EPURON

Biodiversity Assessment Addendum

RYE PARK WIND FARM

MARCH 2016

ngh environmental

www.nghenvironmental.com.au

Document Verification

Project Title: Biodiversity Assessment Addendum

Rye Park Wind Farm

Project Number: 6042

Project File Name: Rye_Park_BA_Addendum_Final_v2.2.docx

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft v1.0	16/10/15	Dave Maynard Deb Frazer Bianca Heinze	Brooke Marshall	Brooke Marshall
Final v1.0	18/12/15	Dave Maynard	Brooke Marshall	Brooke Marshall
Final v2.0	09/03/16	Dave Maynard	Brooke Marshall	Brooke Marshall
Final v2.1	24/03/16	Dave Maynard (minor changes)		
Final v2.2	5/04/16	Dave Maynard (minor changes)		

NGH Environmental Pty Ltd (ACN: 124 444 622. ABN: 31 124 444 622) and NGH Environmental (Heritage) Pty Ltd (ACN: 603 938 549. ABN: 62 603 938 549) are part of the NGH Environmental Group of Companies.

www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
unit 17/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053

Wagga Wagga Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Newcastle - Hunter and North Coast
153 tudor st
hamilton nsw 2303 (m 0475 946 632)

Bega - ACT and South East NSW
suite 1, 216 carp st (po box 470)
bega nsw 2550 (t 02 6492 8333)

Bathurst - Central West and Orana
35 morrisset st (po box 434)
bathurst nsw 2795 (m 0448 820 748)

EXECUTIVE SUMMARY

This Biodiversity Assessment Addendum (henceforth, the 'addendum') documents key changes to the proposed infrastructure, since the Environmental Assessment was exhibited. It details where impacts have been avoided and minimised though changes to the proposed design of the wind farm and provides a revised assessment of the potential impacts to biodiversity associated with these changes and additional mitigation measures that are now required. It provides an update to the original Biodiversity Assessment completed by NGH Environmental in 2014 and is designed to be read in conjunction with that document.

This addendum also documents additional biodiversity investigations undertaken since the submission of the Rye Park Biodiversity Assessment in 2014, and addresses submissions received from the NSW Office of Environment and Heritage on the exhibited Environmental Assessment for the proposed Rye Park Wind Farm.

Changes to the project

Changes have been made to the project as assessed in the original Biodiversity Assessment. This now forms the preