area was not determined to be either potential or core Koala habitat in accordance with SEPP 44, due to the identification of only three individual key feed trees of *Eucalyptus albens* (White Box). There are however, secondary feed trees on site, *E. melliodora*, *E. polyanthemos*, *E. blakelyi* and *E. bridgesiana* (OEH 2018). There have been five records of Koalas being found along or near Aarons Pass Road (OEH 2018). Further assessment using the 'EPBC Act referral guidelines for the vulnerable Koala' (Department of the Environment [DoE], 2014) was undertaken which concluded that significant impacts to Koala would not occur as a result of the development site. However, it is possible that Koalas move through the area.

The development site, Aarons Pass Road, is located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA) and is located along a road reserve. The surrounding properties adjoining the site are either zoned as Primary Production RU1, Large Lot Residential R5, Environmental

Management E3 or Infrastructure SP2 water supply systems under the Mid-Western Council Local Environment Plan (LEP; 2012).

The proposed activity requires development consent under State Significant Development (SSD) Part 4 of the NSW *Environment Planning and Assessment Act 1979* (EP&A Act).

This report has been prepared to meet the requirements of the Biodiversity Assessment Method 2016 (BAM) established under Section 6.7 of the BC Act.

For vegetation zone 1 – PCT 277 Intact, the BAM Credit Calculator (BAMC) generated a vegetation integrity score of 56.5. Nine ecosystem credits are required to offset the removal of 0.32 ha for vegetation zone 1. For vegetation zone 2 – PCT 277 Degraded, the BAMC generated a vegetation integrity score of 40.4. Seven ecosystem credits are required to offset the removal of 0.4 ha for vegetation zone 2. For vegetation zone 3 – PCT 290 Intact, the BAMC generated a vegetation integrity score of 69.3. 47 ecosystem credits are required to offset the removal of 1.6 ha of vegetation zone 3. For vegetation zone 4 – PCT 290 Degraded, the BAMC generated a vegetation integrity score of 61. 76 ecosystem credits are required to offset the removal of 2.8 ha for vegetation zone 4.

Additionally, a total of five species credits are required to offset the impact on *Acacia meiantha*, and one species credit is required to offset the impact on *Pomaderris reperta*. Fauna surveys were not conducted so due to the presence of suitable habitat on site, ten species of fauna were presumed to be present. 156 species credits are required to offset each of the Bush Stone-curlew, the Squirrel Glider, and Koala which were considered to occur across the entire development site, and 154 species credits each are required to offset the impacts on Gang-gang cockatoo, Glossy Black-Cockatoo, Eastern Pygmy-possum, Barking Owl, Powerful Owl, Masked Owl and the Brush-tailed Phascogale which have been assumed to occur across the development site containing hollow bearing trees.

Serious and Irreversible Impacts (SII) values have been considered as part of this assessment. These values include the 'White Box Yellow Box Blakely's Red Gum Woodland' and threatened flora species *Acacia meiantha* and *Pomaderris reperta* which are also listed as candidate SII. Given that there were no known published thresholds for these species, a threshold of 0 is assumed and therefore it is possible that SII could occur given the small and isolated populations of these two species. Modification to the road design has reduced impacts and these will be further mitigated by evaluating detailed design options to avoid individuals in the first instance. Where avoidance is not possible, the Proponent has committed to amending the Project Biodiversity Management Plan (BMP) to incorporate management strategies for the removal and pruning of *P. reperta* and *A. meiantha* in consultation with the Secretary of DPE. Management measures may include translocating affected individuals and propagation via cuttings collected from site to mitigate the impacts of any clearance works on these threatened flora. If these precautions are followed, it is unlikely that an SII will occur.

Seven Matters of National Environmental Significance (MNES) were identified as potentially adversely affected by the proposed development. An assessment of the Commonwealth Significant Impact Criteria (Commonwealth of Australia 2013) was applied to one threatened community (White Box Yellow Box Blakely's Red Gum Grassy Woodland) and each of the six threatened species listed under the EPBC Act, including one mammal, *Phascolarctos cinereus* (Koala), four bird species, *Anthochaera phrygia* (Regent Honeyeater), *Grantiella picta* (Painted Honeyeater), *Lathamus discolor* (Swift Parrot) and two

endangered flora species, *Pomaderris reperta* and *Acacia meiantha*. The assessment concluded that the project would not have a significant impact on the above-mentioned species.

All impacts to MNES and BC Act listed entities have been avoided as far as practicable and all impacts have been assessed in accordance with Commonwealth guidelines. Mitigation strategies have been put into place to manage potential impacts to MNES and BC Act listed entities. The development footprint has been modified, reduced and access routes have been altered to avoid impacts to Threatened Ecological Communities and habitat for listed species. Additionally, the removal of vegetation will be avoided where possible by vegetation trimming rather than removal wherever possible.



# Contents

<b>1. Stage 1: Biodiversity assessment</b>	<b>1</b>
1.1 Introduction	1
1.1.1 General description of the development site	1
1.1.2 Development site footprint	2
1.1.3 Sources of information used	2
1.2 Legislative context	5
1.3 Landscape features	6
1.3.1 IBRA regions and subregions	6
1.3.2 Native vegetation extent	6
1.3.3 Rivers and streams	6
1.3.4 Wetlands	6
1.3.5 Connectivity features	6
1.3.6 Areas of geological significance and soil hazard features	6
1.3.7 Site context	7
1.4 Native vegetation	7
1.4.1 Survey effort	7
1.4.2 Plant Community Types present	8
1.4.3 PCT selection justification	9
1.4.4 Threatened Ecological Communities Justification	10
1.4.5 Vegetation integrity assessment	10
1.4.6 Use of local data	11
1.5 Threatened species	15
1.5.1 Ecosystem credit species	15
1.6 Species credit species	17
1.6.1 Targeted surveys	18
1.6.2 Use of local data	35
1.6.3 Expert reports	35
<b>2. Stage 2: Impact assessment (biodiversity values)</b>	<b>36</b>
2.1 Avoiding impacts	36
2.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat	36
2.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat	37
2.1.3 Prescribed biodiversity impacts	38
2.2 Assessment of Impacts	40
2.2.1 Direct impacts	40
2.2.2 Change in vegetation integrity	41
2.2.3 Indirect impacts	41
2.2.4 Prescribed biodiversity impacts	43
2.2.5 Mitigating and managing impacts	44

2.2.6 Serious and Irreversible Impacts (SAII) .....	48
2.3 Risk assessment .....	54
2.4 Impact summary .....	58
2.4.1 Serious and Irreversible Impacts (SAII) .....	58
2.4.2 Impacts requiring offsets .....	58
2.4.3 Impacts not requiring offsets .....	59
2.4.4 Areas not requiring assessment .....	59
2.4.5 Credit summary .....	59
2.5 Consistency with legislation and policy .....	64
2.5.1 <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) .....	64
2.5.2 SEPP 44 Koala habitat Assessment .....	71
<b>3. Conclusion.....</b>	<b>74</b>
<b>4. References .....</b>	<b>76</b>
<b>Appendix A: Definitions.....</b>	<b>78</b>
<b>Appendix B: Vegetation plot data .....</b>	<b>81</b>
<b>Appendix C: Biodiversity credit report.....</b>	<b>85</b>
<b>Appendix D: Map Books .....</b>	<b>86</b>

## List of Figures

Figure 1: Site Map .....	3
Figure 2: Location Map.....	4
Figure 3: Plant Community Types and native vegetation extent.....	12
Figure 4: Plot locations.....	13
Figure 5: Threatened Ecological Communities.....	14
Figure 6: Species polygon for <i>Pomaderris reperta</i> .....	23
Figure 7: Species polygon for <i>Acacia meiantha</i> .....	24
Figure 8: Species polygon for <i>Ninox connivens</i> .....	25
Figure 9: Species polygon for <i>Phascogale tapoatafa</i> .....	26
Figure 10: Species polygon for <i>Burhinus grallarius</i> .....	27
Figure 11: Species polygon for <i>Cercartetus nanus</i> .....	28
Figure 12: Species polygon for <i>Callocephalon fimbriatum</i> .....	29
Figure 13: Species polygon for <i>Calyptorhynchus lathami</i> .....	30
Figure 14: Species polygon for <i>Phascolarctos cinereus</i> .....	31
Figure 15: Species polygon for <i>Tyto novaehollandiae</i> .....	32
Figure 16: Species polygon for <i>Ninox strenua</i> .....	33
Figure 17: Species polygon for <i>Petaurus norfolcensis</i> .....	34
Figure 18: Final project footprint including construction and operation .....	57
Figure 19: Serious and Irreversible Impacts.....	61
Figure 20: Impacts requiring offset.....	62
Figure 21: Areas not requiring assessment.....	63

## List of Tables

Table 1: Legislative context .....	5
Table 2: IBRA regions.....	6
Table 3: IBRA subregions.....	6
Table 4: Native vegetation extent.....	6
Table 5: Percent native vegetation cover in the landscape .....	7
Table 6: Patch size .....	7
Table 7: Full-floristic PCT identification plots.....	7
Table 8: Vegetation integrity plots.....	8
Table 9: Plant Community Types.....	8
Table 10: Threatened Ecological Communities.....	9
Table 11: PCT selection justification .....	9
Table 12: Vegetation integrity.....	11
Table 13: Predicted ecosystem credit species .....	15
Table 14: Candidate species credit species.....	17
Table 15: Targeted surveys .....	18
Table 16: Weather conditions (Mudgee Airport, Bureau of Meteorology, 2018) .....	18
Table 17: Survey effort.....	19
Table 18: Species credit species included in the assessment .....	19
Table 19: Justification for exclusion of candidate species credit species .....	20
Table 20: Locating a project to avoid and minimise impacts on vegetation and habitat .....	36
Table 21: Designing a project to avoid and minimise impacts on vegetation and habitat .....	37
Table 22: Prescribed biodiversity impacts .....	38
Table 23: Locating a project to avoid and minimise prescribed biodiversity impacts .....	39
Table 24: Designing a project to avoid and minimise prescribed biodiversity impacts.....	39
Table 25: Direct impacts to native vegetation .....	40
Table 26: Direct impacts on threatened ecological communities .....	40
Table 27: Direct impacts on threatened species and threatened species habitat .....	41
Table 28: Change in vegetation integrity .....	41
Table 29: Indirect impacts.....	42
Table 30: Direct impacts on prescribed biodiversity impacts .....	43
Table 31: Measures proposed to mitigate and manage impacts.....	44
Table 32: Candidate Serious and Irreversible Impacts.....	48
Table 33: Determining whether impacts are serious and irreversible.....	49
Table 34: Evaluation of an impact on a candidate species .....	50
Table 35: Evaluation of an impact on a TEC.....	52
Table 36: Likelihood criteria .....	54
Table 37: Consequence criteria.....	54
Table 38: Risk matrix .....	55
Table 39: Risk assessment.....	55
Table 40: Impacts to native vegetation that require offsets .....	58

Table 41: Impacts on threatened species and threatened species habitat that require offsets .....58

Table 42: Ecosystem credits required .....59

Table 43: Species credit summary.....60



## Abbreviations

Abbreviation	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically Endangered Ecological Community
DNG	Derived Native Grassland
DoEE	Commonwealth Department of Environment and Energy
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act 1994
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS	Local Land Service
NSW	New South Wales
NOW	NSW Office of Water
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community
VIS	Vegetation Information System
WM Act	NSW Water Management Act 2000

# 1. Stage 1: Biodiversity assessment

## 1.1 Introduction

This Biodiversity Development Assessment Report (BDAR) has been prepared by Dr. Cheryl O'Dwyer, who is an Accredited Person under the NSW *Biodiversity Conservation Act 2016* (BC Act) with support from Vivian Hamilton and Martin Stuart.

The contents of this BDAR complies with the minimum requirements outlined in Table 25 of the Biodiversity Assessment Methodology (BAM; OEH, 2017).

### 1.1.1 General description of the development site

Aarons Pass Road is located approximately 45 km south of Mudgee in Central West NSW. The development site subject to this BDAR included both sides of the approximately 20 km length of Aarons Pass Rd to be subject to the development site from the Castlereagh Highway to the CRWF northern site entrance. The development site varies with small sections only 1-2 m wide present whilst the majority of the width of the development site varied between 5-10 m.

The development site is wholly located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA) and is largely within a road reserve. The surrounding area is zoned RU1 Primary Production with small sections zoned R5 Large Lot Residential, E5 Environmental Management or, SP2 Infrastructure under the Mid-Western Regional Local Environment Plan (LEP; MWRC, 2012).

The vegetation mapping produced within this BDAR is based on field observation and data collection, using ESRI Collector for ArcGIS on handheld tablets and handheld GPS.

There are inconsistencies in the aerial imagery when compared to both the current road design and the vegetation mapping produced within this BDAR. This is largely due to clearing undertaken by Council during previous road upgrades after the 2007 aerial photograph (SIX Maps) was captured. The current road design and vegetation mapping have been produced based on site surveyed data of the existing road and road reserve. Therefore, the current road design and vegetation mapping are considered to be an accurate representation.

Two Plant Community Types (PCT) are present along the length of Aarons Pass Road and have been mapped as PCT 227 and PCT 290. PCT 277 conforms to the Endangered Ecological Community (EEC) '*White Box Yellow Box Blakely's Red Gum Woodland*', listed under the NSW BC Act. While PCT 277 also comprises part of the Critically Endangered Ecological Community (CEEC) '*White Box Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*', listed under the EPBC Act.

Five threatened species were recorded along the roadside (two flora and three fauna) and potential habitat for 25 threatened fauna species has been assumed to be present based on suitable site characteristics. Fifteen (15) of these species require no further assessment as they are considered Ecosystem credit species. 10 threatened fauna species are presumed to be present based on the presence of habitat features and species credits have been calculated for these species.

This report includes two base maps, the Site Map (Figure 1) and the Location Map (Figure 2). The Site Map is comprised of 59 individual tiles which show greater detail. These are included in Appendix D.

### 1.1.2 Development site footprint

The development site covers an area of 6.47 ha.

The CRWF Project Approval (SSD-6697) allowed for clearing of 1.54 ha of native vegetation on Aarons Pass Road (including 0.28 ha of EEC) at the time it was approved on 10 May 2016. Improvements to the road design since the approval of the Traffic Management Plan (TMP) and Biodiversity Management Plan (BMP) on 15 December 2017 have resulted in inconsistencies between the approved road design the proposed improvements to the road alignment; however, given the like-for-like vegetation communities present within the Aaron's Pass Road road reserve, this BDAR has been prepared upon consideration that the approved 1.54 ha of native vegetation approved for clearing along Aaron's Pass Road can be directly exchanged for the same area within the development site. An area of 0.12 ha has been cleared at the eastern end of the development site in association with the commencement of road construction, which occurs outside of the current road design. This area was not considered as part of this assessment, however, was considered to have been cleared under the existing CRWF Project Approval (SSD-6697).

Therefore, the additional area of native vegetation clearing for the development site the subject of this BDAR is 5.05 ha and defines the likely extent of impact, and includes:

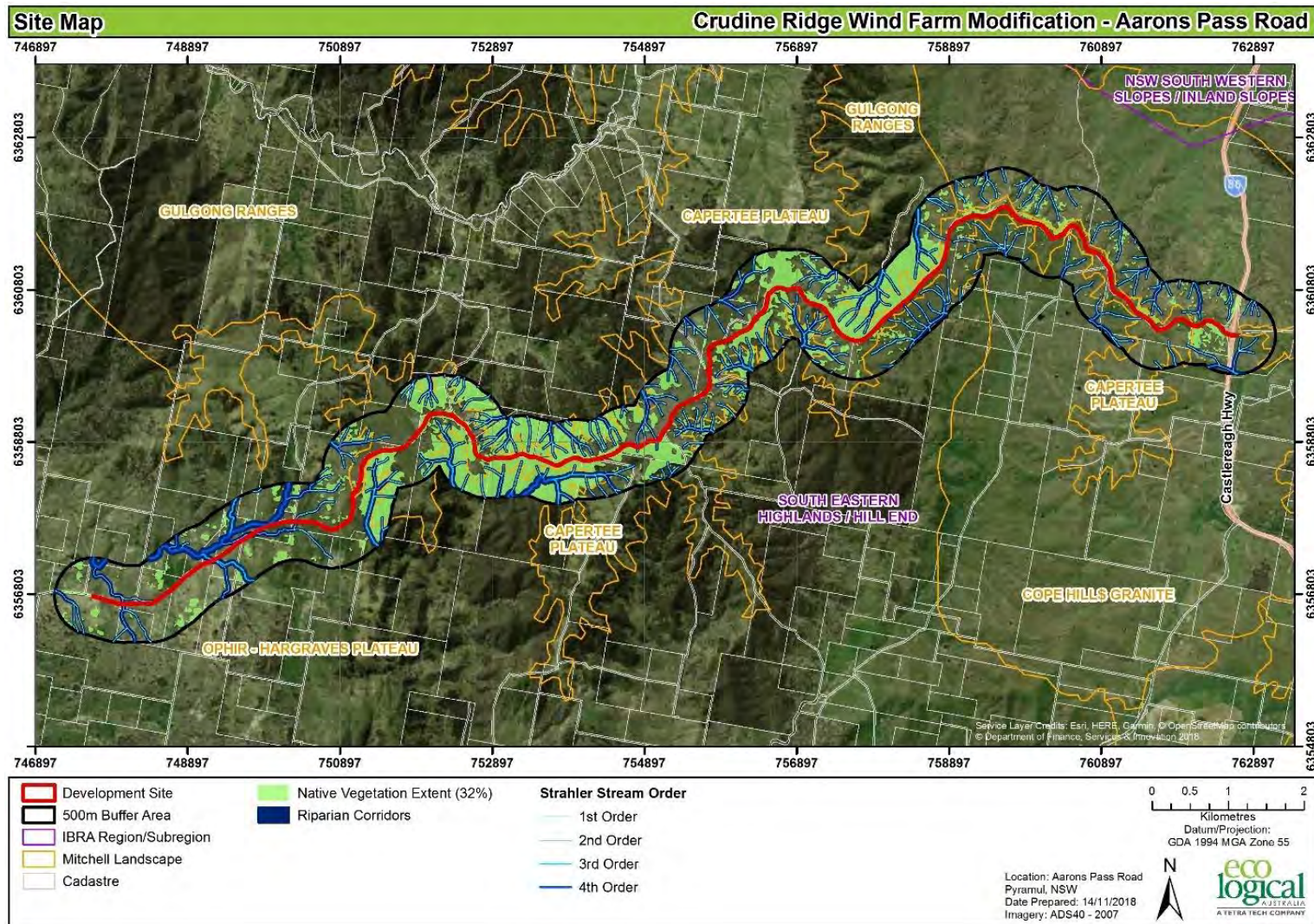
1. The new proposed road design
2. A 0.5 m civil works buffer around the road design, for potential temporary disturbance areas associated with civil works required for the road construction.
3. The blade swept path, which will require pruning of vegetation in some areas to allow for the passage of the blade components of the wind turbines.

It should be noted that not all vegetation within the blade swept path will be disturbed as a result of the proposed road upgrade works. Rather, vegetation present within this path will be pruned where necessary to facilitate transportation of the wind turbine blades with the remainder of the vegetation in this zone retained.

### 1.1.3 Sources of information used

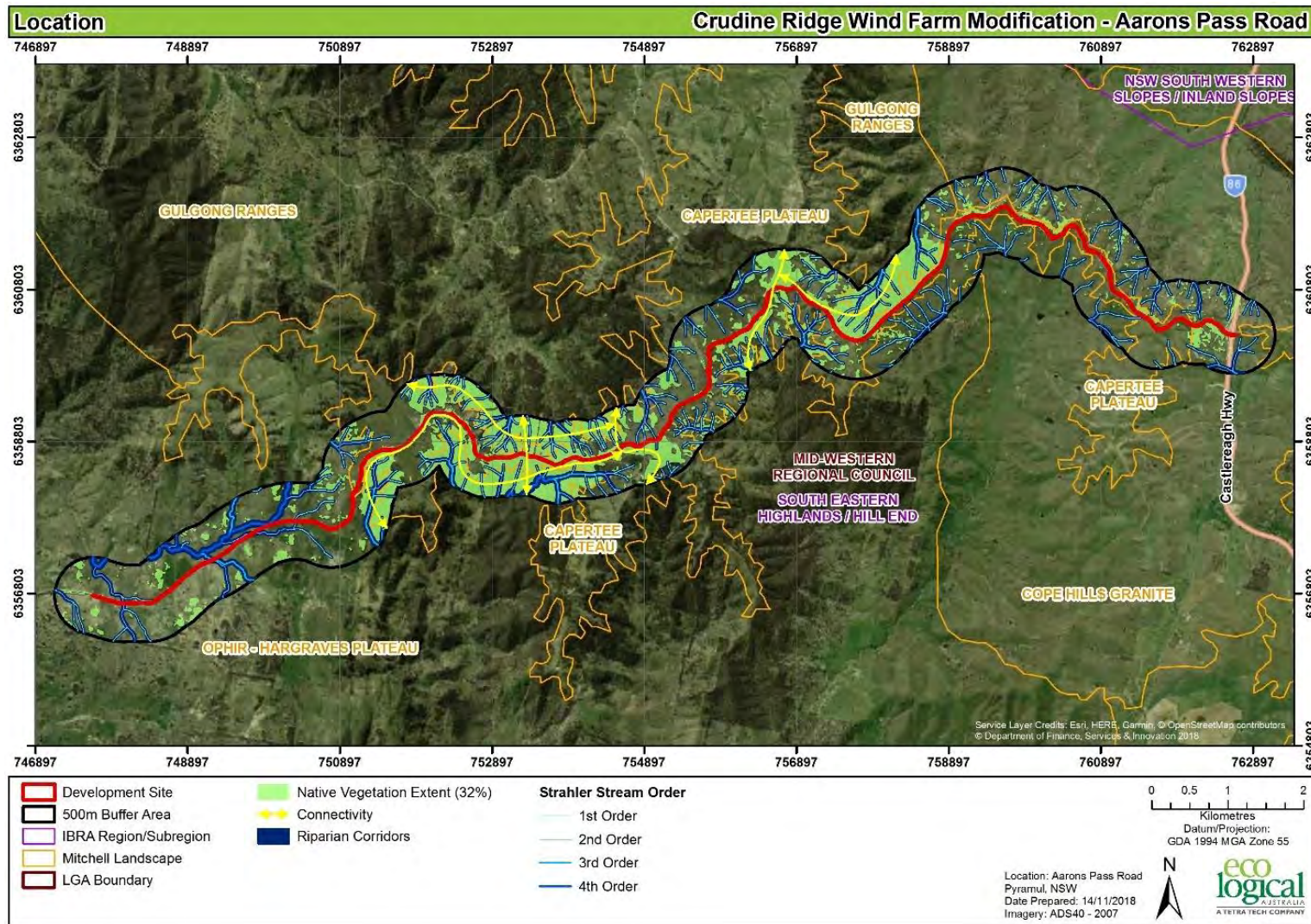
The following data sources were reviewed as part of this report:

- Biodiversity Assessment Methodology Calculator
- BioNet Vegetation Classification (OEH, 2018)
- Bionet Atlas of NSW Wildlife (OEH 2018) covering an area from 10km buffer around coordinates North -32.83: West 149.64; East 149.81; South -32.93 (Datum GDA94)
- EPBC Protected Matters Search Tool (DotEE, 2018) using a 10km buffer around coordinates – 32.83 149.64,-32.93 149.81 (Datum GDA94)
- Aerial Mapping (SIXMaps)
- OEH Threatened Species Profile Data Collection (OEH, 2018b)
- Aarons Pass Road threatened flora species survey letter report (ELA, 2018)
- Addendum - Crudine Ridge Wind Farm Part 3A Ecological Assessment, Aarons Pass Rd, and north access point (ELA, 2013).



**Figure 1: Site Map**





**Figure 2: Location Map**

## 1.2 Legislative context

Table 1: Legislative context

Name	Relevance to the project	Report Section
<b>Commonwealth</b>		
<b>Environmental Protection and Biodiversity Conservation Act 1999</b>	Matters of National Environmental Significance have been identified on or near the development site. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.	2.5.1
<b>State</b>		
<b>Environmental Planning and Assessment Act 1979</b>	The proposed development requires consent under the Mid-Western Regional Local Environmental Plan (LEP) and is to be assessed under Part 4 of the EP&A Act.	N/A
<b>Biodiversity Conservation Act 2016</b>	The proposed development exceeds the BAM threshold and requires submission of a Biodiversity Development Assessment Report (i.e. this report).	All
<b>Fisheries Management Act 1994</b>	The development does not involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, dredging, reclamation or obstruction of fish passage. A permit or consultation under the FM Act is not required.	N/A
<b>Local Land Services Amendment Act 2016</b>	The LLS Act does not apply to development consent issued under Part 4 of the EP&A Act.	N/A
<b>Water Management Act 2000</b>	A Controlled Activity Approval under s91 of the WM Act is not required as the proposed development is state significant development.	N/A
<b>Planning Instruments</b>		
<b>Vegetation SEPP</b>	The Vegetation SEPP applies to development that does not require consent. As this project requires consent under the Mid-Western Regional LEP, the Vegetation SEPP is not relevant.	N/A
<b>SEPP 14 – Coastal Wetlands</b>	SEPP Coastal Management 2018 consolidated SEPP 14 Coastal Wetlands, SEPP 26 Littoral Rainforests and SEPP 71 Coastal Protection. The proposed development is not located on land subject to SEPP Coastal Management 2018.	N/A
<b>SEPP 44 – Koala Habitat Protection</b>	The proposed development site is located within the Mid-Western Regional Council Local Government Area which is listed as one of the Council's to which SEPP 44 applies. The proposed Works does not impact on core koala habitat as defined by SEPP 44.	2.5.2
<b>Mid-Western Regional Local Environment Plan (LEP)</b>	The development site is located in a Road reserve. Surrounding property is zoned RU 1 Primary Production, R5 Large Lot Residential, E3 Environmental Management and SP2 Infrastructure under the Mid-Western Regional Council LEP.	N/A
<b>Mid-Western Regional Development Control Plan (DCP)</b>	The Mid-Western Regional Council DCP has been reviewed for additional provisions that may relate to the Development Site. No additional provisions are required.	N/A

## 1.3 Landscape features

### 1.3.1 IBRA regions and subregions

The development site falls within the IBRA region and subregions as outlined in Table 2 and Table 3.

**Table 2: IBRA regions**

IBRA region	Area within development site (ha)
South Eastern Highlands Biogeographic Region	5.05 ha

**Table 3: IBRA subregions**

IBRA subregion	Area within development site (ha)
Hill End	5.05 ha

### 1.3.2 Native vegetation extent

The extent of native vegetation within the development site and buffer is outlined in Table 4.

**Table 4: Native vegetation extent**

Area within the development site (ha)	Area within the 500 m buffer (ha)
5.05 ha	676 ha

There are differences between the mapped vegetation extent and the aerial imagery. The road reserve is narrow, less than 10 m along most of the length and much of the vegetation visible on the aerial is canopy from overhanging vegetation that will not be impacted by the development site.

### 1.3.3 Rivers and streams

The Work area contains a number of minor streams along the route of the Aaron's Pass Road Upgrade. The majority of the length of Aaron's Pass Road is located on a ridgeline. Therefore, a number of unnamed minor tributaries commence on the slopes of this ridgeline.

Two first order streams are present along Aaron's Pass Road. One fourth order stream is present within the vicinity of Aaron's Pass Road, Cow Flat Creek.

### 1.3.4 Wetlands

The development site does not contain any wetlands.

### 1.3.5 Connectivity features

The development site does not contain any connectivity features.

### 1.3.6 Areas of geological significance and soil hazard features

The development site does not contain areas of geological significance and soil hazard features.

### 1.3.7 Site context

#### 1.3.7.1 Method applied

The linear based method has been applied to this development.

#### 1.3.7.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in a Geographic Information System (GIS) using aerial imagery sourced from SIX Maps using increments of 5%. The results of this analysis are shown in Table 5.

**Table 5: Percent native vegetation cover in the landscape**

Area within the development site (ha)	Cover within the 500 m buffer (%)
5.05	32%

#### 1.3.7.3 Patch size

Patch size was calculated using available vegetation mapping for all patches of intact native vegetation on and adjoining the development site (Table 6).

**Table 6: Patch size**

Patch	Patch size area (ha)
PCT 277	>100
PCT 290	>100

## 1.4 Native vegetation

### 1.4.1 Survey effort

Vegetation surveys were undertaken within the development site by David Allworth, Rebecca Croake, Tomas Kelly, Kate Maslen and Cheryl O'Dwyer on the 17<sup>th</sup> – 21<sup>st</sup> September and the 5<sup>th</sup> and 6<sup>th</sup> November 2018 (Figure 4).

A total of five full-floristic / vegetation integrity plots were surveyed to identify PCTs and Threatened Ecological Communities (TECs) on the development site (Table 7 and Table 8). All five plots were altered from the standard 20 x 50 m to a 5 x 200 m plot formation to best fit within the development site in accordance with the BAM. Full floristic surveys were taken within the nested 5 x 80 m (0.04 ha). Litter cover plots were located 1 m from the 200 m midline, on alternate sides and at 20, 60, 100, 140, and 180 m from the midline start.

All field data collected at full-floristic and vegetation integrity plots is included in Appendix B.

**Table 7: Full-floristic PCT identification plots**

PCT ID	PCT Name	Number of plots surveyed
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (0.94 ha).	2
290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on	3



PCT ID	PCT Name	Number of plots surveyed
	hills in the southern part of the NSW South Western Slopes Bioregion (5.51 ha).	

**Table 8: Vegetation integrity plots**

Veg Zone	PCT ID	PCT Name	Condition	Area (ha)	Plots required	Plots surveyed
1	277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	Intact	0.32	1	1
2	277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	Degraded	0.35	1	1
3	290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion.	Intact	1.55	1	1
4	290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion.	Degraded	2.83	2	2

#### 1.4.2 Plant Community Types present

A total of two PCTs were identified on the development site (Table 9, Figure 3, Appendix D). Of these, one is listed as a TEC under the BC Act and EPBC Act (Table 10, Figure 5), namely *White Box Yellow Box Blakely's Red Gum Woodland* (listed as EEC under the BC Act) / *White Box Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (listed as CEEC under the EPBC Act). Justification for the selection of PCTs occurring on the development site is based on a quantitative analysis of full-floristic plot data and is provided in Table 11. Both PCT's have been stratified into two vegetation zones based on two condition classes (Intact and Degraded) present.

**Table 9: Plant Community Types**

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area	Percent cleared
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	Western Slopes Grassy Woodlands	Grassy Woodlands	0.67 ha	94%
290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills	Upper Riverina Dry Sclerophyll Forests	Dry Sclerophyll Forests	4.38 ha	67%

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Area	Percent cleared
	in the southern part of the NSW South Western Slopes Bioregion.		(Shrub/grass sub formation)		

Table 10: Threatened Ecological Communities

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Area (ha)	Listing status	Name	Area (ha)
277	EEC	<i>White Box</i> <i>Yellow Box</i> <i>Blakely's Red</i> <i>Gum Woodland</i>	0.67	CEEC	<i>White Box</i> <i>Yellow Box -</i> <i>Blakely's Red</i> <i>Gum Grassy</i> <i>Woodland</i> <i>and Derived</i> <i>Native</i> <i>Grassland</i>	0.32

Table 11: PCT selection justification

PCT ID	PCT Name	Selection criteria	Species relied upon for identification of vegetation type and relative abundance
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	IBRA region, landform, soils, vegetation formation and vegetation class	The dominant overstory was <i>Eucalyptus blakelyi</i> and <i>E. melliodora</i> with a ground layer of <i>Poa sieberiana</i> and <i>Themeda triandra</i> . <i>Acacia dealbata</i> was also present.
290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion.	IBRA region, landform, soils, vegetation formation and vegetation class	<i>Eucalyptus macrorhyncha</i> . was not present in the plots however, it was dominant along the roadside together with <i>E. globoidea</i> , <i>E. rossii</i> and <i>E. polyanthemos</i> . <i>Hibbertia obtusifolia</i> , <i>Dianella revoluta</i> and <i>Hardenbergia violacea</i> were present in the lower stratum.

### 1.4.3 PCT selection justification

Classification of vegetation zone 1 as PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, was based on various attributes which were considered in combination to assign vegetation to the best fit PCT. Attributes included dominant species in each stratum, community composition, soils and landscape position. Plot data collected in the field was input

into the BioNet Vegetation Information System (VIS). The canopy comprised of *Eucalyptus blakelyi* (Blakely's Red Gum) and *E. melliodora* (Yellow Box) with the occasional *E. bridgesiana* (Apple Box). Within the ground stratum, several of the species characteristic of Box Gum Woodland were present: *Aristida ramosa* (Purple Wiregrass), *Austrostipa scabra* (Rough Speargrass), *Bothriochloa macra* (Red-leg Grass), *Rytidosperma setacea* (Smallflower Wallaby Grass) and *Themeda australis* (Kangaroo grass).

For the areas classified as PCT 290, a qualitative analysis of the plot data and nearby canopy species were used to aid in the analysis. *Eucalyptus macrorhyncha* (Red Stringybark) was not in two of the plots but was a dominant canopy species. *Eucalyptus rossii* (Inland Scribbly Gum) and *E. polyanthemos* (Red Box) were also dominant. Within the mid stratum very few of the species were present however within the ground stratum, species typical of PCT 290 were present: *Dianella revoluta* (Blue Flax Lily), *Hardenbergia violacea* (False Sarsaparilla), *Poa sieberiana* (Snowgrass), *Rytidosperma pallidum* (Red-anther Wallaby Grass) and *Stypanandra glauca* (Nodding Blue Lily).

Whilst the PCT's have been classified into two vegetation zones, intact and degraded, it is considered that both vegetation zones within the development site have been highly modified, with the mid-storey and ground-layer species diverging from species originally present in these PCTs. It can also be that the disturbed vegetation communities no longer comprise certain characteristic species from certain structural layers present in the undisturbed form of these PCTs.

Another PCT considered for this site was PCT 326 *Long-leaved Box - Red Box grass-shrub open forest on hillslopes in the Mudgee Region, NSW central western slopes*. However, this PCT was ruled out due to the lack of characteristic canopy species, *Eucalyptus albens*, and *Eucalyptus cannonii* and due to variations within the middle and ground stratums. Both PCT 277 and 290 inhabit IBRA Bioregion of South Eastern Highlands and Hill End subregion.

#### 1.4.4 Threatened Ecological Communities Justification

BioNet VIS lists PCT 277 as comprising the EEC, 'White Box Yellow Box Blakely's Red Gum Woodland' (Box Gum Woodland) listed under the BC Act.

Justification of PCT 277 within the development site as Box Gum Woodland is based on the presence of diagnostic species in the upper (*E. blakelyi*, *E. melliodora* and *E. albens*) and lower stratum, vegetation structure and characteristic soil of the community. While the vegetation structure is degraded by weed incursion, past clearing and impacts of edge effects, PCT 277 still manifests as a form of Box Gum Woodland. As is typical of Box Gum Woodland, there was a poor representation of forbs. Seven characteristic species of Box Gum Woodland were identified within plot data, *Aristida ramosa* (Purple Wiregrass), *Austrostipa scabra* (Rough Speargrass), *Bothriochloa macra* (Red-leg Grass), *Geranium solanderi* (Native Geranium), *Lomandra filiformis* (Wattle Matt-rush), *Rytidosperma* spp. (Wallaby Grass) and *Themeda triandra* (Kangaroo grass).

#### 1.4.5 Vegetation integrity assessment

A vegetation integrity assessment using the Credit Calculator (BAMC) was undertaken and the results are outlined in Table 12.

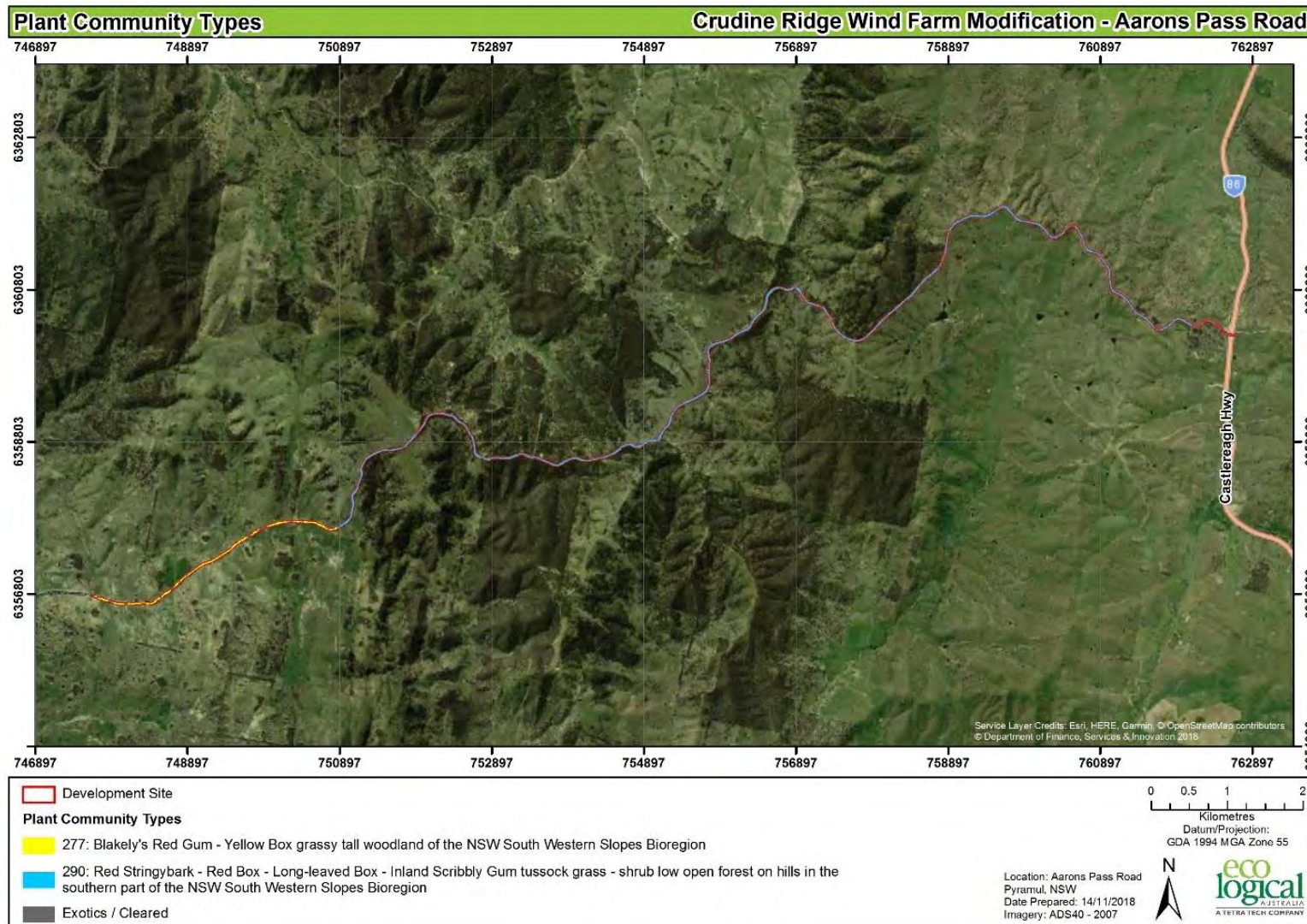
**Table 12: Vegetation integrity**

Veg Zone	PCT ID	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
1	277	Intact	0.32	89.2	20.2	100	56.5
2	277	Degraded	0.35	41.3	17.7	90.3	40.4
3	290	Intact	1.55	75.6	44.1	99.9	69.3
4	290	Degraded	2.83	67.3	33.7	100	61

**1.4.6 Use of local data**

Use of local data is not proposed.





**Figure 3: Plant Community Types and native vegetation extent**



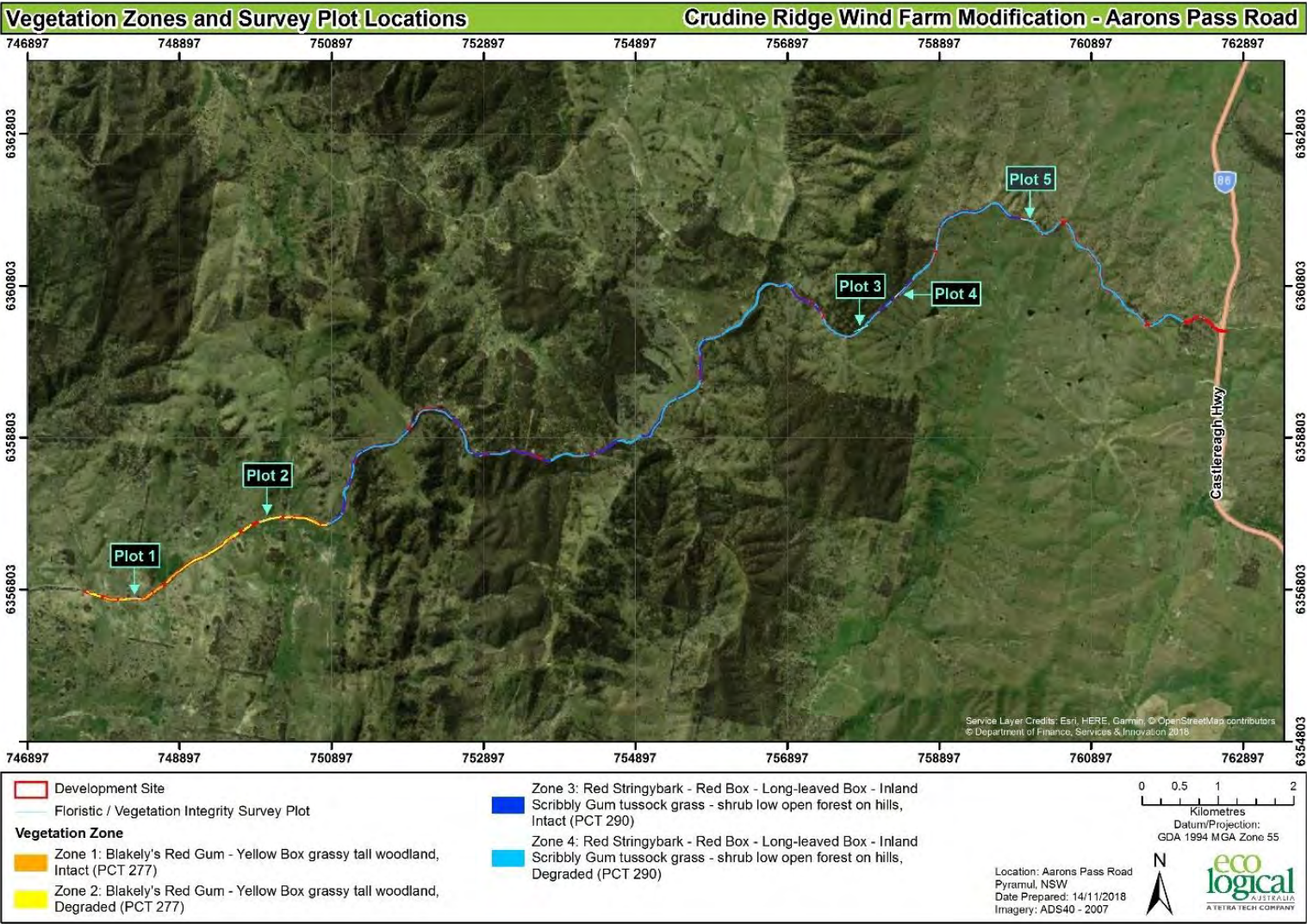


Figure 4: Plot locations





**Figure 5: Threatened Ecological Communities**

## 1.5 Threatened species

### 1.5.1 Ecosystem credit species

Ecosystem credit species predicted to occur within the development site, their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 13. An assessment of those predicted ecosystem credit species identified have been undertaken to determine likelihood of those species to occur based on the absence of necessary habitat components or habitat constraints, in accordance with BAM sections 6.4.1.10 and 6.4.1.17. All species identified by the BAMC had the potential to occur within the development site.

**Table 13: Predicted ecosystem credit species**

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
<i>Anthochaera phrygia</i>	Regent Honeyeater (foraging)			High	Critically Endangered	Critically Endangered
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (foraging)			Moderate	Vulnerable	Not Listed
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo			High	Vulnerable	Not Listed
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow			Moderate	Vulnerable	Not Listed
<i>Chthonicola sagittata</i>	Speckled Warbler			High	Vulnerable	Not Listed
<i>Circus assimilis</i>	Spotted Harrier			Moderate	Vulnerable	Not Listed
<i>Climacteris picumnus</i>	Brown Treecreeper (eastern subspecies)			Moderate	Vulnerable	Not Listed
<i>Daphoenositta chrysoptera</i>	Varied Sittella			Moderate	Vulnerable	Not Listed
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll			High	Vulnerable	Endangered
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle			High	Vulnerable	Not Listed
<i>Glossopsitta pusilla</i>	Little Lorikeet			High	Vulnerable	Not Listed
<i>Grantiella picta</i>	Painted Honeyeater	Mistletoe present at density of		Moderate	Vulnerable	Vulnerable



Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
		greater than five mistletoes per hectare				
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)			High	Vulnerable	Not Listed
<i>Hieraaetus morphnoides</i>	Little Eagle (foraging)			Moderate	Vulnerable	Not Listed
<i>Lathamus discolor</i>	Swift Parrot (foraging)			Moderate	Endangered	Critically Endangered
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)			Moderate	Vulnerable	Not Listed
<i>Melanodryas cucullata</i>	Hooded Robin (south-eastern form)			High	Vulnerable	Not Listed
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)			Moderate	Vulnerable	Not Listed
<i>Miniopterus schreibersii</i>	Eastern Bentwing-bat (foraging)			High	Vulnerable	Not Listed
<i>Neophema pulchella</i>	Turquoise Parrot			High	Vulnerable	Not Listed
<i>Ninox connivens</i>	Barking Owl (foraging)			High	Vulnerable	Not Listed
<i>Ninox strenua</i>	Powerful Owl (foraging)			High	Vulnerable	Not Listed
<i>Petroica boodang</i>	Scarlet Robin			Moderate	Vulnerable	Not Listed
<i>Petroica phoenicea</i>	Flame Robin			Moderate	Vulnerable	Not Listed
<i>Phascolarctos cinereus</i>	Koala (foraging)			High	Vulnerable	Vulnerable
<i>Polytelis swainsonii</i>	Superb Parrot (foraging)			Moderate	Vulnerable	Not Listed
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)			Moderate	Vulnerable	Not Listed
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail bat			High	Vulnerable	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
<i>Stagonopleura guttata</i>	Diamond Firetail			Moderate	Vulnerable	Not Listed
<i>Tyto novaehollandiae</i>	Masked Owl (foraging)			High	Vulnerable	Not Listed
<i>Varanus rosenbergi</i>	Rosenberg's Goanna			High	Vulnerable	Not Listed

## 1.6 Species credit species

Species credit species predicted to occur at the development site (i.e. candidate species), their associated habitat constraints, geographic limitations and sensitivity to gain class is included in Table 14. An assessment of those species credit species identified has been undertaken to determine likelihood of those species to occur based on the absence of necessary habitat components or habitat constraints, in accordance with BAM sections 6.4.1.10 and 6.4.1.17. For those species that have been excluded, the justification is also provided. Maps from OEH to determine breeding habitat for Swift Parrot and Regent Honeyeater have been requested but at the time of submission have not yet been received.

**Table 14: Candidate species credit species**

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
<i>Acacia ausfeldii</i>	Ausfeld's Wattle			High	Vulnerable	Not Listed
<i>Acacia meiantha</i>				High	Endangered	Not Listed
<i>Burhinus grallarius</i>	Bush Stone-curlew			High	Endangered	Not Listed
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding)			High	Vulnerable	Not Listed
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo			High	Vulnerable	Not Listed
<i>Cercartetus nanus</i>	Eastern Pygmy-possum			High	Vulnerable	Not Listed
<i>Eucalyptus cannonii</i>	Capertee Stringybark			High	Vulnerable	Not Listed
<i>Eucalyptus pulverulenta</i>	Silver-leafed Gum			High	Vulnerable	Vulnerable
<i>Eucalyptus robertsonii</i> subsp. <i>Hemisphaerica</i>	Robertson's Peppermint			N/A	Vulnerable	Vulnerable
<i>Grevillea divaricata</i>				High	Endangered	Not Listed
<i>Ninox connivens</i>	Barking Owl (breeding)			High	Vulnerable	Not Listed

Species	Common Name	Habitat Constraints	Geographic limitations	Sensitivity to gain class	NSW listing status	EPBC Listing status
<i>Ninox strenua</i>	Powerful Owl (breeding)			High	Vulnerable	Not Listed
<i>Petaurus norfolcensis</i>	Squirrel Glider			High	Vulnerable	Not Listed
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Hollow bearing trees		High	Vulnerable	Not Listed
<i>Phascolarctos cinereus</i>	Koala (breeding)			High	Vulnerable	Vulnerable
<i>Pomaderris reperta</i>	Denman Pomaderris			High	Critically Endangered	Critically Endangered
<i>Swainsona recta</i>	Small Purple-pea			High	Endangered	Endangered
<i>Swainsona sericea</i>	Silky Swainson-pea			High	Vulnerable	Not Listed
<i>Tyto novaehollandiae</i>	Masked Owl (breeding)			High	Vulnerable	Not Listed

### 1.6.1 Targeted surveys

Targeted surveys for flora species credit species were undertaken at the development site on the dates outlined in Table 15. Two ecologists, one on either side of the road meandered along the 10 m wide vegetation over the 20 km covering an area of 20 ha, with the results of the surveys shown as individual species polygons on Figure 6 to Figure 17.

**Table 15: Targeted surveys**

Date	Surveyors	Target species
17 <sup>th</sup> -21 <sup>st</sup> September 2018	Tomas Kelly and Rebecca Croake	Flora
5 <sup>th</sup> – 7 <sup>th</sup> October 2018	David Allworth, Cheryl O'Dwyer and Kate Maslen	Flora

Weather conditions during the targeted surveys are outlined in Table 16. The summer preceding the spring survey recorded slightly warmer than average temperatures, but the months leading up to the survey period were colder than the historical mean. The region has been experiencing drought conditions during 2018.

**Table 16: Weather conditions (Mudgee Airport, Bureau of Meteorology, 2018)**

Date	Rainfall (mm)	Minimum temperature 0C	Maximum temperature 0C
17 September 2018	0	-0.3	17.7
18 September 2018	0	0	23.3
19 September 2018	0	3.4	21.4
20 September 2018	0	-1.0	17.8
21 September 2018	0	-1.1	20.0
5 November 2018	0	9.0	29.7

Date	Rainfall (mm)	Minimum temperature 0C	Maximum temperature 0C
6 <sup>th</sup> November 2018	0	17.2	32.5

Survey effort undertaken at the development is outlined in Table 17.

**Table 17: Survey effort**

Method	Habitat (ha)	Stratification units	Total effort	Target species
Habitat search (day)	20	SU<50ha	17-21 September – 100 person hours	Flora and opportunistic sightings of birds
Random meander	20	SU<50ha	17-21 September – 100 person hours	Flora and opportunistic sightings of birds
Transect	0.5	SU<50ha	5-6 October – 5 transects 40 person hours	Flora

Following completion of targeted surveys, the species credit species included in the assessment are outlined in Table 18.

**Table 18: Species credit species included in the assessment**

Species	Common Name	Species presence	Geographic limitations	Number of individuals / Habitat (ha)	Biodiversity Risk Weighting
<b>FLORA</b>					
<i>Acacia ausfeldii</i>	Ausfelds wattle	No (surveyed)			2
<i>Acacia meiantha</i>		Yes (surveyed)		59 individuals / 0.1 ha	3
<i>Eucalyptus cannonii</i>	Capertee Stringybark	No (surveyed)			2
<i>Eucalyptus pulverulenta</i>	Silver-leafed Gum	No (surveyed)			2
<i>Eucalyptus robertsonii</i> subsp. <i>Hemisphaerica</i>	Robertson's Peppermint	No (surveyed)			1
<i>Grevillea divaricate</i>		No (surveyed)			3
<i>Pomaderris reperta</i>	Denman Pomaderris	Yes (surveyed)		1 individual / 0.01 ha	3
<i>Swainsona recta</i>	Small Purple-pea	No (surveyed)			2
<i>Swainsona sericea</i>	Silky Swainson-pea	No (surveyed)			2
<b>FAUNA</b>					
<i>Burhinus grallarius</i>	Bush Stone-curlew	Yes (assumed present)		5.05 ha	2
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Yes (assumed present)		4.97 ha	2



Species	Common Name	Species presence	Geographic limitations	Number of individuals / Habitat (ha)	Biodiversity Risk Weighting
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Yes (assumed present)		4.97 ha	2
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Yes (assumed present)		4.97 ha	2
<i>Ninox connivens</i>	Barking Owl	Yes (assumed present)		4.97 ha	2
<i>Ninox strenua</i>	Powerful Owl	Yes (assumed present)		4.97 ha	2
<i>Petaurus norfolcensis</i>	Squirrel Glider	Yes (assumed present)		5.05 ha	2
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Yes (assumed present)		4.97 ha	2
<i>Phascolarctos cinereus</i>	Koala	Yes (assumed present)		5.05 ha	2
<i>Tyto novaehollandiae</i>	Masked Owl	Yes (assumed present)		4.97 ha	2

Table 19: Justification for exclusion of candidate species credit species

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
<i>Anthochaera phrygia</i>	Regent Honeyeater (Breeding)	Critically Endangered	Critically Endangered	This species is not known to breed in the development site (National Recovery Plan). There are only two known key breeding regions within NSW – the Capertee Valley and the Bundarra-Barraba region. Breeding areas consist of Box-Ironbark with River Sheoaks. Nests are usually located in Ironbarks, Sheoaks and Angophoras located on fertile soils that have high water content. Aarons Pass Road does not contain these plant species nor are the soils fertile or moist. Regularly used areas within the Capertee Valley is the Mudgee-Munghorn Gap – Wollar region which is 50 km north of Aarons Pass Road. Maps from OEH have been requested to confirm that the development site does not contain species credit habitat.
<i>Aprasia parapulchella</i>	Pink-tailed Lizard	Legless Vulnerable	Vulnerable	This species inhabits sites which are typically well-drained with rocky outcrops or scattered and partially buried rocks.

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
				Suitable rocky areas are not present within the development site.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Vulnerable	Vulnerable	This species requires areas with extensive caves and cliffs. The development site does not contain breeding habitat such as caves, overhangs or culverts within 2 km that are suitable for the species to utilise the site.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. This species requires rivers, swamps, lakes and freshwater billabong within 1 km for foraging with large mature trees nearby. Habitat was not deemed suitable for breeding for this species.
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The presence of this species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site. No nests were observed during the field survey.
<i>Lathamus discolor</i>	Swift Parrot (breeding)	Endangered	Critically Endangered	The presence of this species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site. Breeding is not known to occur within the area. This species is only known to breed in Tasmania during Spring. Maps from OEH have been requested to confirm that the development site does not contain species credit habitat.
<i>Litoria booroolongensis</i>	Booroolong Frog	Endangered	Endangered	There were no permanent streams within the development site. No suitable habitat was identified on site.
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The presence of this species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise

Species	Common Name	NSW listing status	EPBC Listing status	Justification for exclusion of species
				the development site. No nests were observed during field surveys as nests are usually located along or near watercourses.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (breeding)	Vulnerable	Not Listed	This is a dual credit species, and only a species credit species when specific habitat constraints are present for breeding. The development site does not contain breeding habitat such as caves, overhangs or culverts that are suitable for the species to breed within the development site.
<i>Polytelis swainsonii</i>	Superb Parrot	Vulnerable	Vulnerable	The Superb Parrot inhabits Box-Gum Woodlands on the South-Western Slopes their core breeding area is bounded by Cowra and Yass in the east and Grenfell, Cootamundra and Coolac in the west. This region is well south of the development site. .
<i>Zieria obcordata</i>		Endangered	Endangered	The presence of this species was not identified, and it was determined that the habitat is substantially degraded such that this species is unlikely to utilise the development site.



Figure 6: Species polygon for *Pomaderris reperta*



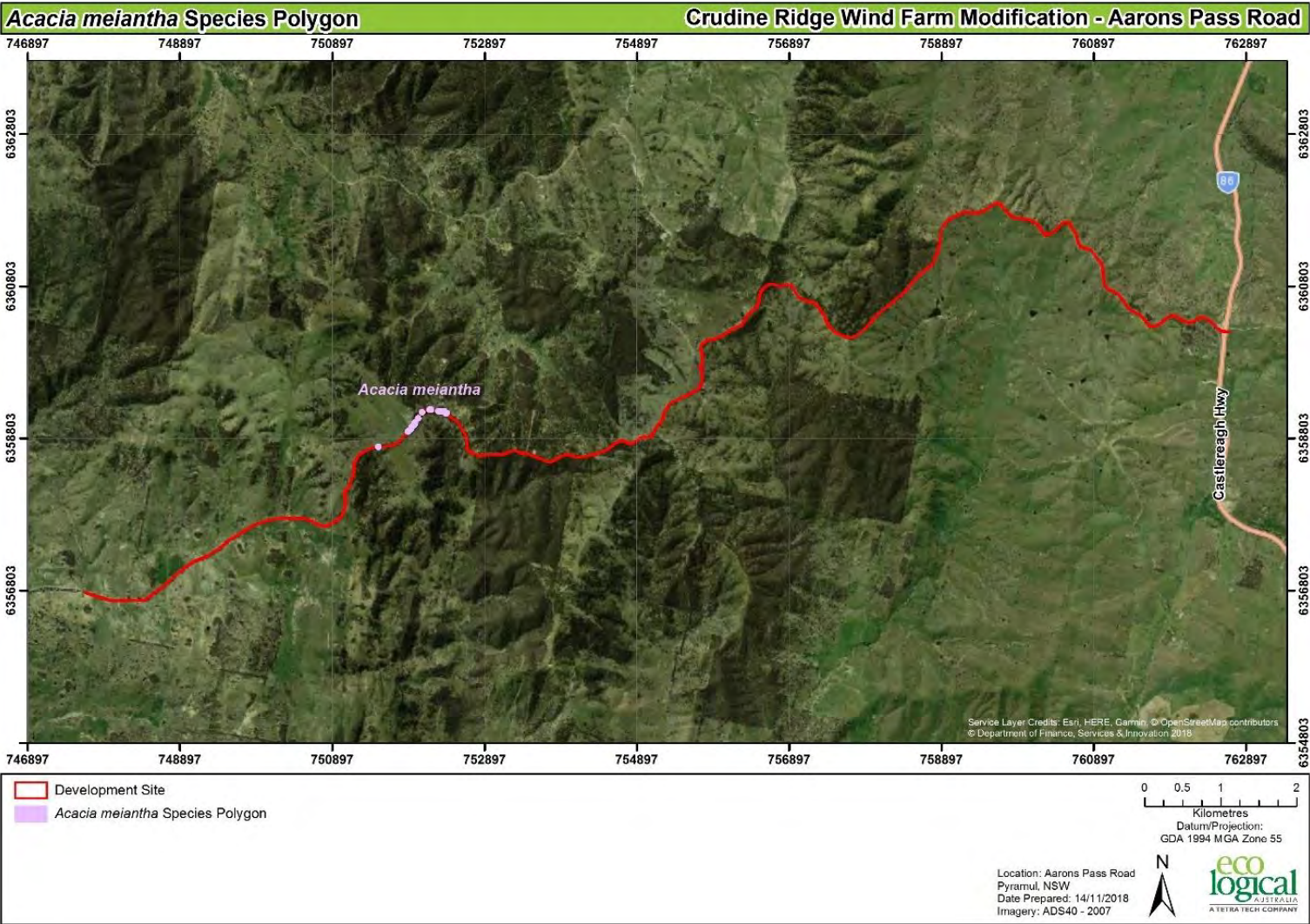


Figure 7: Species polygon for *Acacia meiantha*

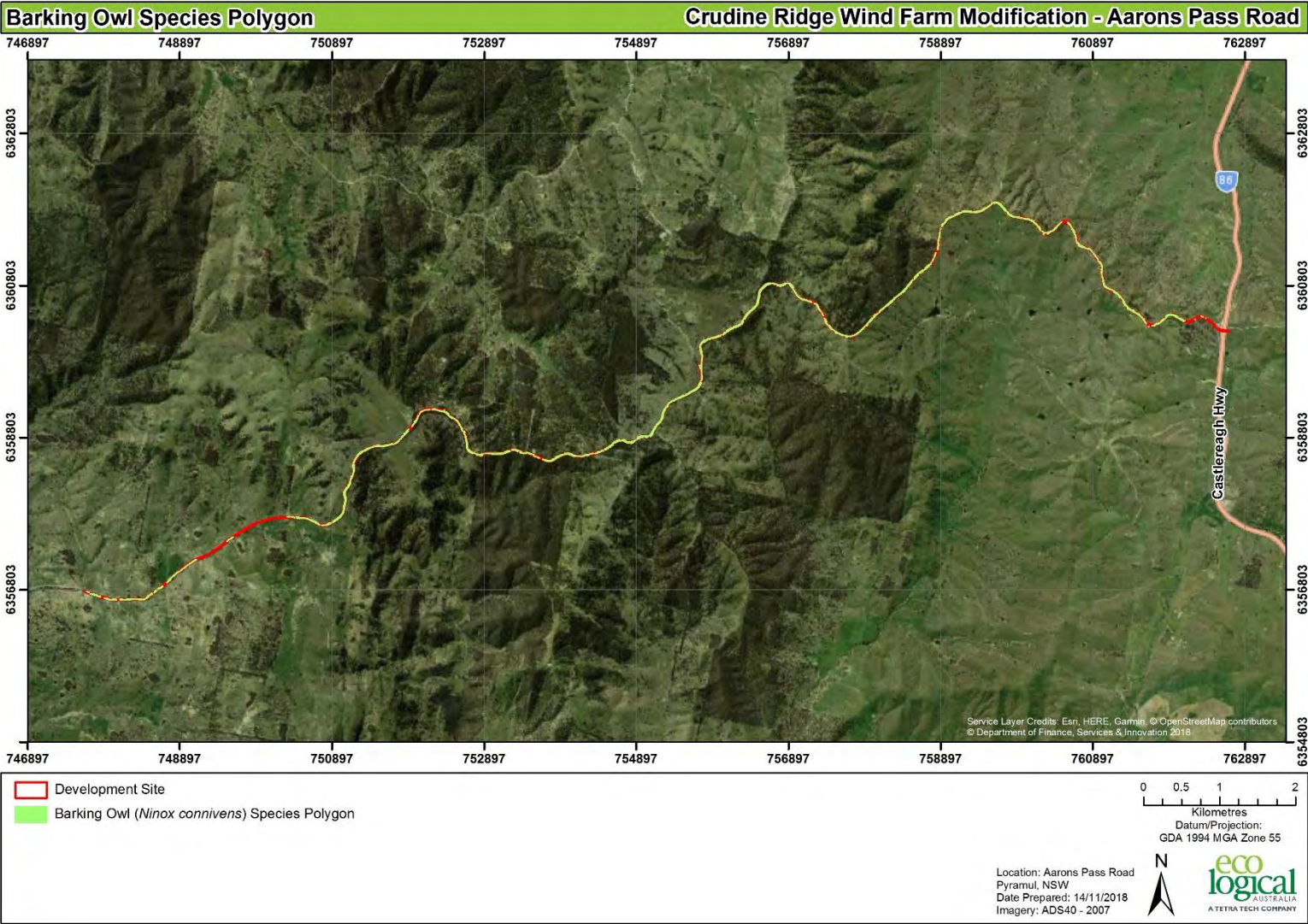


Figure 8: Species polygon for *Ninox connivens*



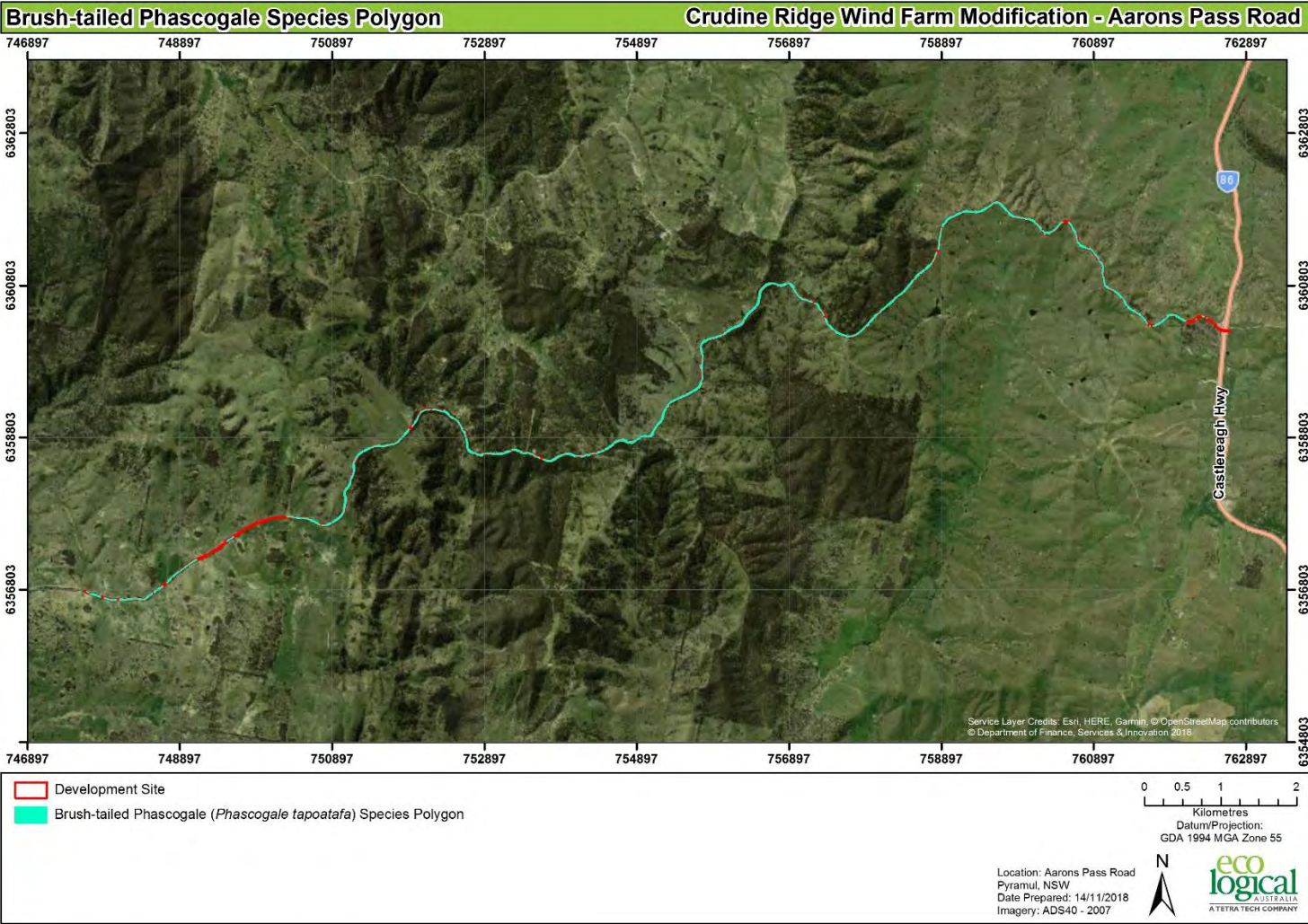


Figure 9: Species polygon for *Phascogale tapoatafa*

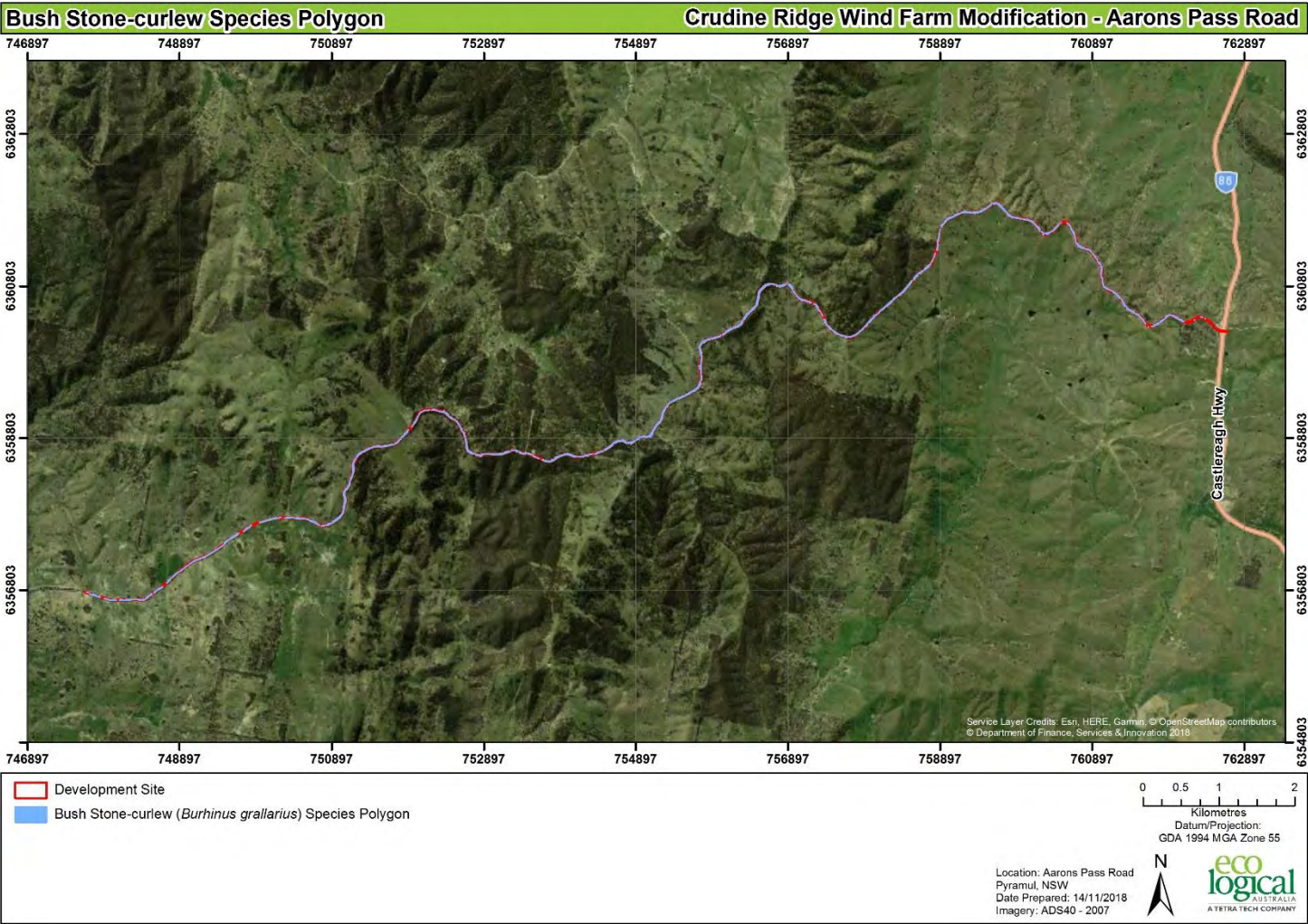


Figure 10: Species polygon for *Burhinus grallarius*



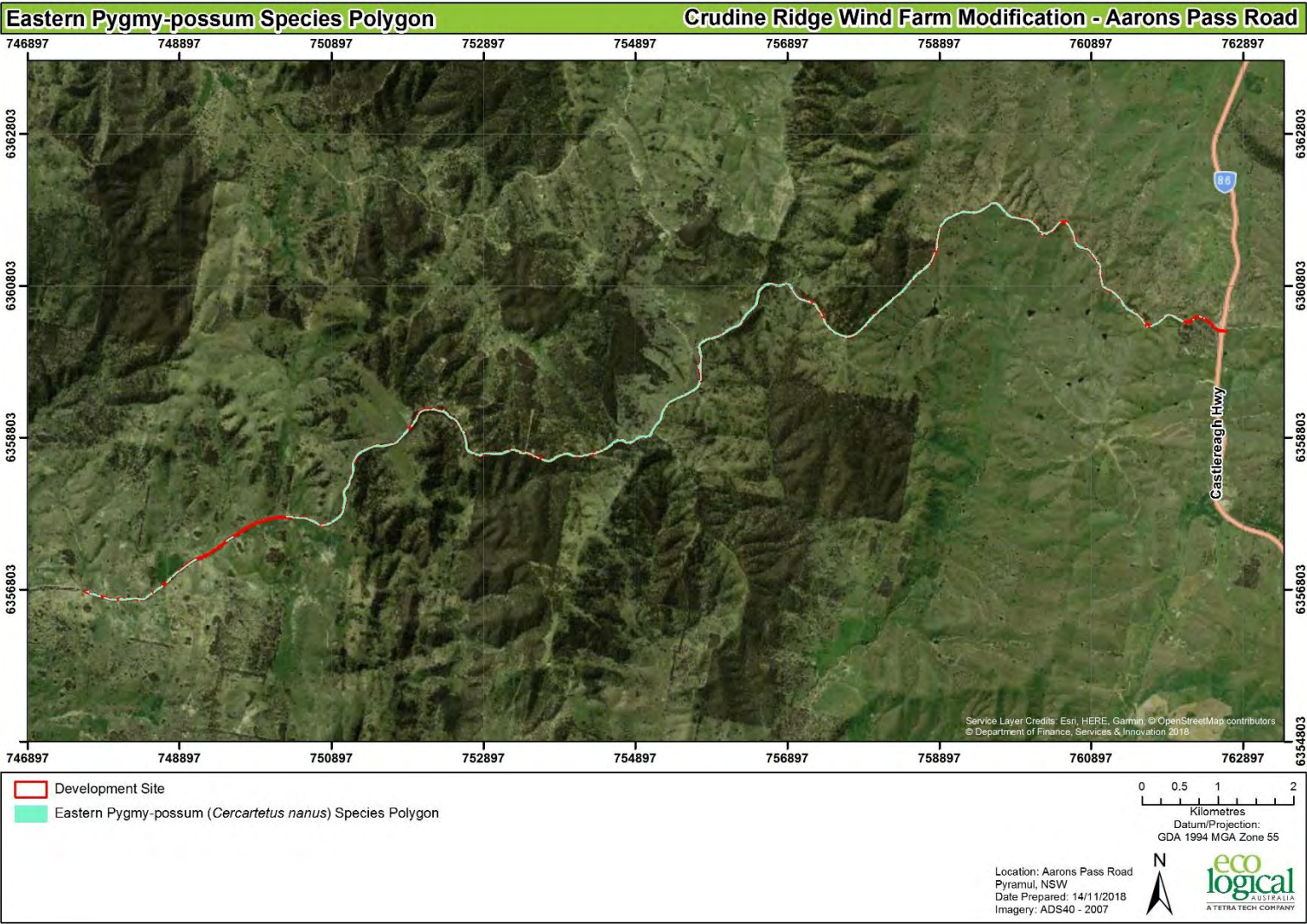


Figure 11: Species polygon for *Cercartetus nanus*



Figure 12: Species polygon for *Callocephalon fimbriatum*



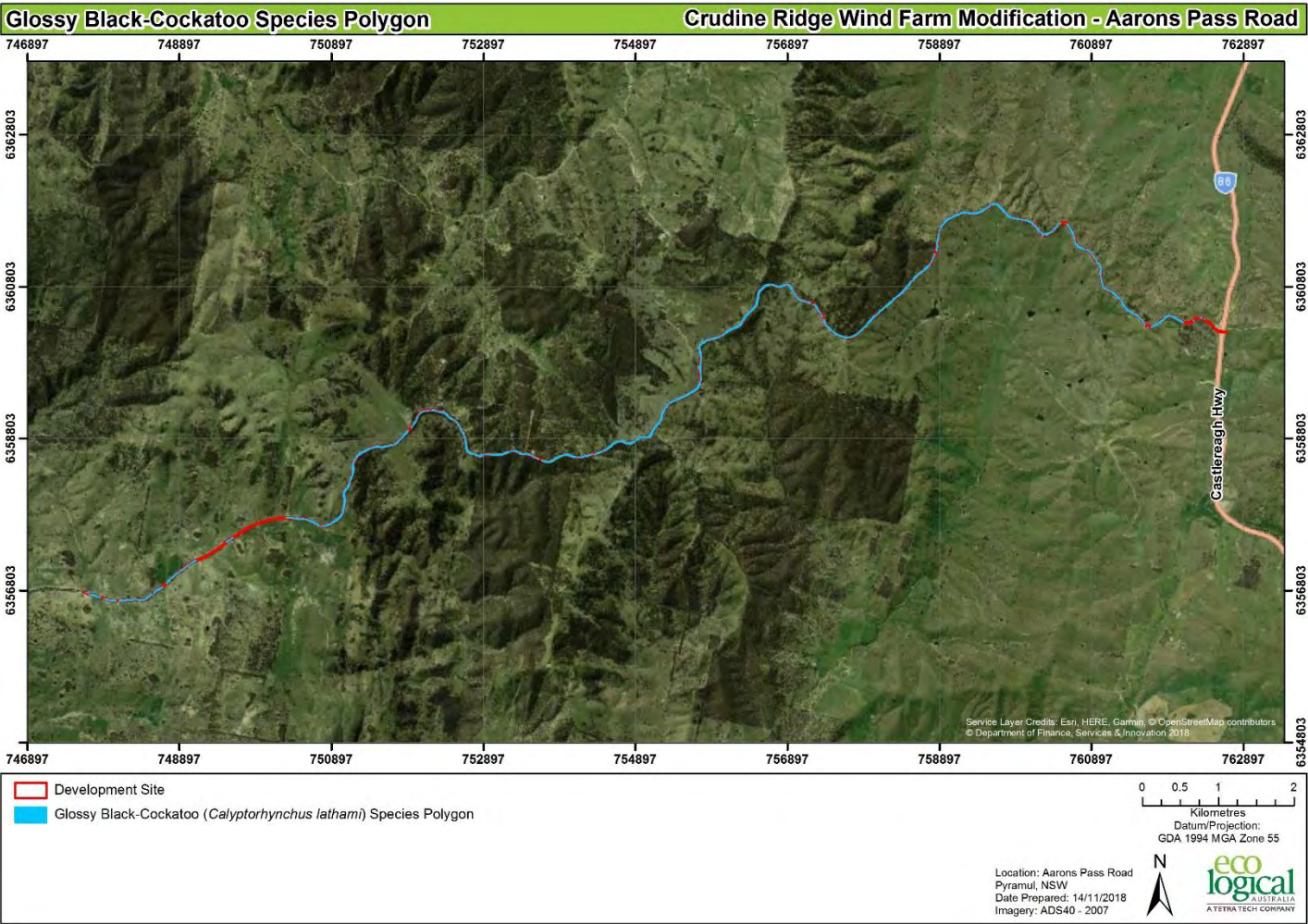


Figure 13: Species polygon for *Calyptorhynchus lathami*

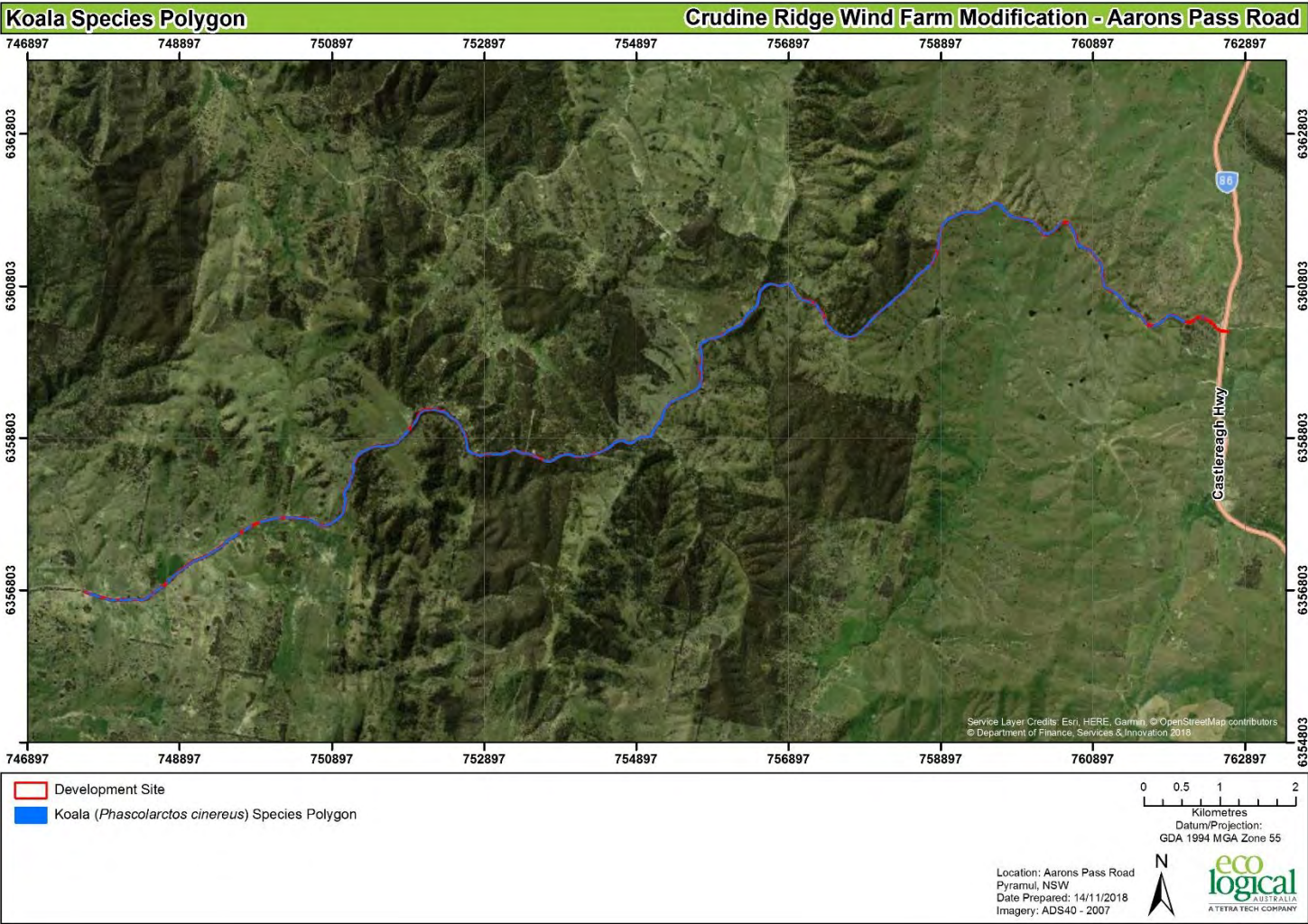


Figure 14: Species polygon for *Phascolarctos cinereus*



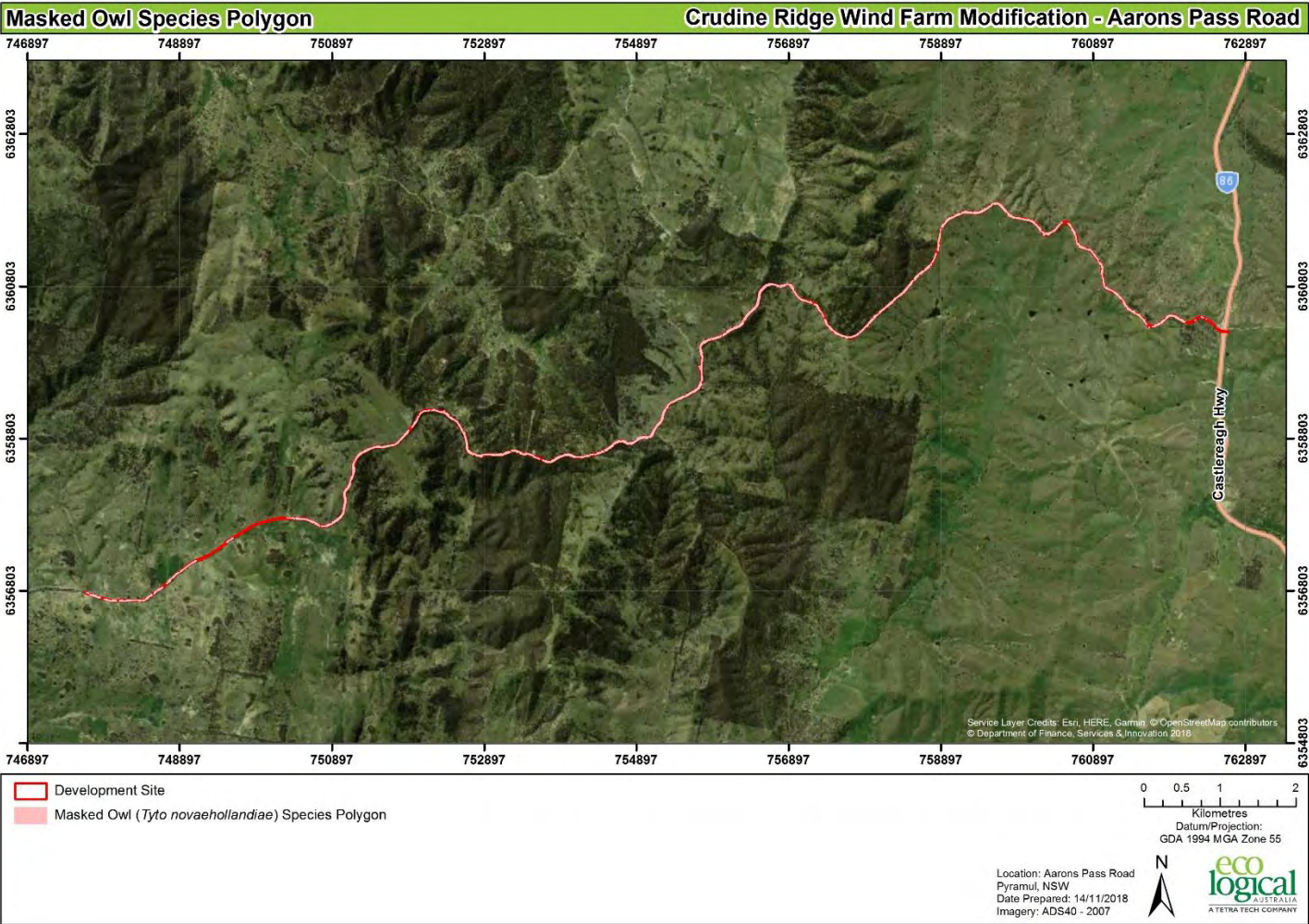


Figure 15: Species polygon for *Tyto novaehollandiae*

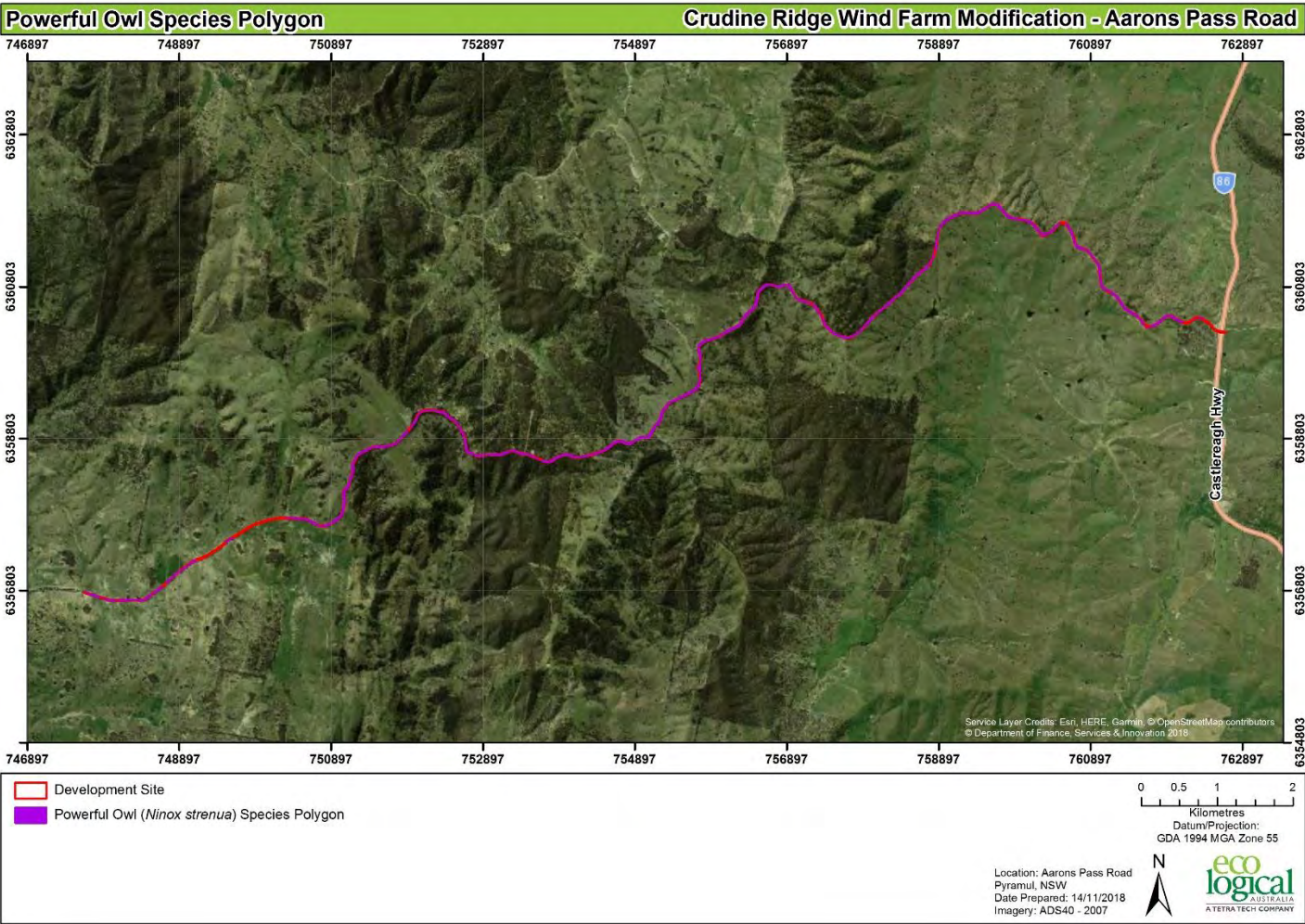


Figure 16: Species polygon for *Ninox strenua*



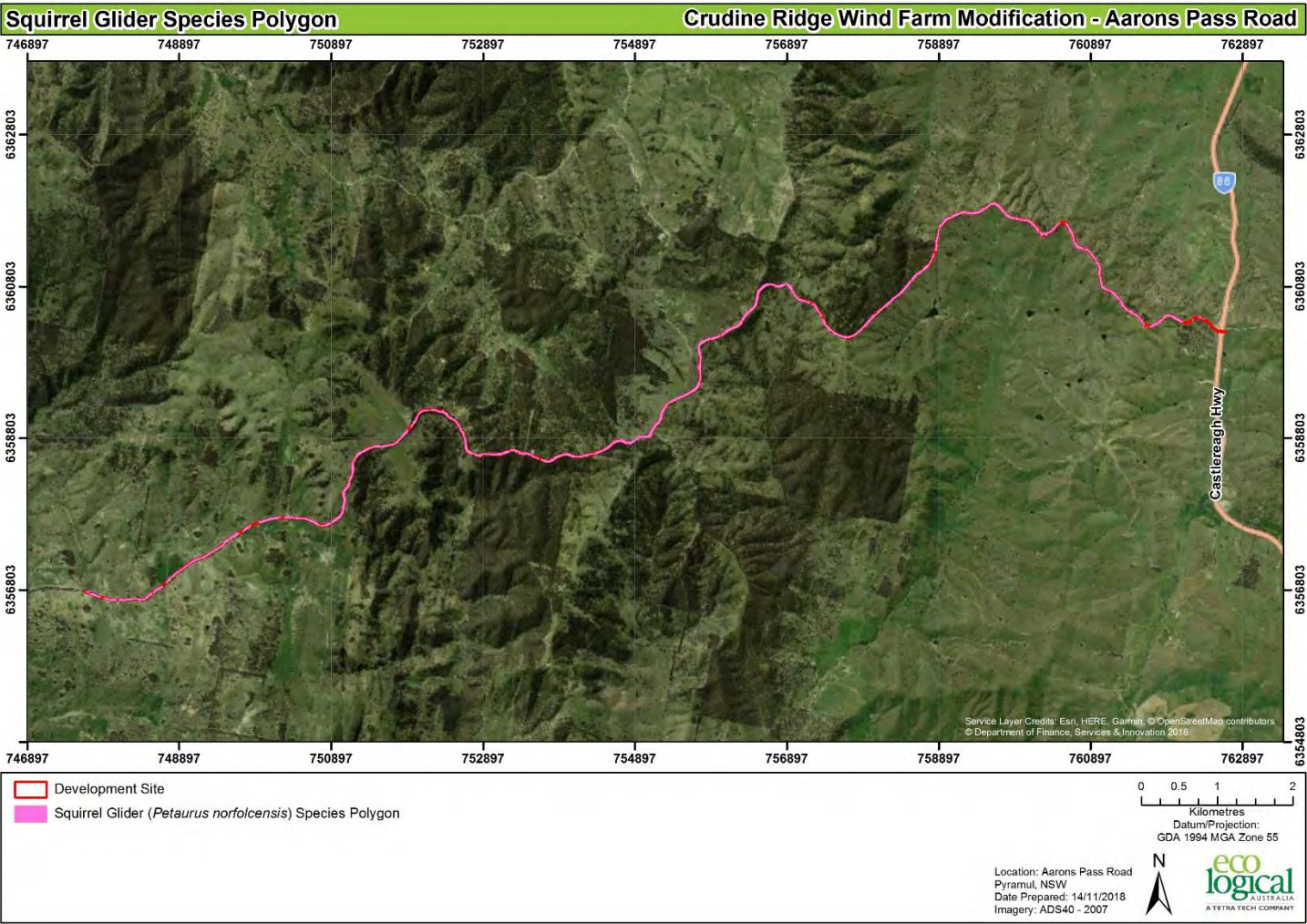


Figure 17: Species polygon for *Petaurus norfolcensis*

### 1.6.2 Use of local data

The use of local data is not proposed.

### 1.6.3 Expert reports

Expert reports have not been used as part of this BDAR.



## 2. Stage 2: Impact assessment (biodiversity values)

### 2.1 Avoiding impacts

#### 2.1.1 Locating a project to avoid and minimise impacts on vegetation and habitat

The development has been located in a way which avoids and minimises impacts as outlined in Table 20.

**Table 20: Locating a project to avoid and minimise impacts on vegetation and habitat**

Approach	How addressed	Justification
<b>locating the project in areas where there are no biodiversity values</b>	Areas with reduced biodiversity values have been utilised within the development footprint.	<p>The footprint and access route has been adjusted multiple times to avoid areas of higher biodiversity values and EEC.</p> <p>Whilst 5.05 ha of vegetation has been assessed as being impacted, not all of this vegetation will be cleared. Areas of temporary direct impacts exist associated with road construction, along with areas where wind turbine blades will pass over vegetation (blade swept path) which will be pruned or left in situ.</p>
<b>locating the project in areas where the native vegetation or threatened species habitat is in the poorest condition</b>	The access route along Aarons Pass Rd avoids areas of higher quality vegetation and species habitat.	Alternative routes were investigated and clearing regimes have been modified to minimise impacts to species. Vegetation has been retained wherever possible, particularly within the blade swept path.
<b>locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species</b>	The access route along Aarons Pass Rd avoids areas of higher quality vegetation and species habitat	Alternative routes were investigated and clearing regimes have been modified to minimise impact to species. Nearby areas of remnant native vegetation identified as EEC or CEEC have been avoided.
<b>locating the project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained</b>	The development site avoids impediments to connectivity.	The development site contains limited habitat connectivity and is largely located within a fragmented landscape. Lands directly adjoining the development site are heavily grazed or cropped with some patches of vegetated and connected areas directly adjoining the site. Given that not all vegetation will be removed within the total 5.05 ha footprint, the development will not impact on the movement of species and genetic material between areas of nearby habitat.

### 2.1.2 Designing a project to avoid and minimise impacts on vegetation and habitat

The development has been designed in a way which avoids and minimises impacts as outlined in Table 21.

**Table 21: Designing a project to avoid and minimise impacts on vegetation and habitat**

Approach	How addressed	Justification
<b>reducing the clearing footprint of the project</b>	<p>Alternative access routes were investigated, and the removal of vegetation has been modified to minimise impacts to species.</p> <p>Knowledge of the location of the Denman Pomaderris has allowed transport options to be modified, and project activities able to ensure that direct impacts upon this species will be minimal (1 individual).</p>	<p>The project has been designed to minimise vegetation and habitat clearing through strategic planning. This project has been modified to minimise areas of EEC and CEEC.</p> <p>Whilst 5.05 ha of vegetation has been assessed as being impacted, not all of this vegetation will be cleared. Areas of temporary direct impacts exist associated with road construction, along with areas where wind turbine blades will pass over vegetation (blade swept path) which will be pruned or left in situ.</p> <p>The height of the blade of the turbine on the transport vehicles is above the height of the Denman Pomaderris present within the blade swept path. This has ensured that impact to this species is avoided wherever possible, with the potential for pruning to be undertaken to ensure impacts are minimised.</p>
<b>providing structures to enable species and genetic material to move across barriers or hostile gaps</b>	<p>Whilst assessment has been considered for the entire removal of 5.05 ha of vegetation not all of this will be removed, sections will be pruned, and trees will be avoided where possible. Only small patches along the total length of Aarons Pass Road, approximately 20 km will be removed.</p>	<p>The access route and road modification has been planned to avoid the removal of vegetation where possible and allow for pruning of vegetation. All existing corridors off-site allowing for the movement of species and genetic material will be retained.</p>
<b>making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.</b>	<p>Impacts to the vegetation will occur in small areas along the 20 km length of Aarons Pass Road</p>	<p>The total development site covers an area of 6.59 ha. Of this 1.54 ha has already been approved for clearing under the CRWF Development Consent (SSD-6697) and given the like-for-like vegetation communities, it is considered that the SSD-6697 approved 1.54 ha can be directly exchanged for the same area within the development site. Therefore, the additional area of native vegetation clearing for the development site the subject of this BDAR is 5.05 ha. Not all of this will be cleared, where possible</p>

Approach	How addressed	Justification
		areas will be only partially disturbed with select tree removal and pruning of vegetation.
<b>Efforts to avoid and minimise impacts through design must be documented and justified</b>	Modifications and strategic planning to avoid and minimise impacts to species.	The footprint has been adjusted multiple times to avoid areas of higher biodiversity values and EEC.

### 2.1.3 Prescribed biodiversity impacts

The development site has the prescribed biodiversity impacts as outlined in Table 22.

**Table 22: Prescribed biodiversity impacts**

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities effected
<b>impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range</b>	The access route and road modification has been planned to avoid the removal of vegetation where possible and allow for trimming. All existing corridors off-site allowing for the movement of species and genetic material will be retained	Brush-tailed Phascogale, Bush Stone-curlew, Eastern Pygmy-possum and Squirrel Glider, Koala.
<b>impacts of development on movement of threatened species that maintains their lifecycle</b>	The access route and road modification has been planned to avoid the removal of vegetation where possible and allow for trimming. All existing corridors off-site allowing for the movement of species and genetic material will be retained	Brush-tailed Phascogale, Bush Stone-curlew, Eastern Pygmy-possum and Squirrel Glider, Koala.
<b>impacts of vehicle strikes on threatened species or on animals that are part of a TEC.</b>	Whilst it is unlikely that Koalas use the area for breeding or foraging due to the lack of feed trees, the roadside vegetation may be used as a corridor to facilitate movement. Koalas have been struck by vehicles in the vicinity of the development site (OEH 2018). The development site consists of the removal of a total of 5.05 ha of vegetation across the 20km length of road. Only particular sections of the road will be widened, and other areas will have vegetation pruned and large trees removed. The development site contains limited habitat connectivity and is located within a fragmented landscape. It is unlikely that vehicle strikes on threatened animals will increase.	Koala

### 2.1.3.1 Locating a project to avoid and minimise prescribed biodiversity impacts

The development has been located in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 23.

**Table 23: Locating a project to avoid and minimise prescribed biodiversity impacts**

Approach	How addressed	Justification
<b>locating the envelope of surface works to avoid direct impacts on the habitat features</b>	The access route and road modification has been planned to avoid and minimise the removal of vegetation where possible. Not all vegetation within the 5.05 ha footprint will be removed.	The route and access have been planned and modified to avoid areas of high biodiversity values and reduce the impact by allowing for vegetation trimming rather than removal.
<b>locating the project to avoid severing or interfering with corridors connecting different areas of habitat, migratory flight paths to important habitat or preferred local movement pathways</b>	The access route and road modification has been planned to avoid and minimise the loss of vegetation and connectivity.	Alternative routes and access have been investigated. The road modification development site has been modified to minimise impacts to species. The overall footprint has been reduced.

### 2.1.3.2 Designing a project to avoid and minimise prescribed biodiversity impacts

The development has been designed in a way which avoids and minimises prescribed biodiversity impacts as outlined in Table 24.

**Table 24: Designing a project to avoid and minimise prescribed biodiversity impacts**

Approach	How addressed	Justification
<b>design of project elements to minimise interactions with threatened and protected species and ecological communities, and the persistence of habitat features.</b>	Strategic planning and modifications to the original design. Alternative routes and access were considered to minimize impacts to species.	The 5.05 ha footprint includes areas that will not be totally cleared of vegetation. There is a 0.5 m civil works buffer zone and a blade swept path that will enable vegetation to be trimmed rather than complete removal.



## 2.2 Assessment of Impacts

### 2.2.1 Direct impacts

The direct impacts of the development on:

- native vegetation are outlined in Table 25
- threatened ecological communities are outlined in Table 26
- threatened species and threatened species habitat is outlined in Table 27
- prescribed biodiversity impacts is outlined in Section 2.2.2
- Direct impacts including the final project footprint (construction and operation) are shown on Figure 18

**Table 25: Direct impacts to native vegetation**

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.	Western Slopes Grassy Woodlands	Grassy Woodlands	0.67 ha
290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion.	Upper Riverina Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrub/grass sub formation)	4.38 ha

**Table 26: Direct impacts on threatened ecological communities**

PCT ID	BC Act			EPBC Act		
	Listing status	Name	Direct impact (ha)	Listing status	Name	Direct impact (ha)
277	TEC	White Box Yellow Box Blakely's Red Gum Woodland	0.67	CEEC	White Box Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	0.32

**Table 27: Direct impacts on threatened species and threatened species habitat**

Species	Common Name	Direct impact number of individuals / habitat (ha)	NSW listing status	EPBC Listing status
<b>FLORA</b>				
<i>Acacia meiantha</i>		59 individuals / 0.1 ha	Endangered	Not Listed
<i>Pomaderris reperta</i>	Denman Pomaderris	1 individual / 0.01 ha	Critically Endangered	Critically Endangered
<b>FAUNA</b>				
<i>Burhinus grallarius</i>	Bush Stone-curlew	5.05 ha	Endangered	Not Listed
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	4.97 ha	Vulnerable	Not Listed
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	4.97 ha	Vulnerable	Not Listed
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	4.97 ha	Vulnerable	Not Listed
<i>Ninox connivens</i>	Barking Owl	4.97 ha	Vulnerable	Not Listed
<i>Ninox strenua</i>	Powerful Owl	4.97 ha	Vulnerable	Not Listed
<i>Petaurus norfolcensis</i>	Squirrel Glider	5.05 ha	Vulnerable	Not Listed
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	4.97 ha	Vulnerable	Not Listed
<i>Phascolarctos cinereus</i>	Koala	5.05 ha	Vulnerable	Vulnerable
<i>Tyto novaehollandiae</i>	Masked Owl	4.97 ha	Vulnerable	Not Listed

### 2.2.2 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in Table 28.

**Table 28: Change in vegetation integrity**

Veg Zone	PCT ID	Condition	Area (ha)	Current vegetation integrity score	Future vegetation integrity score	Change in vegetation integrity
1	277	Intact	0.32	56.5	0	-56.5
2	277	Degraded	0.35	40.4	0	-40.4
3	290	Intact	1.55	69.3	0	-69.3
4	290	Degraded	2.83	61	0	-61

### 2.2.3 Indirect impacts

The indirect impacts of the development are outlined in Table 29. Indirect impact zones are assumed to be within 10 m of the impact footprint.

Table 29: Indirect impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
<b>sedimentation and contaminated and/or nutrient rich run-off</b>	Construction	Runoff during construction works	Sedimentation and runoff into nearby dams, creeks	During heavy rainfall or storm events	During rain events	Short-term impacts
<b>noise, dust or light spill</b>	Construction	Noise and dust created from machinery	Adjacent vegetation	Daily, during construction	Sporadic throughout construction and throughout operation period	Short-term impacts
<b>inadvertent impacts on adjacent habitat or vegetation</b>	Construction	Damage to adjacent habitat or vegetation	Adjacent vegetation	Daily, during construction and operational phases	Throughout project period	Potentially long-term impacts
<b>transport of weeds and pathogens from the site to adjacent vegetation</b>	Construction	Spread of weed seed and pathogens from incoming machinery and equipment	Potential for spread into nearby habitat	Daily, during construction and operational phases	Throughout project period	Potentially long-term impacts
<b>vehicle strike</b>	Construction / operation	Potential for native fauna to be struck by working machinery and moving vehicles	Within access roads and within Development Site	Daily, during construction and operational phases	Throughout project period	Potentially long-term impacts
<b>trampling of threatened species</b>	Construction / operation	Potential for <i>Pomaderris reperta</i> and <i>Acacia meiantha</i> to be trampled by machinery	Within access roads and within Development Site	Daily, during construction and operational phases	Throughout project period	Potentially long-term impacts
<b>rubbish dumping</b>	Construction / operation	Illegal dumping by workers	Potential for rubbish to spread into areas outside Development Site	Any time	Throughout life of project	Potentially long-term impacts
<b>wood collection</b>	Construction / operation	Removal of wood in vegetation adjacent to Development Site	Throughout adjacent vegetation	Potential to occur at any time during construction or operational phases	Throughout life of project	Short-term impacts

Indirect impact	Project phase	Nature	Extent	Frequency	Duration	Timing
<b>bush rock removal and disturbance</b>	Construction / operation	Removal of rocks in vegetation adjacent to Development Site	Potential for disturbance in adjacent vegetation and area	Potential to occur at any time during construction or operational phases	Throughout life of project	Short-term impacts
<b>increase in predatory species populations</b>	Construction / operation	Potential for an increase in predatory species in the locality through disturbance to vegetation	Throughout adjacent vegetation	Likely to occur gradually after disturbance to habitat and vegetation takes place.	During construction phase of project	Short-term impacts
<b>increase in pest animal populations</b>	Construction / operation	Potential to increase if food scraps/rubbish is left on site. Potential to increase +/- decrease due to disturbance to existing vegetation.	Throughout adjacent vegetation	Likely to occur gradually after disturbance to habitat and vegetation takes place	During construction phase of project	Short-term impacts
<b>increased risk of fire</b>	Construction / operation	Potential for fire to spark during construction and operation from any machinery or electrical works	Throughout adjacent vegetation	Potential to occur at any time throughout the operational or construction phases	During operating/ construction hours	During operational /construction hours
<b>disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.</b>	Construction / operation	No specialist breeding or foraging habitat identified	N/A	N/A	N/A	N/A

#### 2.2.4 Prescribed biodiversity impacts

The development site has the prescribed biodiversity impacts as outlined in Table 30.

**Table 30: Direct impacts on prescribed biodiversity impacts**

Prescribed impact	biodiversity	Nature	Extent	Frequency	Duration	Timing
<b>impacts of development on movement of threatened species that maintains their lifecycle</b>		Reduction in habitat for the Brush-tailed Phascogale,	Decline in population	Daily, during construction works	Throughout project period	Potentially long-term impacts



Prescribed impact	biodiversity	Nature	Extent	Frequency	Duration	Timing
		Squirrel Glider, Eastern Pygmy-possum and Bush Stone-curlew and Koala				
impacts of vehicle strikes on threatened species or on animals that are part of a TEC.		Potential for native fauna to be struck by working machinery and moving vehicles	Within access roads and within Development Site	Daily, during construction and operational phases	Throughout project period	Potentially long-term impacts

### 2.2.5 Mitigating and managing impacts

Measures proposed to mitigate and manage impacts at the development site before, during and after construction are outlined in Table 31.

**Table 31: Measures proposed to mitigate and manage impacts**

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Displacement of resident fauna	Minor	Negligible	Supervision by a qualified ecologist/licensed wildlife handler during disturbance and removal of stags in accordance with best practice methods	Relocation of fauna in a sensitive manner	Prior to and during removal of HBT	Project Manager / Ecologist
timing works to avoid critical life cycle events such as breeding or nursing	Minor	Negligible	Avoid clearing works during breeding/nesting period	Impacts to fauna during breeding/nesting avoided	During clearing works	Project Manager
instigating clearing protocols including pre-clearing surveys, daily surveys and staged	Minor	Negligible	Supervision by a qualified ecologist/licensed wildlife handler during vegetation disturbance and removal	Any fauna utilising habitat within the development site area will be identified and managed to ensure clearing works minimise the	During clearing works	Project Manager/ Ecologist

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
clearing, the presence of a trained ecological or licensed wildlife handler during clearing events				likelihood of injuring resident fauna		
clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance; for example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	Minor	Negligible	Supervision by a qualified ecologist during vegetation disturbance and removal	Any areas within the development site area that will be trimmed to partially cleared will be identified and managed to ensure clearing works minimise the likelihood of causing inadvertent damage	During clearing works	Project Manager/ Ecologist
sediment barriers or sedimentation ponds to control the quality of water released from the site into the receiving environment	Moderate	Minor	Manage exposed soil surfaces Sediment and erosion control on works- silt nets downslope from workings	Control of erosion and sedimentation	Duration of the project	Project Manager
noise barriers or daily/season	Minor	Negligible	Daily timing of construction activities	Noise impacts associated with the development will be	For the duration of	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
al timing of construction and operational activities to reduce impacts of noise			recommended in accordance with Table 1 of Interim Noise Guidelines (2009) Monday to Friday 7.00am to 6.00pm Saturday 8.00am to 1.00pm No work on Sunday or public holidays	managed in accordance with guidelines.	in construction works	
light shields or daily/seasonal timing of construction and operational activities to reduce impacts of light spill	Minor	Negligible	Operating times will only occur during daylight hours, and night lights will not be used	Light impacts associated with construction and operation will be avoided as works will occur during daylight hours	For the duration of the project	Project Manager
adaptive dust monitoring programs to control air quality	Moderate	Minor	Dust suppression measures	Mitigate dust created during construction/operation	For the duration of the project	Project Manager
programming construction activities to avoid impacts; for example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat	Minor	Negligible	Timing of construction works should be planned to occur outside of the summer/autumn breeding/nesting season, where possible.	impacts to fauna during breeding/nesting avoided	During clearing works	Project Manager

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
on the site are not breeding or nesting						
hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	Moderate	Minor	All machinery/equipment cleaned prior to entering/exiting the Development Site  There are currently no weeds on the Development Site listed under the NSW Biosecurity Act 2015. Future weed infestations should be managed/removed by a qualified Bush Regenerator	Prevent the spread of weeds or pathogens	Duration of project	Project manager
staff training and site briefing to communicate environmental features to be protected and measures to be implemented	Minor	Negligible	All staff working on the development will undertake an environmental induction as part of their site familiarisation. Site briefings should be updated based on phase of the work. This induction will include items such as: 1. Site environmental procedures (vegetation management, sediment and erosion control, exclusion fencing and noxious weeds) 2. What to do in case of environmental emergency (chemical spills, fire, injured fauna) 3. Key contacts in case of	All staff entering the Development Site are fully aware of all environmental aspects relating to the development and know what to do in case of any environmental emergencies	To occur for all staff entering / working at the Development Site and when environmental issues become apparent	Project Manager, all staff



Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
			environmental emergency			
development control measures to regulate activity in vegetation and habitat adjacent to residential development including controls on pet ownership, rubbish disposal, wood collection, fire management and disturbance to nests and other niche habitats	Moderate	Minor	Installation of signage to indicate No Go zones, rubbish disposal guidance, prohibition of wood collection, prohibition from lighting fires, prohibition of disturbance to vegetation outside of the Development Site, and pest & disease management	Protection of flora and fauna surrounding the Development Site	Prior to the commencement of construction	Client

### 2.2.6 Serious and Irreversible Impacts (SAII)

The development site contains three Serious and Irreversible Impacts (SAII) candidate entity identified in Table 32. Detailed consideration of whether impacts on candidate species are serious and irreversible is included in Table 33, Table 34 and on TECs is included in Table 35.

**Table 32: Candidate Serious and Irreversible Impacts**

Species / Community	Common Name	Principle	Direct impact individuals / area (ha)	Threshold
<b>White Box Yellow Box Blakely's Red Gum Woodland</b>	Box Gum Woodland	Principle 1 and Principle 2	Removal of 0.67 ha	Not yet published
<b><i>Acacia meiantha</i></b>		Principle 3	Removal of 59 individuals from a known population of 750-1000	Not yet published
<b><i>Pomaderris reperta</i></b>	Denman Pomaderris	Principle 3	Disturbance to 1 individual from a	Not yet published

Species / Community	Common Name	Principle	Direct impact individuals / area (ha)	Threshold
			known population of 52	

Table 33: Determining whether impacts are serious and irreversible

Determining whether impacts are serious and irreversible	Assessment
<b>Principle 1</b>	
<b>Does the proposal impact on a species, population or ecological community that is a candidate entity because it is in a rapid rate of decline?</b>	Yes. The development site will result in a loss of 0.67 ha of White Box Yellow Box Blakely's Red Gum Woodland
<b>If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible</b>	The proposed development will remove 0.67 ha of EEC. Within 1000 ha of the development site, White Box Yellow Box Blakely's Red Gum Woodlands cover approximately 45% of the area. The removal of 0.67 ha represents less than 0.21% of these lands. Within 10,000 ha of the development site, the White Box Yellow Box Blakely's Red Gum Woodlands cover approximately 48% of the area. The removal of 0.67 ha represents just 0.02% ha of these lands within 10,000 ha (OEH 2017). Within the IBRA subregion the area remaining after impact will be 99.99% (OEH 2015). The area reserved within the IBRA region is 7,672 ha and 360 ha within the IBRA subregion. Considering the characteristics of the surrounding lands are very similar to that of the Development Site, there is the potential that the occurrence of this EEC could be extensive in its derived form.
<b>Principle 2</b>	
<b>Does the proposal impact on a species that is a candidate entity because it has been identified as having a very small population size?</b>	No
<b>If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible</b>	
<b>Principle 3</b>	
<b>Does the proposal impact on the habitat of a species or an area of an ecological community that is a candidate entity because it has a very limited geographic distribution?</b>	Yes. Both <i>Acacia meiantha</i> and <i>Pomaderris reperta</i> have limited geographic distributions.
<b>If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.</b>	Given that no published thresholds are available any impact is considered likely to be a SAIL.  <i>A. meiantha</i> is known from three disjunct populations within the Central Tablelands within 100 km from each other. The population along Aarons Pass Road is primarily confined to approximately 1.5 km of road easement. The population of <i>Acacia meiantha</i> along Aarons Pass Road is estimated to be between 750 and 1000 individuals (Eldridge 2015). Removing or pruning 59 individuals (0.1 ha) from the

Determining whether impacts are serious and irreversible	Assessment
	<p>population may result in a loss of 8% of the population which may lead to a long-term decrease in the size of the population. <i>Pomaderris reperta</i> is known from two ridgelines in the Denman area in the upper Hunter Valley within a total extent of occurrence of less than 12 km. The population of <i>Pomaderris reperta</i> was recently identified along Aarons Pass Road and has been estimated at 52 individuals. Three individuals are within the blade swept path but are below 2 m in height so only minor pruning may be required. One individual is located within the impact zone and this individual cannot be avoided through detailed design. It will be translocated to a safe area in accordance with the measures to be adopted and agreed to within the BMP. Caution will need to be undertaken when felling trees nearby. If these precautions are followed it is unlikely that an SAI will occur.</p>

#### Principle 4

Does the proposal impact on a species, a component of species habitat or an ecological community that is a candidate entity because it is irreplaceable?

NA

b. If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.

**Table 34: Evaluation of an impact on a candidate species**

Impact Assessment Provision	Assessment
The actions and measures taken to avoid direct and indirect impacts on the entities.	<p>All individual <i>A. meiantha</i> and <i>P. reperta</i> have been tagged and GPS located to ensure individuals are not inadvertently impacted during the development. Additionally, the development site footprint has been altered to reduce the impact on individuals and where possible individuals will be trimmed rather than removed. Any individuals that are required to be removed will be translocated using measures to be developed in the BMP to the satisfaction of DPE. The BMP requires that site staff are inducted to be aware of environmental values and the plan will be updated to include a requirement for staff to be familiarised with the threatened species management protocols. It has been recommended that an ecologist be on site to assist with the familiarisation of these species with construction staff.</p>
the size of the local population directly and indirectly impacted by the development.	<p>The proposed development will remove a small area of occupancy of <i>Acacia meiantha</i>, and <i>Pomaderris reperta</i> however a larger area of occupancy will remain undisturbed and will be managed to support continuation of the remaining population. It is estimated that 59 individual <i>A. meiantha</i> and 1 individual <i>P. reperta</i> will be impacted. Removing these individuals may impact on the local</p>

Impact Assessment Provision	Assessment
	population. However, these individuals will be translocated or pruned if required in accordance with measures to be adopted in the BMP to the satisfaction of DPE.
<b>the extent to which the impacts exceeds any thresholds</b>	No published thresholds exist for the TEC or the two threatened plant species. Therefore, a threshold of 0 has been assumed and any loss of individuals is likely to have an impact. Therefore the Proponent has committed to avoiding impacts where possible, pruning individuals within the blade swept path or translocating individuals to a safe area.
<b>An estimation of change in habitat available to the local population as a result of the proposed development</b>	<i>A. meiantha</i> occurs along a 1.5 km linear strip of roadside vegetation. Not all the vegetation will be removed and 59 individual <i>A. meiantha</i> will be directly impacted either by pruning or translocating to another area. There is available habitat along Aarons Pass Road for the population to expand. This is also the case for <i>P. reperta</i> .
<b>the likely impact that the development will have on the habitat of the local population including the proposed loss, modification, destruction or isolation of the available habitat used by the local population</b>	The existing road currently intersects the known populations of <i>A. meiantha</i> and <i>P. reperta</i> with individuals identified on either side of the road. The proposed road widening will remove a small area of occupancy of available habitat although there are areas of undisturbed habitat for these species which remain outside the proposed development footprint. The proposed road widening is not expected to increase fragmentation of the existing population.
<b>modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development</b>	The removal of individuals can disrupt breeding and pollination required to maintain genetic diversity. Given the already small population occurring on the development site the loss of the small number of individuals that are to be impacted it is possible that genetic diversity and long-term evolutionary development will be impeded. The Proponent will incorporate management strategies for the removal and /or pruning of individuals which may include but is not limited to translocation and /or propagation from cuttings collected from site. This will enable the genetic diversity and long-term evolutionary development to be retained.
<b>2. the likely impact on the ecology of the local population.</b>	
<b>for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:</b>	Due to the small scale of the proposed development site and the small number of individuals that will be affected, the ecology and biology of the residual population is unlikely to be impacted. The removal or pruning of 59 <i>A. meiantha</i> and 1 <i>P. reperta</i> is unlikely to affect the remaining population post development. Translocating and or propagating individuals will maintain genetic diversity and long-term evolutionary development of the species.
<b>3. a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development</b>	The existing road currently intersects the known populations of <i>A. meiantha</i> and <i>P. reperta</i> with individuals identified on either side of the road. The proposed widening development site will not increase fragmentation of the existing populations.



Impact Assessment Provision	Assessment
<b>4. the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range</b>	<i>A. meiantha</i> is known from three disjunct populations within the Central Tablelands within 100 km from each other. There is no genetic exchange between the extant populations. <i>Pomaderris reperta</i> is known from two ridgelines in the Denman area in the upper Hunter Valley within a total extent of occurrence of less than 12 km and was only recently identified along Aarons Pass Road. There is no likely genetic exchange with other populations. Given the small number of individuals that will be impacted it is unlikely that viability and diversity will be impacted.
<b>5. the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population</b>	The development site will be managed in accordance with the CRWF BMP to ensure that the spread of weeds and soil and plant diseases are controlled. Weeds will be managed in accordance with the BMP to identify the mitigation measures and monitoring requirements to ensure the spread of weeds and pathogens are prevented and incursions are adequately managed.
<b>6. the measure/s proposed to contribute to the recovery of the species in the Interim Biogeographic Regionalisation for Australia (IBRA) subregion.</b>	The development site will protect against the spread of weeds and the movement of pathogens into adjoining similar vegetation and will not directly, or otherwise indirectly impact areas outside of the development site area footprint.

Table 35: Evaluation of an impact on a TEC

Impact Assessment Provisions	Assessment
<b>Actions and measures taken to avoid the direct and indirect impacts on the TEC</b>	The development site footprint and access route has been modified numerous times to avoid EEC and CEEC. Additionally, not all areas will be totally cleared, individual trees will be removed, and vegetation trimmed to facilitate access. A total of 0.67 ha of TEC will be impacted.
<b>1. the area and condition of the TEC to be impacted directly and indirectly by the proposed development</b>	The development site will remove 0.32 ha of derived Box Gum Woodland in a good condition, with integrity scores of 56.5 in the BAMC. The development site will also remove 0.35 ha of derived Box Gum Woodland in low condition with an integrity score of 40.4 in the BAMC.
<b>the extent to which the impact exceeds the thresholds for the TEC</b>	No published threshold for this TEC is available so the threshold is considered to be 0. The removal of 0.67 ha has exceeded the threshold. However, given the small areas to be impacted a SAIL is unlikely.
<b>2. the extent and overall condition of the TEC within an area of 1000 ha, and then 10000 ha, surrounding the proposed development footprint. In the case of strategic biodiversity certification projects, the extent and overall condition of the TEC may be assessed across the IBRA sub region</b>	Detailed mapping of the local occurrence of the EEC is not available. Much of the landscape consists of lands similar to that of the Work Site. These areas have been highly disturbed/grazed and have not been mapped by any vegetation mapping programs as a native vegetation community. Within 1000 ha of the development site, these White Box Yellow Box Blakely's Red Gum Woodlands cover approximately 45% of the area. The removal of 0.67 ha

Impact Assessment Provisions	Assessment
	<p>represents less than 0.21% of these lands. Within 10,000 ha of the development site, the White Box Yellow Box Blakely's Red Gum Woodlands cover approximately 48% of the area. The removal of 0.67 ha represents just 0.02% ha of these lands within 10,000 ha (OEH 2017). Within the IBRA subregion the area remaining after impact will be 99.99% (OEH 2015). The area reserved within the IBRA region is 7,672 ha and 360 ha within the IBRA subregion. Considering the characteristics of the surrounding lands are very similar to that of the Development Site, there is the potential that the occurrence of this EEC could be extensive in its derived form.</p> <p>Within the IBRA region 7,672 ha of this EEC is within reserve system and 360 ha reserved within the subregion.</p>
<b>3. an estimate of the extant area and overall condition of the TEC remaining before and after the impact of the proposed development has been taken into consideration</b>	<p>The proposal will reduce the extant area of the EEC by 0.67 ha. Considering the very small area and reduced quality of the vegetation to be removed, it is considered that the development will have a negligible impact on the extant area and overall condition of the EEC on a broad scale. The area remaining within the IBRA subregion before (149,531 ha) and after development (149,530 ha) is 99.99%.</p>
<b>4. the development proposal's impact on:</b>	
<b>a. abiotic factors critical to the long-term survival of the TEC; for example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns; will it alter natural disturbance regimes that the TEC depends upon, e.g. fire, flooding etc.?</b>	<p>The development will not impact abiotic factors critical to the long-term survival of the EEC.</p>
<b>b. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of under-storey species or harvesting of plants</b>	<p>The development will not impact characteristic and functionally important species outside of the proposed impact area.</p>
<b>c. the quality and integrity of an occurrence of the TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the TEC</b>	<p>The development is unlikely to result in the spread of invasive weed species into vegetation adjacent to the development site. However, this potential impact will be controlled during pre-construction works, throughout construction. The development will not have additional impacts to the quality and integrity of the occurrence of Box Gum Woodland outside of the proposed impact area.</p>
<b>5. direct or indirect fragmentation and isolation of an area of the TEC</b>	<p>The development will not cause direct or indirect fragmentation or isolation of any area of Box Gum Woodland. The development site does not provide a sole link between habitat or areas of vegetation.</p>
<b>6. the measures proposed to contribute to the recovery of the TEC in the IBRA subregion.</b>	<p>The development site will protect against the spread of weeds into adjoining similar vegetation and will not directly, or otherwise indirectly impact areas outside of the Development footprint.</p>

## 2.3 Risk assessment

A risk assessment has been undertaken for any residual impacts likely to remain after the mitigation measures (Section 2.2) have been applied. Likelihood criteria, consequence criteria and the risk matrix are provided in Table 36, Table 37 and Table 38 respectively.

**Table 36: Likelihood criteria**

Likelihood criteria	Description
<b>Almost certain</b> (Common)	Will occur, or is of a continuous nature, or the likelihood is unknown. There is likely to be an event at least once a year or greater (up to ten times per year). It often occurs in similar environments. The event is expected to occur in most circumstances.
<b>Likely</b> (Has occurred in recent history)	There is likely to be an event on average every one to five years. Likely to have been a similar incident occurring in similar environments. The event will probably occur in most circumstances.
<b>Possible</b> (Could happen, has occurred in the past, but not common)	The event could occur. There is likely to be an event on average every five to twenty years.
<b>Unlikely</b> (Not likely or uncommon)	The event could occur but is not expected. A rare occurrence (once per one hundred years).
<b>Remote</b> (Rare or practically impossible)	The event may occur only in exceptional circumstances. Very rare occurrence (once per one thousand years). Unlikely that it has occurred elsewhere; and, if it has occurred, it is regarded as unique.

**Table 37: Consequence criteria**

Consequence category	Description
<b>Critical</b> (Severe, widespread long-term effect)	Destruction of sensitive environmental features. Severe impact on ecosystem. Impacts are irreversible and/or widespread. Regulatory and high-level government intervention/action. Community outrage expected. Prosecution likely.
<b>Major</b> (Wider spread, moderate to long term effect)	Long-term impact of regional significance on sensitive environmental features (e.g. wetlands). Likely to result in regulatory intervention/action. Environmental harm either temporary or permanent, requiring immediate attention. Community outrage possible. Prosecution possible.
<b>Moderate</b> (Localised, short-term to moderate effect)	Short term impact on sensitive environmental features. Triggers regulatory investigation. Significant changes that may be rehabilitated with difficulty. Repeated public concern.
<b>Minor</b> (Localised short-term effect)	Impact on fauna, flora and/or habitat but no negative effects on ecosystem. Easily rehabilitated. Requires immediate regulator notification.
<b>Negligible</b> (Minimal impact or no lasting effect)	Negligible impact on fauna/flora, habitat, aquatic ecosystem or water resources. Impacts are local, temporary and reversible. Incident reporting according to routine protocols.

Table 38: Risk matrix

Consequence	Likelihood				
	Almost certain	Likely	Possible	Unlikely	Remote
<b>Critical</b>	Very High	Very High	High	High	Medium
<b>Major</b>	Very High	High	High	Medium	Medium
<b>Moderate</b>	High	Medium	Medium	Medium	Low
<b>Minor</b>	Medium	Medium	Low	Low	Very Low
<b>Negligible</b>	Medium	Low	Low	Very Low	Very Low

Table 39: Risk assessment

Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
<b>Vegetation clearing</b>	Construction / operation	Low	Very Low
<b>sedimentation and contaminated and/or nutrient rich run-off</b>	Construction	Medium	Low
<b>noise, dust or light spill</b>	Construction	Low	Very Low
<b>inadvertent impacts on adjacent habitat or vegetation</b>	Construction	Low	Very Low
<b>transport of weeds and pathogens from the site to adjacent vegetation</b>	Construction	Medium	Very Low
<b>vehicle strike</b>	Construction / operation	Low	Very Low
<b>trampling of threatened flora species</b>	Construction / operation	Low	Very Low
<b>rubbish dumping</b>	Construction / operation	Very Low	Very Low
<b>wood collection</b>	Construction / operation	Low	Very Low
<b>bush rock removal and disturbance</b>	Construction / operation	Medium	Low
<b>increase in predatory species populations</b>	Construction / operation	Low	Very Low
<b>increase in pest animal populations</b>	Construction / operation	Low	Very Low
<b>increased risk of fire</b>	Construction / operation	Low	Very Low



Potential impact	Project phase	Risk (pre-mitigation)	Risk (post mitigation)
disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.	Construction / operation	Low	Very Low
sedimentation and contaminated and/or nutrient rich run-off	Construction	Medium	Low



Figure 18: Final project footprint including construction and operation

## 2.4 Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

### 2.4.1 Serious and Irreversible Impacts (SAIL)

As discussed in Section 2.2.6, as the thresholds for a SAIL on Box Gum Woodland, *A. meiantha* and *P. reperta* have not yet been published by the OEH, all impacts are potentially SAIL. Considering the degraded nature of Box Gum Woodland in the development site and small area to be removed (0.32 ha with vegetation integrity score of 56.5 and 0.35 ha with vegetation integrity score of 40.4), it is unlikely that the development would have a SAIL.

The removal or pruning of 59 individuals of *A. meiantha* (8%) and the translocation of one individual *P. reperta* (2%) may have an impact on the population. However, the Proponent has committed to avoiding individuals within the impact zone where possible through a detailed design process in accordance with the BMP. Where the impacts cannot be avoided, pruning individuals within the blade swept path will be undertaken with propagation to be undertaken to mitigate the potential for impacts to the population. Where removal of plants is required, they will be translocated within the development area or to a nearby conservation area to be determined by a qualified botanist. Pruning, propagation and translocation measures will be defined and adopted within the BMP, to be updated to the satisfaction of the Secretary of DPE, following approval of the Modification. Given these measures it is unlikely that a SAIL will occur.

### 2.4.2 Impacts requiring offsets

The impacts of the development requiring offset for native vegetation are outlined in Table 40 and shown on Figure 20. The impacts of the development requiring offset for threatened species and threatened species habitat are outlined in Table 41 and Figure 20.

**Table 40: Impacts to native vegetation that require offsets**

PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (0.94 ha).	Western Slopes Grassy Woodlands	Grassy Woodlands	0.67 ha
290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion (5.51 ha).	Upper Riverina Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrub/grass sub formation)	4.38 ha

**Table 41: Impacts on threatened species and threatened species habitat that require offsets**

Species	Common Name	Direct impact number of individuals / habitat (ha)	NSW listing status	EPBC Listing status
<i>Acacia meiantha</i>		59 individuals / 0.1 ha	Endangered	Not Listed
<i>Pomaderris reperta</i>	Denman Pomaderris	1 individuals / 0.01 ha	Critically Endangered	Critically Endangered

Species	Common Name		Direct impact number of individuals / habitat (ha)	NSW listing status	EPBC Listing status
<i>Burhinus grallarius</i>	Bush Stone-curlew		5.05 ha	Endangered	Not Listed
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		4.97 ha	Vulnerable	Not Listed
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo		4.97 ha	Vulnerable	Not Listed
<i>Cercartetus nanus</i>	Eastern Pygmy-possum		4.97 ha	Vulnerable	Not Listed
<i>Ninox connivens</i>	Barking Owl		4.97 ha	Vulnerable	Not Listed
<i>Ninox strenua</i>	Powerful Owl		4.97 ha	Vulnerable	Not Listed
<i>Petaurus norfolcensis</i>	Squirrel Glider		5.05 ha	Vulnerable	Not Listed
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale		4.97 ha	Vulnerable	Not Listed
<i>Phascolarctos cinereus</i>	Koala		5.05 ha	Vulnerable	Vulnerable
<i>Tyto novaehollandiae</i>	Masked Owl		4.97 ha	Vulnerable	Not Listed

#### 2.4.3 Impacts not requiring offsets

The impacts of the development not requiring offset are those areas of cleared land dominated by exotic species which do not provide habitat for threatened species. Species that are not threatened or form part of an EEC were not assessed. These areas were identified in Figure 3.

#### 2.4.4 Areas not requiring assessment

Areas consisting of exotic vegetation were not assessed (Figure 3 and Figure 21).

#### 2.4.5 Credit summary

The number of ecosystem credits required for the development are outlined in Table 42. The number of species credits required for the development are outlined in Table 43. A biodiversity credit report is included in Appendix C.

**Table 42: Ecosystem credits required**

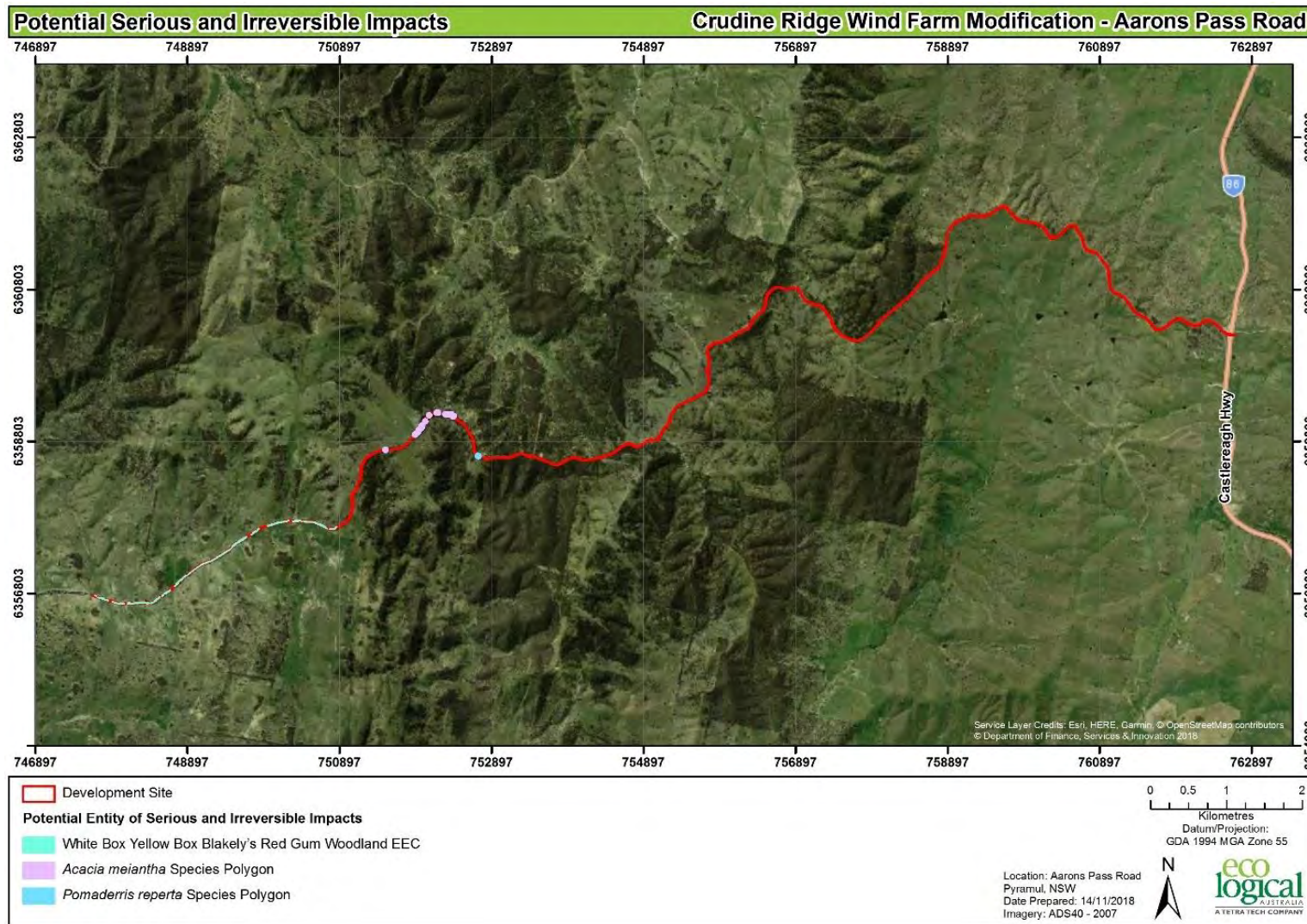
PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
277	Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Grassy Woodlands	0.67 ha	16
290	Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on	Dry Sclerophyll Forests (Shrub/grass sub formation)	4.38 ha	123



PCT ID	PCT Name	Vegetation Formation	Direct impact (ha)	Credits required
	hills in the southern part of the NSW South Western Slopes Bioregion.			

**Table 43: Species credit summary**

Species	Common Name	Direct impact number of individuals / habitat (ha)	Credits required
<i>Acacia meiantha</i>		59 individuals / 0.1 ha	5
<i>Pomaderris reperta</i>	Denman Pomaderris	1 individual / 0.01 ha	1
<i>Burhinus grallarius</i>	Bush Stone-curlew	5.05 ha	156
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	4.97 ha	154
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	4.97ha	154
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	4.97ha	154
<i>Ninox connivens</i>	Barking Owl	4.97 ha	154
<i>Ninox strenua</i>	Powerful Owl	4.97 ha	154
<i>Petaurus norfolcensis</i>	Squirrel Glider	5.05 ha	156
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	4.97 ha	154
<i>Phascolarctos cinereus</i>	Koala	5.05 ha	156
<i>Tyto novaehollandiae</i>	Masked Owl	4.97 ha	154



**Figure 19: Serious and Irreversible Impacts**



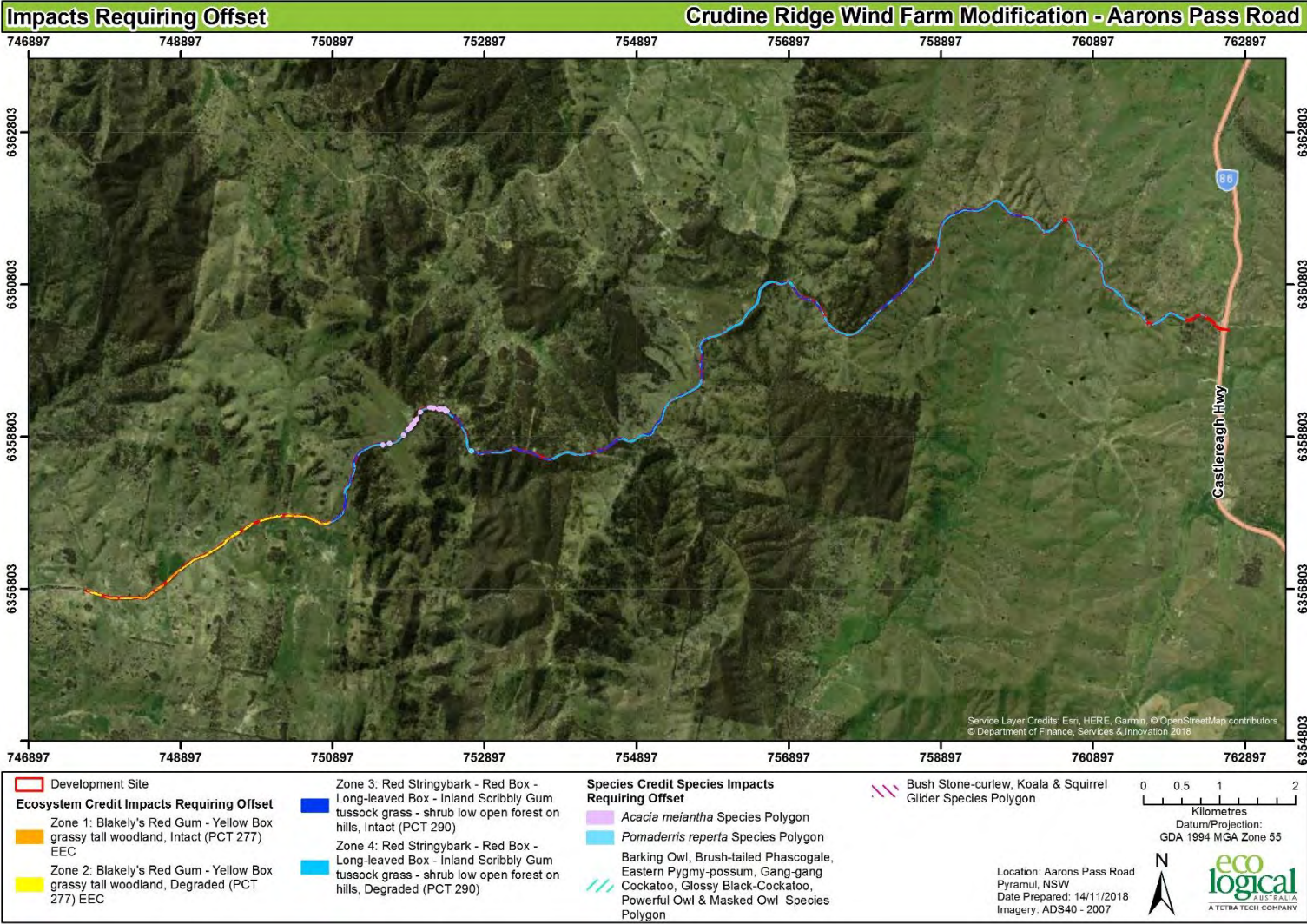
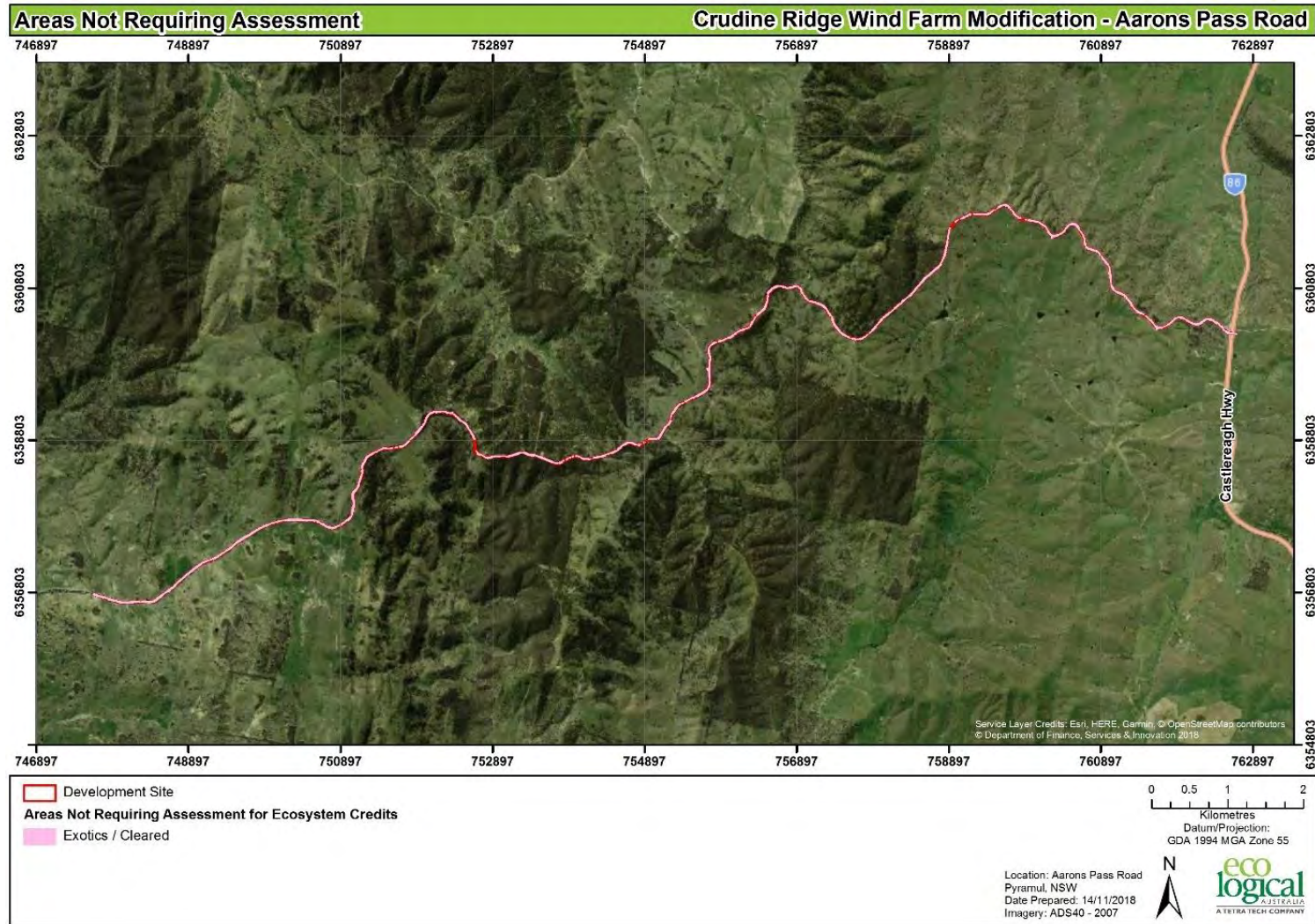


Figure 20: Impacts requiring offset





**Figure 21: Areas not requiring assessment**



## 2.5 Consistency with legislation and policy

Additional matters relating to impacts on flora and fauna which are not covered by the BC Act must also be addressed for the proposed development. Potential impacts on MNES in accordance with the EPBC Act and SEPP 44 Koala Habitat have been addressed below.

### 2.5.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where MNES may be affected. Under the Act, any action which 'has, will have, or is likely to have a significant impact on a matter of MNES' is defined as a 'controlled action', and requires approval from the Commonwealth Department of the Environment (DotE), which is responsible for administering the EPBC Act (DotE 2013).

The process includes conducting an Assessment of Impact for listed threatened species and ecological communities that represent a MNES that will be impacted as a result of the proposed action. Significant impact guidelines (DotE 2013) that outline a number of criteria have been developed by the Commonwealth, to provide assistance in conducting the Assessment of Significance and help decide whether or not a referral to the Commonwealth is required.

Seven MNES were assessed under the EPBC Act:

1. White Box Yellow Box Blakely's Red Gum Grassy Woodland DNG – listed as critically endangered under the EPBC Act
2. *Acacia meiantha* - listed as endangered under the EPBC Act
3. *Denman Pomaderris* - listed as critically endangered under the EPBC Act
4. Regent Honeyeater - listed as critically endangered under the EPBC Act
5. Painted Honeyeater - listed as Vulnerably under the EPBC Act
6. Swift Parrot - listed as critically endangered under the EPBC Act
7. Koala - listed as vulnerable under the EPBC Act

#### 2.5.1.1 *White Box Yellow Box Blakely's Red Gum Grassy Woodland (WBYBBRG)*

An action is likely to have a significant impact on a critically endangered ecological community if there is a real chance of possibility that it will:

- **reduce the extent of an ecological community**

The proposal involves the removal of 0.32 ha of WBYBBRG along a 20 km stretch of Aaron's Pass Road. The extent of the CEEC will be reduced but this reduction is not considered significant given the extent of the community within the locality. The proposed disturbance of 0.32 ha by the development is able to be undertaken in compliance with the EPBC Approval (2011-6206) approval limit for TEC disturbance (3.28 ha) and is not considered to be in addition to that already approved.

- **fragment or increase fragmentation of an ecological community**

The proposed works will remove a maximum of 0.32 ha of vegetation which meets the listing criteria for this community. The disturbance area only forms a small part of a larger patch of the community and as such, the proposed development site will not permanently fragment the ecological community.

- **adversely affect habitat critical to the survival of an ecological community**

The small scale of temporary disturbance will not adversely affect habitat critical to the survival of this CEEC.

- **modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

Mitigation measures provided for the proposed road widening have specified construction of appropriate sediment controls. No groundwater or surface water is proposed to be extracted through implementation of the proposed road widening. As such, the proposed development site will not modify or destroy abiotic factors necessary for the survival of the CEEC.

- **cause a substantial change in the species composition of an occurrence of an ecological community; including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

The proposed development site will not cause substantial change to species composition of the CEEC due to the small scale of the proposed disturbance.

- **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
  - **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
  - **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or**

Weed control mitigation and management measures have been included within the approved BMP for the Crudine Ridge Wind Farm. Weeds and exotic species will be management within the development site to avoid the spread of existing weeds and to management any incursions that may arise. Regular inspections form part of the management activities proposed for control of invasive species. These management measures will ensure that invasive species, should they occur, are adequately controlled.

There will be no materials or compounds used during the clearing of vegetation that will inhibit the ecological community. As such, the proposed development site will not cause a reduction in the quality or integrity of CEEC.

- **interfere with the recovery of an ecological community**

Due to the small scale of the disturbance, the proposed development site will not interfere with the recovery of the CEEC. In addition to this, the proposed disturbance of 0.32 ha of disturbance proposed by the development is able to be undertaken in compliance with the EPBC Approval (2011-6206) approval limit for TEC disturbance. Therefore, given the small area proposed to be disturbed and the ability to undertake the disturbance in compliance with current EPBC approvals for the Crudine Ridge Wind Farm, referral is not recommended.

### 2.5.1.2 *Acacia meiantha*

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The disturbance to approximately 59 *Acacia meiantha* individuals from the known population of 750-1,000 is not likely to lead to a long-term decrease in the size of the population. Long-term survival of the remaining individuals outside of the study area will continue unimpeded by the development and, over time, would be expected to compensate for the loss of any individuals from within the impact area.

- **reduce the area of occupancy of the species**

The proposed development will remove a small area of occupancy of *Acacia meiantha*, however, a larger area of occupancy will remain undisturbed and will be managed to support continuation of the remaining population. Areas of undisturbed potential habitat for this species will remain outside of the proposed development footprint.

- **fragment an existing population into two or more populations**

The existing road currently intersects the known population of *Acacia meiantha*, with individuals currently fragmented on either side of the road. The proposed road widening works will not further increase the likelihood of fragmentation of the existing population.

- **adversely affect habitat critical to the survival of a species**

*Acacia meiantha* occurs in a range of sclerophyll forest communities (OEH 2018). No critical habitat has been defined for this species (Department of the Environment and Energy [DotEE] 2018).

- **disrupt the breeding cycle of a population**

Removal of individual specimens can disrupt breeding cycles, however, processes critical to the species lifecycle, such as pollination and maintenance of genetic variability, will continue unimpeded in the remaining population given the small number of individuals to be impacted.

- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Removal of potential habitat for this species will occur as a result of the development site. Areas of intact equivalent habitat will remain outside of the study area

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The development will be managed in accordance with the CRWF BMP to ensure that weeds and feral/invasive pest species are controlled. Weed management procedures will be undertaken in accordance with the BMP to identify the mitigation measures and monitoring requirements to ensure the spread of weeds is prevented and that incursions are adequately managed.

- **introduce disease that may cause the species to decline, or**

The development will be managed in accordance with the CRWF BMP to ensure that the spread of both soil and plant diseases are controlled. The remaining population of *Acacia meiantha* will be undisturbed

by the development, further preventing the introduction of disease. Equipment that is brought to site for use in the road construction works will be cleaned prior to site to ensure that spread of disease that may cause the species to decline is minimised.

- **interfere with the recovery of the species.**

Due to the small scale of the disturbance, the proposed development will not interfere with the recovery of *Acacia meiantha*.

#### 2.5.1.3 *Pomaderris reperta* (Denman Pomaderris)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The potential disturbance to one individual Denman Pomaderris from the known population of 52 individuals is not likely to lead to a long-term decrease in the size of the population. Long-term survival of the remaining individuals, will continue unimpeded by the development. Impacts to this individual will be avoided if possible or it will be translocated to a safe area. Three individuals are also within the blade swept path but these are below the 2 m height and therefore will not be removed, and only minimal pruning may be required.

- **reduce the area of occupancy of the species**

The proposed development will remove a small area of occupancy of Denman Pomaderris, however, a larger area of occupancy will remain undisturbed and will be managed to support continuation of the remaining population. Areas of undisturbed potential habitat for this species will remain outside of the proposed development footprint.

- **fragment an existing population into two or more populations**

The existing road currently intersects the known population of Denman Pomaderris, with individuals identified on either side of the road. The proposed road widening works will unlikely to further increase the fragmentation of the existing population.

- **adversely affect habitat critical to the survival of a species**

Denman Pomaderris occurs in a range of sclerophyll forest communities (OEH 2018). No critical habitat has been defined for this species (Department of the Environment and Energy [DotEE] 2018).

- **disrupt the breeding cycle of a population**

Removal of individual specimens can disrupt breeding cycles, however, processes critical to the species lifecycle, such as pollination and maintenance of genetic variability, will continue unimpeded in the remaining population given the one individual to be removed.

- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

Removal of potential habitat for this species will occur as a result of the development site. Areas of intact equivalent habitat will remain, including that associated with all individuals which will remain undisturbed by the development site.



- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The development site will be managed in accordance with the CRWF BMP to ensure that weeds and feral /invasive pest species are controlled. Weed management will be undertaken in accordance with the BMP to identify the mitigation measures and monitoring requirements to ensure the spread of weeds is prevented and that incursions are adequately managed.

- **introduce disease that may cause the species to decline, or**

The development site will be managed in accordance with the CRWF BMP to ensure that the spread of both soil and plant diseases are controlled. The remaining population of Denman Pomaderris will be undisturbed by the development site, further preventing the introduction of disease. Equipment that is brought to site for use in the road construction works will be cleaned prior to site to ensure that spread of disease that may cause the species to decline is minimised.

- **interfere with the recovery of the species.**

Denman Pomaderris has been assigned to the Site-managed species management stream under the OEH *Saving our Species* program.

#### 2.5.1.4 *Anthochaera Phrygia* (Regent Honeyeater)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The proposed road widening will only remove a small area (5.05 ha) of potential habitat comprising woodland. Given this, and the large area of alternate habitat surrounding the study area and the high mobility of the species, the proposed works are unlikely to lead to a long-term decrease in the size of an important population of the species.

- **reduce the area of occupancy of the species**

The proposed works will remove a small area of occupancy of the species and a larger area of potential habitat will remain undisturbed and will be managed to support continuation of potential remaining populations. Areas of undisturbed potential habitat for this species will remain outside of the proposed works footprint.

- **fragment an existing population into two or more populations**

The proposed road widening works will not increase fragmentation of the existing population given that the species is highly mobile.

- **adversely affect habitat critical to the survival of a species**

Review of the Department of the Environment and Energy Species Profile and Threats Database showed that critical habitat registered for this species is any breeding or foraging habitat in areas where the species is likely to occur. Key areas in NSW are Mudgee-Wollar and the Capertee Valley, Bundarra-Barraba, Pilliga Woodlands and the Hunter Valley areas.

- **disrupt the breeding cycle of a population**

Due to the species being highly mobile it is unlikely that disturbance to foraging habitat will disrupt the breeding cycle of an important population.

- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The road widening will impact upon only a small area of potential foraging habitat for this species. Due to the species being highly mobile it is unlikely the clearing will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Areas of intact equivalent habitat will remain outside of the study area, undisturbed by the development site.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The road widening will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

- **introduce disease that may cause the species to decline, or**

The road widening will not introduce disease that may cause the species to decline or interfere substantially with the recovery of the species.

- **interfere with the recovery of the species.**

The long term objectives of the Regent Honeyeater Recovery Plan were to: ensure that the species persists in the wild; to achieve a down-listing from nationally endangered to vulnerable by stabilising the population decline and securing habitat extent and quality in the main areas of occupancy, and, to achieve increasing reporting rates (5% per annum) in areas previously used regularly. As no records of this species have been made within the clearing area, and limited suitable habitat is going to be removed, no impact is expected on any individuals or populations of Regent Honeyeater. It is therefore believed that the action proposed remains consistent with the objectives of the recovery plan for this species.

#### 2.5.1.5 *Lathamus discolor* (Swift Parrot)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The proposed road widening will only remove a small area (5.05 ha) of potential habitat comprising woodland. Given this, and the large area of alternate habitat surrounding the study area and the high mobility of the species, the proposed works are unlikely to lead to a long-term decrease in the size of an important population of the species.

- **reduce the area of occupancy of the species**

The proposed works will remove a small area of occupancy of the species and a larger area of occupancy will remain undisturbed and will be managed to support continuation of the remaining population. Areas of undisturbed potential habitat for this species will remain outside of the proposed works footprint.

- **fragment an existing population into two or more populations**

The proposed road widening works will not increase fragmentation of the existing population given that the species is highly mobile.

- **adversely affect habitat critical to the survival of a species**

No critical habitat has been defined for this species.

- **disrupt the breeding cycle of a population**

Due to the species being highly mobile it is unlikely that disturbance to foraging habitat will disrupt the breeding cycle of an important population. In addition, this species breeds in Tasmania therefore the proposed development will not impact upon the breeding cycle for this species.

- **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The road widening will impact upon only a small area of potential foraging habitat for this species. Due to the species being highly mobile it is unlikely the clearing will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Areas of intact equivalent habitat will remain outside of the study area, undisturbed by the development site.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The road widening will not result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat.

- **introduce disease that may cause the species to decline, or**

The road widening will not introduce disease that may cause the species to decline or interfere substantially with the recovery of the species.

- **interfere with the recovery of the species.**

The overall objectives of the Swift Parrot Recovery Plan were to: prevent further decline of the Swift Parrot population; and achieve a demonstrable sustained improvement in the quality and quantity of Swift Parrot habitat to increase carrying capacity. As no records of this species have been made within the clearing area, and a limited area of suitable is not going to be removed, no impact is expected on any individuals or populations of Swift Parrot. It is therefore believed that the action proposed remains consistent with the objectives of the recovery plan for this species.

#### 2.5.1.6 *Grantiella picta* (Painted Honeyeater)

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- **substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**

The proposed road widening will result in the removal of 5.05 ha of woodland, which represent potential foraging habitat for this species. Given the highly mobile nature of this species and the availability of alternate habitat outside of the study area within the locality, the proposed works do not have the potential to modify, destroy or isolate an area of important habitat for this species.

- **result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**

No harmful invasive species are expected to become established in areas of potential habitat for this species as a result of the proposed works. Weed, sediment and erosion controls will be in place during the proposed works to mitigate the potential spread and/or introduction of invasive species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

The proposed road widening will not impact upon breeding habitat for this species, and the potential foraging habitat which occurs in the study area would form at most a fraction of the species' range within the locality. Given this, the proposed clearing of vegetation is unlikely to seriously disrupt the lifecycle of any proportion of the species.

### 2.5.2 SEPP 44 Koala habitat Assessment

The proposed road upgrade was assessed against the SEPP 44. MWRC is listed as one of the Councils to which SEPP 44 applies.

Under SEPP 44, there are two categories of koala habitat:

- Core Koala habitat, meaning an area with a resident population of koalas, evidenced by attributes such as breeding females, recent sightings and historical records. The impact area is not considered Core koala habitat as:
  - No koalas were identified during previous field survey effort (ELA 2011). There are only five (5) isolated historical records of koalas within a 10 km boundary of the road, dating from between 1980 to 2011.
- Potential Koala habitat, meaning areas of native vegetation where the key koala feed trees of the types listed in Schedule 2 of SEPP 44 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. The impact area is not considered Potential koala habitat as:
  - The only key koala feed trees of the types listed in Schedule 2 identified in the impact area were three (3) White Box. These trees were found within a patch of vegetation comprising in excess of 100 trees, therefore, they did not constitute 15% of the total number of trees in the upper or lower strata of the tree component.

As the categories of koala habitat scheduled in SEPP 44 do not apply, a koala management plan will not be required for the development site. The koala is considered as a species with the potential to occur in the impact area, in low numbers.

The development site has been further assessed using the 'EPBC Act referral guidelines for the vulnerable Koala' (Department of the Environment [DoE], 2014). A decision as to whether a proposed



action will have or is likely to have a significant impact on the koala is made using two key considerations outlined in the EPBC guidelines:

- Adversely affecting habitat critical to the survival of the koala and/or
- Interfering substantially with the recovery of the koala through the introduction or exacerbation of key threats in areas of habitat critical to the survival of the koala (section 8).

Habitat destruction is recognised as the primary adverse effect on habitat critical to the survival of the koala. Whether or not there are other impacts, the loss of habitat critical to the survival of the koala can be sufficient to trigger a significant impact. Application of the koala habitat assessment tool from the proposed impact area was undertaken, resulting in a score of 5/10. A score of five or greater means that an assessment of significance is required.

In summary, the assessment score can be attributed to the following key factors:

- Low numbers of preferred feed trees within the footprint clearing will not present a significant impact to the overall habitat quality of the surrounding environment.
- The BMP reduces risk of harming koalas by conducting inspections prior to felling. In the event that habitat features or protected species are present tree felling is to be conducted under the supervision of a qualified ecologist.
- Fragmentation and isolation of populations will not occur as a result of this action due to the narrow width of areas to be cleared.
- The potential for impacts from the clearing of woodland vegetation to substantially interfere with the recovery of the koala have been assessed as follows.
- Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.
- The project will not result in the introduction of domestic dogs to the area. Wild dogs are present in the region. Although not directly related to the application, Local Land Services recently completed their 2018 autumn wild dog baiting in the region, further reducing the chance of dog attacks.
- Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.
- Koala fatalities will not be increased due to the absence of a permanent koala population. Vehicle movements will increase during the construction of the CRWF, however, increases to permanent traffic volumes are not expected to increase significantly throughout the life of the project. The approved TMP and BMP for the CRWF includes detail on speed limit restrictions to reduce fauna strike.
- Facilitating the introduction or spread of disease or pathogens for example Chlamydia or *Phytophthora cinnamomi*, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.
- The increased risk of disease introduction is minimal due to the existing use of the study area as a road open to public traffic movements. The approved BMP details recommended vehicle washdown and hygiene measures to prevent the spread of pathogens.

- Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.
- The road upgrade will follow the existing road and will not result in the creation of any additional barriers to movement.
- Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.
- The road upgrade will follow the existing road and will not result in the creation of any significant long term changes to hydrology.

The koala is considered as a species with the potential to occur in the impact area, in low numbers. The above assessment has concluded that impacts to koala from the proposed road upgrade will not be significant, therefore, no further assessment under the EPBC Act has been undertaken.

### 3. Conclusion

This BDAR has been prepared to meet the requirements of the BAM established under Section 6.7 of the BC Act. This BDAR considers 5.05 ha of disturbance for a proposed upgrade to Aarons Pass Road and has considered total removal of the vegetation within three categories of disturbance proposed (permanent clearing, temporary disturbance and the blade swept path). The 5.05 ha assessed in the BDAR was assigned to two Plant Community Types (PCT):

1. PCT 277 - Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion (0.67 ha)
2. PCT 290 - Red Stringybark – Red Box – Long-leaved Box – Inland Scribbly Gum tussock grass shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion (4.38 ha).

The entire area of PCT 277 (0.67 ha) meets the criteria for EEC listed under the BC Act, with smaller patches totaling 0.32 ha meeting the CEEC listing criteria under the EPBC Act:

- White Box Yellow Box Blakely's Red Gum Woodland (listed as EEC under the BC Act)
- White Box Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (listed as CEEC under the EPBC Act).

Nine threatened flora species were identified from the data audit as known, likely or having the potential to occur within the development site area, with two of these identified and confirmed during the field survey. *Acacia meiantha*, listed as Endangered under both the BC Act and EPBC Act was identified, along with *Pomaderris reperta* (Denman Pomaderris), which is listed as Critically Endangered under the BC Act and EPBC Act. Fifty-nine individual *A. meiantha* have been identified for removal within the development site. One *Pomaderris reperta* has been identified for removal within the development site. Three further *Pomaderris reperta* individuals are within the blade swept path of the road upgrade and will not be directly impacted by vegetation clearing.

Thirty-one threatened fauna species were identified from the data audit as known, likely or having the potential to occur within the development site area, with three of these identified and confirmed during the field survey. *Artamus cyanopterus cyanopterus* (Dusky Woodswallow), *Daphoenositta chrysoptera* (Varied Sittella) and *Petroica boodang* (Scarlet Robin) were identified, all are listed as Vulnerable under the BC Act and identified as ecosystem credit species within the BAMC. Threatened fauna habitat was assessed, comprising mainly 150 individual hollow-bearing trees to be removed within the development site. Ten threatened species credit species was presumed to occupy the extent of Aarons Pass Road and will be impacted by the development. These species include the Bush stone curlew, Gang-gang Cockatoo, Glossy Black-Cockatoo, Eastern Pygmy Possum, Squirrel Glider, Brush tailed Phascogale, Powerful Owl, Barking Owl, Masked Owl and Koala.

Serious and Irreversible Impacts (SII) values have been considered as part of this assessment. These values include 'White Box Yellow Box Blakely's Red Gum Woodland' and threatened flora species *Acacia meiantha* and *Pomaderris reperta*, which are also listed as candidate SII. A threshold of 0 is assumed and therefore it is possible that SII could occur given the small and isolated populations of these two

species. Subject to the outcomes of the detailed design process, and the implementation of avoidance measures adopted within, including trimming and translocation, serious impacts are unlikely.

For vegetation zone 1 – PCT 277 Intact, the BAM Credit Calculator (BAMC) generated a vegetation integrity score of 56.5. Nine ecosystem credits are required to offset the removal of 0.32 ha for vegetation zone 1. For vegetation zone 2 – PCT 277 Degraded, the BAMC generated a vegetation integrity score of 40.4. Seven ecosystem credits are required to offset the removal of 0.4 ha for vegetation zone 2). For vegetation zone 3 – PCT 290 Intact, the BAMC generated a vegetation integrity score of 69.3. 47 ecosystem credits are required to offset the removal of 1.6 ha of vegetation zone 3. For vegetation zone 4 – PCT 290 Degraded, the BAMC generated a vegetation integrity score of 61. 76 ecosystem credits are required to offset the removal of 2.8 ha for vegetation zone 4. Additionally, a total of five species credits are required to offset the impact on *Acacia meiantha*, and one species credit is required to offset the impact on *Pomaderris reperta*. Fauna surveys were not conducted so due to the presence of suitable habitat on site, ten species of fauna were presumed to be present. 156 species credits are required to offset each of the Bush Stone-curlew, the Squirrel Glider, and Koala. 154 species credits each are required to offset the impacts on Gang-gang cockatoo, Glossy Black-Cockatoo, Eastern Pygmy-possum, Barking Owl, Powerful Owl, Masked Owl and the Brush-tailed Phascogale.

An assessment of the Commonwealth Significant Impact Criteria (Commonwealth of Australia 2013) was applied to one threatened community (White Box Yellow Box Blakely's Red Gum Grassy Woodland) and six threatened species listed under the EPBC Act, including one mammal, *Phascolarctos cinereus* (Koala), four bird species, *Anthochaera phrygia* (Regent Honeyeater), *Grantiella picta* (Painted Honeyeater), *Lathamus discolor* (Swift Parrot) and two endangered flora species, *Pomaderris reperta* and *Acacia meiantha*. The assessment concluded that the project would not have a significant impact on the above-mentioned species.

All impacts to MNES and BC Act listed entities have been avoided as far as practicable and all impacts have been assessed in accordance with Commonwealth guidelines. Mitigation strategies have been put into place to manage potential impacts to MNES and BC Act listed entities. The development footprint has been modified, reduced and access routes have been altered to avoid impacts to EEC, CEEC and critical habitat for listed species. Additionally, the removal of vegetation will be avoided where possible by vegetation trimming rather than removal wherever possible.



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## Appendix A: Definitions

Terminology	Definition
<b>Biodiversity credit report</b>	The report produced by the Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site.
<b>BioNet Atlas</b>	The BioNet Atlas (formerly known as the NSW Wildlife Atlas) is the OEH database of flora and fauna records. The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails) and some fish
<b>Broad condition state:</b>	Areas of the same PCT that are in relatively homogenous condition. Broad condition is used for stratifying areas of the same PCT into a vegetation zone for the purpose of determining the vegetation integrity score.
<b>Connectivity</b>	The measure of the degree to which an area(s) of native vegetation is linked with other areas of vegetation.
<b>Credit Calculator</b>	The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
<b>Development</b>	Has the same meaning as development at section 4 of the EP&A Act, or an activity in Part 5 of the EP&A Act. It also includes development as defined in section 115T of the EP&A Act.
<b>Development footprint</b>	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials.
<b>Development site</b>	An area of land that is subject to a proposed development that is under the EP&A Act.
<b>Ecosystem credits</b>	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
<b>High threat exotic plant cover</b>	Plant cover composed of vascular plants not native to Australia that if not controlled will invade and outcompete native plant species.
<b>Hollow bearing tree</b>	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the minimum entrance width is at least 5 cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1 m above the ground. Trees must be examined from all angles.
<b>Important wetland</b>	A wetland that is listed in the Directory of Important Wetlands of Australia (DIWA) and SEPP 14 Coastal Wetlands
<b>Linear shaped development</b>	Development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length
<b>Local population</b>	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately.
<b>Local wetland</b>	Any wetland that is not identified as an important wetland (refer to definition of Important wetland).
<b>Mitchell landscape</b>	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.

Terminology	Definition
<b>Multiple fragmentation impact development</b>	Developments such as wind farms and coal seam gas extraction that require multiple extraction points (wells) or turbines and a network of associated development including roads, tracks, gathering systems/flow lines, transmission lines
<b>Operational Manual</b>	The Operational Manual published from time to time by OEH, which is a guide to assist assessors when using the BAM
<b>Patch size</b>	An area of intact native vegetation that: a) occurs on the development site or biodiversity stewardship site, and b) includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or $\leq 30$ m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or stewardship site..
<b>Proponent</b>	A person who intends to apply for consent to carry out development or for approval for an activity.
<b>Reference sites</b>	The relatively unmodified sites that are assessed to obtain local benchmark information when benchmarks in the Vegetation Benchmarks Database are too broad or otherwise incorrect for the PCT and/or local situation. Benchmarks can also be obtained from published sources.
<b>Regeneration</b>	The proportion of over-storey species characteristic of the PCT that are naturally regenerating and have a diameter at breast height $< 5$ cm within a vegetation zone.
<b>Remaining impact</b>	An impact on biodiversity values after all reasonable measures have been taken to avoid and minimise the impacts of development. Under the BAM, an offset requirement is calculated for the remaining impacts on biodiversity values.
<b>Retirement of credits</b>	The purchase and retirement of biodiversity credits from an already-established biobank site or a biodiversity stewardship site secured by a biodiversity stewardship agreement.
<b>Riparian buffer</b>	Riparian buffers applied to water bodies in accordance with the BAM
<b>Sensitive biodiversity values land map</b>	Development within an area identified on the map requires assessment using the BAM.
<b>Site attributes</b>	The matters assessed to determine vegetation integrity. They include: native plant species richness, native over-storey cover, native mid-storey cover, native ground cover (grasses), native ground cover (shrubs), native ground cover (other), exotic plant cover (as a percentage of total ground and mid-storey cover), number of trees with hollows, proportion of over-storey species occurring as regeneration, and total length of fallen logs.
<b>Site-based development</b>	a development other than a linear shaped development, or a multiple fragmentation impact development
<b>Species credits</b>	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
<b>Subject land</b>	Is land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. It includes land that may be a development site, clearing site, proposed for biodiversity certification or land that is proposed for a biodiversity stewardship agreement.
<b>Threatened Biodiversity Data Collection</b>	Part of the BioNet database, published by OEH and accessible from the BioNet website.
<b>Threatened species</b>	Critically Endangered, Endangered or Vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as Critically Endangered, Endangered or Vulnerable.



Terminology	Definition
<b>Vegetation Benchmarks Database</b>	A database of benchmarks for vegetation classes and some PCTs. The Vegetation Benchmarks Database is published by OEH and is part of the BioNet Vegetation Classification.
<b>Vegetation zone</b>	A relatively homogenous area of native vegetation on a development site, land to be biodiversity certified or a biodiversity stewardship site that is the same PCT and broad condition state.
<b>Wetland</b>	An area of land that is wet by surface water or ground water, or both, for long enough periods that the plants and animals in it are adapted to, and depend on, moist conditions for at least part of their life cycle. Wetlands may exhibit wet and dry phases and may be wet permanently, cyclically or intermittently with fresh, brackish or saline water
<b>Woody native vegetation</b>	Native vegetation that contains an over-storey and/or mid-storey that predominantly consists of trees and/or shrubs

## Appendix B: Vegetation plot data

Table B.1: Species matrix (species recorded by plot)

Scientific Name	Exotic	Form	Cover (%) Plot 1	Cover (%) Plot 2	Cover (%) Plot 3	Cover (%) Plot 4	Cover (%) Plot 5
<i>Acacia buxifolia</i>		SG			0.1	0.2	
<i>Acacia dealbata</i>		TG	1	4	0.1		0.2
<i>Acacia decora</i>		SG					
<i>Acacia implexa</i>		SG			0.1	0.1	0.5
<i>Alternanthera spp.</i>		FG				0.1	
<i>Amyema spp.</i>		OG	0.1			0.1	
<i>Anagallis arvensis</i>	*	FG	0.1	0.1			
<i>Aristida ramosa</i>		GG	0.1		0.1		
<i>Asperula conferta</i>		FG	0.1	0.1			0.1
<i>Austrostipa scabra</i>		GG	1				
<i>Austrostipa scabra</i>		GG					
<i>Bothriochloa macra</i>		GG	0.1				
<i>Brachychiton populneus</i> <i>subsp. populneus</i>		TG	0.1				
<i>Bromus diandrus</i>	*	GG	0.8				
<i>Bromus hordeaceus</i>	*	GG		0.2			
<i>Bulbine bulbosa</i>		FG					0.1
<i>Bursaria spinosa</i>		SG					0.1
<i>Cassinia arcuata</i>		SG	0.5	1	0.1		
<i>Cassinia quinquefaria</i>		SG				0.1	0.3
<i>Chrysanthemum spp.</i>	*	FG					0.1
<i>Chrysocephalum apiculatum</i>		FG				0.2	0.1
<i>Cirsium vulgare</i>	*	FG	0.1	0.5			
<i>Cynoglossum australe</i>		FG	0.1	0.1			
<i>Dianella revoluta</i>		FG	0.1		0.2	2	0.1
<i>Dichelachne spp.</i>		GG			0.1		0.1
<i>Diuris spp.</i>		FG			0.1	0.1	
<i>Echium plantagineum</i>	*	FG		0.2			
<i>Einadia hastata</i>		FG	0.1				
<i>Einadia nutans</i>		FG	0.1				
<i>Eragrostis spp.</i>	*	GG		0.8			

Scientific Name	Exotic	Form	Cover (%) Plot 1	Cover (%) Plot 2	Cover (%) Plot 3	Cover (%) Plot 4	Cover (%) Plot 5
<i>Eucalyptus blakelyi</i>		TG	10	0.8			
<i>Eucalyptus bridgesiana</i>		TG		2			
<i>Eucalyptus globoidea</i>		TG			25	20	5
<i>Eucalyptus macrorhyncha</i>		TG	1				
<i>Eucalyptus melliodora</i>		TG	10	2			
<i>Eucalyptus polyanthemos</i>		TG			2	2	
<i>Eucalyptus rossii</i>		TG			2	15	20
<i>Geranium solanderi</i>		FG	0.1			0.1	0.1
<i>Glycine tabacina</i>		OG			0.1	0.1	
<i>Goodenia hederacea</i>		FG			0.1	0.2	0.1
<i>Hardenbergia violacea</i>		OG			0.1	0.1	0.2
<i>Hibbertia obtusifolia</i>		SG			0.1	0.2	0.1
<i>Hibbertia spp.</i>		SG				0.1	
<i>Hydrocotyle laxiflora</i>		FG	0.1			0.1	
<i>Hypericum perforatum</i>	*	FG	0.1	0.1			
<i>Hypochaeris radicata</i>	*	FG	0.1	2			0.1
<i>Lepidosperma spp.</i>		GG				0.1	
<i>Lissanthe strigosa</i>		SG	0.1				
<i>Lolium rigidum</i>	*	GG	7	5			0.5
<i>Lomandra confertifolia</i>		GG	0.1				
<i>Lomandra filiformis</i>		GG			0.1	0.1	0.1
<i>Lomandra glauca</i>		GG			0.1		
<i>Lomandra multiflora</i>		GG	0.5		0.2	0.1	0.1
<i>Melicytus dentatus</i>		SG	2	0.2			0.1
<i>Modiola caroliniana</i>	*	FG					0.1
<i>Olearia viscidula</i>		SG					
<i>Oxalis perennans</i>		FG		0.1			
<i>Oxalis spp.</i>		FG					0.1
<i>Ozothamnus spp.</i>		SG			0.1	0.5	0.1
<i>Persoonia linearis</i>		SG			0.5	0.4	
<i>Phalaris aquatica</i>	*	GG	5	20			5
<i>Plantago lanceolata</i>	*	FG	0.1	10			1
<i>Poa sieberiana</i>		GG	0.1		0.5		
<i>Podolobium ilicifolium</i>		SG			0.2	0.5	
<i>Pultenaea microphylla</i>		SG				0.2	0.1

Scientific Name	Exotic	Form	Cover (%) Plot 1	Cover (%) Plot 2	Cover (%) Plot 3	Cover (%) Plot 4	Cover (%) Plot 5
<i>Pultenaea microphylla</i>		SG			0.1		
<i>Pultenaea spp.</i>		SG			0.1		
<i>Rapistrum spp.</i>	*	FG					0.1
<i>Rubus spp.</i>	*	SG	0.1	0.1			1
<i>Rumex brownii</i>		FG	0.1				
<i>Rytidosperma caespitosum</i>		GG			0.1		
<i>Rytidosperma pallidum</i>		GG			0.2	10	0.5
<i>Rytidosperma spp.</i>		GG	0.5			0.5	0.1
<i>Senecio quadridentatus</i>		FG	0.2	0.2	0.1		0.1
<i>Solanum nigrum</i>	*	SG					0.1
<i>Sonchus spp.</i>	*	FG	0.1	0.1			
<i>Sonchus spp.</i>	*	FG					0.1
<i>Stypandra glauca</i>		FG				0.1	
<i>Styphelia triflora</i>		SG					0.3
<i>Taraxacum officinale</i>	*	FG	0.5	2			
<i>Themeda triandra</i>		GG	0.1	0.5			
<i>Trifolium campestre</i>	*	FG	0.1	5			
<i>Trifolium spp.</i>	*	FG	0.1	0.1			
<i>Unknown</i>	*	FG		0.7			
<i>Veronica plebeia</i>		FG	0.1			0.1	
<i>Vicia spp.</i>	*	FG		0.2			1
<i>Vulpia bromoides</i>	*	GG	0.1				
<i>Wahlenbergia spp.</i>		FG	0.1	0.1		0.1	0.1

Tree (TG), Shrub (SG), Grass & Grasslike (GG), Forb (FG), Fern (EG), Other (OG). Plot 1 and 2 were located in PCT 277 and plots 3-5 were located in PCT 290.

Table B.2 Vegetation integrity data (Composition, Structure and Function)

Plot location data						
Plot no.	PCT	Vegetation Zone	Condition	Eastings	Northings	Bearing
1	277	1	Intact	748377	6356687	80
2	277	2	Degraded	749953	6357700	60
3	290	2	Degraded	757954	6360280	50
4	290	1	Intact	785310	6360650	210
5	290	2	Degraded	759970	6361688	290



Composition (number of species)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	5	4	7	10	0	1
2	4	3	2	5	0	0
3	4	9	5	4	0	0
4	4	9	3	10	0	3
5	3	9	3	9	0	0

Structure (Total cover)						
Plot no.	Tree	Shrub	Grass	Forb	Fern	Other
1	22	3	2	1	0	0
2	9	1	1	1	0	0
3	29	1	1	1	0	0
4	37	2	1	3	0	0
5	25	3	0	1	0	0

Function											
Plot no.	Large Trees	Hollow trees	Litter Cover	Length Fallen Logs	Tree Stem 5-9	Tree Stem 10-19	Tree Stem 20-29	Tree Stem 30-49	Tree Stem 50-79	Tree Regen	High Threat Weed Cover
1	26	6	64	72	1	1	1	1	1	1	1
2	5	0	13.2	35	1	1	1	1	1	1	0
3	7	3	99	110	1	1	1	1	1	1	0
4	10	3	62	96	1	1	1	1	1	1	0
5	9	3	75	105	1	1	1	1	1	1	0

## Appendix C: Biodiversity credit report

# BAM Credit Summary Report

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00013288/BAAS18153/18/00013289	Aarons Pass Road Modification -SSD_6697 Mod	07/11/2018
Assessor Name	Report Created	BAM Data version *
Cheryl O'Dwyer	23/11/2018	4
Assessor Number	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	
BAAS18153		

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Candidate SAI	Ecosystem credits
<b>Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion</b>								
1	277_Intact	56.5	0.3	0.25	High Sensitivity to Potential Gain	2.00	TRUE	9
2	277_Degraded	40.4	0.4	0.25	High Sensitivity to Potential Gain	2.00	TRUE	7
							<b>Subtotal</b>	<b>16</b>

## BAM Credit Summary Report

Red Stringybark - Red Box - Long-leaved Box - Inland Scribbly Gum tussock grass - shrub low open forest on hills in the southern part of the NSW South Western Slopes Bioregion								
3	290_Intact	69.3	1.6	0.25	High Sensitivity to Potential Gain	1.75		47
4	290_Degraded	61.0	2.8	0.25	High Sensitivity to Potential Gain	1.75		76
							<b>Subtotal</b>	<b>123</b>
							<b>Total</b>	<b>139</b>

### Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Candidate SAI	Species credits
<b><i>Acacia meiantha</i> / <i>Acacia meiantha</i> ( Flora )</b>						
290_Intact	69.3	0.1	0.25	3	True	5
						<b>Subtotal</b>
						<b>5</b>
<b><i>Burhinus grallarius</i> / <i>Bush Stone-curlew</i> ( Fauna )</b>						
277_Intact	56.5	0.32	0.25	2	False	9
277_Degraded	40.4	0.35	0.25	2	False	7
290_Intact	69.3	1.55	0.25	2	False	54
290_Degraded	61.0	2.83	0.25	2	False	86
						<b>Subtotal</b>
						<b>156</b>



## BAM Credit Summary Report

<b><i>Callocephalon fimbriatum / Gang-gang Cockatoo ( Fauna )</i></b>						
277_Intact	56.5	0.32	0.25	2	N/A	9
290_Intact	69.3	1.55	0.25	2	N/A	54
290_Degraded	61.0	2.83	0.25	2	N/A	86
277_Degraded	40.4	0.27	0.25	2	N/A	5
					<b>Subtotal</b>	<b>154</b>
<b><i>Calyptrorhynchus lathamii / Glossy Black-Cockatoo ( Fauna )</i></b>						
277_Intact	56.5	0.32	0.25	2	N/A	9
277_Degraded	40.4	0.27	0.25	2	N/A	5
290_Intact	69.3	1.55	0.25	2	N/A	54
290_Degraded	61.0	2.83	0.25	2	N/A	86
					<b>Subtotal</b>	<b>154</b>
<b><i>Cercartetus nanus / Eastern Pygmy-possum ( Fauna )</i></b>						
277_Intact	56.5	0.32	0.25	2	False	9
277_Degraded	40.4	0.27	0.25	2	False	5
290_Intact	69.3	1.55	0.25	2	False	54
290_Degraded	61.0	2.83	0.25	2	False	86
					<b>Subtotal</b>	<b>154</b>

## BAM Credit Summary Report

<b><i>Ninox connivens / Barking Owl ( Fauna )</i></b>							
277_Intact	56.5	0.32	0.25	2	N/A		9
277_Degraded	40.4	0.27	0.25	2	N/A		5
290_Intact	69.3	1.55	0.25	2	N/A		54
290_Degraded	61.0	2.83	0.25	2	N/A		86
						<b>Subtotal</b>	<b>154</b>
<b><i>Ninox strenua / Powerful Owl ( Fauna )</i></b>							
277_Intact	56.5	0.32	0.25	2	N/A		9
277_Degraded	40.4	0.27	0.25	2	N/A		5
290_Intact	69.3	1.55	0.25	2	N/A		54
290_Degraded	61.0	2.83	0.25	2	N/A		86
						<b>Subtotal</b>	<b>154</b>
<b><i>Petaurus norfolcensis / Squirrel Glider ( Fauna )</i></b>							
277_Intact	56.5	0.32	0.25	2	False		9
277_Degraded	40.4	0.35	0.25	2	False		7
290_Intact	69.3	1.55	0.25	2	False		54
290_Degraded	61.0	2.83	0.25	2	False		86
						<b>Subtotal</b>	<b>156</b>

## BAM Credit Summary Report

<b><i>Phascogale tapoatafa / Brush-tailed Phascogale ( Fauna )</i></b>							
277_Intact	56.5	0.32	0.25	2	False		9
277_Degraded	40.4	0.27	0.25	2	False		5
290_Intact	69.3	1.55	0.25	2	False		54
290_Degraded	61.0	2.83	0.25	2	False		86
					<b>Subtotal</b>		<b>154</b>
<b><i>Phascolarctos cinereus / Koala ( Fauna )</i></b>							
277_Intact	56.5	0.32	0.25	2	N/A		9
277_Degraded	40.4	0.35	0.25	2	N/A		7
290_Intact	69.3	1.55	0.25	2	N/A		54
290_Degraded	61.0	2.83	0.25	2	N/A		86
					<b>Subtotal</b>		<b>156</b>
<b><i>Pomaderris reperta / Denman Pomaderris ( Flora )</i></b>							
290_Intact	69.3	0.01	0.25	3	True		1
					<b>Subtotal</b>		<b>1</b>
<b><i>Tyto novaehollandiae / Masked Owl ( Fauna )</i></b>							
277_Intact	56.5	0.32	0.25	2	N/A		9
277_Degraded	40.4	0.27	0.25	2	N/A		5



## BAM Credit Summary Report

290_Intact	69.3	1.55	0.25	2 N/A	54
290_Degraded	61.0	2.83	0.25	2 N/A	86
				<b>Subtotal</b>	<b>154</b>



## **Appendix I - Aarons Pass Road Heritage Assessment**

*Prepared by:*  
NSW Archaeology  
September 2018



8 September 2018

Mark Branson  
Crudine Ridge Wind Farm Pty Ltd  
c/o CWP Renewables

Dear Mark

Re: Crudine Ridge Wind Farm – Aarons Pass Road

We understand that road improvement works are proposed on Aarons Pass Road and that these will involve earthworks and civil construction to address the narrow carriageway, road subgrade, drainage issues and road width to improve safety and trafficability for all road users. This letter provides information in regard to the heritage potential of the road.

The works will involve a general widening of the existing carriageway to approximately 6 m wide with drainage channels, culverts and sediment basins installed at appropriate intervals to manage ponding, erosion and sedimentation. The existing road alignment will be adjusted particularly around tight blind corners to improve visibility and road safety for local users, heavy vehicles and over-dimensional movements. Crest works will be undertaken to improve visibility and access for all road users, which may involve cuttings and earthworks adjacent to the existing carriageway. Road base and subgrade will be reviewed and addressed to improve condition, durability and maintenance issues. It is concluded that the proposed works are minimal in scope and would occur on road surfaces, verges and so on which are already highly disturbed.

NSW Archaeology Pty Ltd conducted a field survey and heritage assessment of proposed works along Aarons Pass Road in 2013, as documented in a report entitled *Aarons Pass Road – Heavy Haulage Route Upgrade for the Proposed Crudine Ridge Wind Farm European and Aboriginal Cultural Heritage Assessment Report*. The assessment was undertaken on the section of road between the Castlereagh Highway and the access road into the northern end of the proposed wind farm. A survey was conducted in the proposed activity area and no Aboriginal or European sites were recorded. Furthermore, the area along Aarons Pass Road was found to be of low heritage potential. It was concluded that

there were no heritage constraints with regard to the proposal. It is noted that much of the current proposed impact areas were assessed during the 2013 assessment.

Given the low archaeological potential and sensitivity of Aarons Pass Road, there is no need for any further field inspections to be conducted. However, an updated AHIMS site search has been undertaken which has identified no Aboriginal object sites in the activity area (AHIMS #369230: 7 September 2018). One previously recorded Aboriginal object site, AHIMS Site ID 36-6-0794 (*Aarons Pass 1*) is located immediately to the east of the east end of Aarons Pass Road. The remainder of sites on AHIMS are in the wind farm project area (see AHIMS Site Search attached to this letter). OzArk EHM (2010) conducted an assessment of a section of the Castlereagh Highway realignment works near to the eastern end of Aarons Pass Road. During test excavation, AHIMS Site ID 36-6-0794 (*Aarons Pass 1*) was found to not contain either surface or subsurface artefacts. OzArk EHM (2010: 29) recommended that this site be removed from AHIMS. The site is still listed but noted as *not a site*.

Based on the above, it is concluded that there are no heritage constraints to the proposed works on Aarons Pass Road.

Please call to discuss this matter further if required.

Yours faithfully

A handwritten signature in dark ink, appearing to read 'Julie Dibden', is written over a light blue circular stamp. The signature is fluid and cursive.

Dr Julie Dibden  
New South Wales Archaeology Pty Limited



## AHIMS Web Services (AWS) Extensive search - Site list report

Your Ref/PO Number : Aaron's Pass  
Client Service ID : 369230

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
36-6-0794	Aaron's Pass 1 (AP1)	GDA	55	762722	6360213	Open site	Not a Site	Artefact :-		101793,10186 7,102268
36-6-0948	<u>Contact</u> CRWF SU18/L1	<u>Recorders</u> GDA	Mr.David Maynard 55	758305	6356311	Open site	Valid	Artefact :-	Permits	3280
36-6-0949	<u>Contact</u> CRWF SU18/L2	<u>Recorders</u> GDA	Doctor,Julie Dibden,NSW Archaeology Pty Ltd 55	758186	6356129	Open site	Valid	Artefact :-	Permits	
36-6-0931	<u>Contact</u> CRWF SU9/L1	<u>Recorders</u> GDA	Doctor,Julie Dibden,NSW Archaeology Pty Ltd 55	750844	6356236	Open site	Valid	Artefact :-	Permits	
36-6-0932	<u>Contact</u> CRWF SU9/L2	<u>Recorders</u> GDA	Doctor,Julie Dibden,NSW Archaeology Pty Ltd 55	750955	6355239	Open site	Valid	Artefact :-	Permits	
36-6-0933	<u>Contact</u> CRWF SU9/L3	<u>Recorders</u> GDA	Doctor,Julie Dibden,NSW Archaeology Pty Ltd 55	750357	6354009	Open site	Valid	Artefact :-	Permits	
36-6-0935	<u>Contact</u> CRWF SU10/L1	<u>Recorders</u> GDA	Doctor,Julie Dibden,NSW Archaeology Pty Ltd 55	750098	6354842	Open site	Valid	Artefact :-	Permits	
36-6-0936	<u>Contact</u> CRWF SU10/L2	<u>Recorders</u> GDA	Doctor,Julie Dibden,NSW Archaeology Pty Ltd 55	749783	6355096	Open site	Valid	Artefact :-	Permits	



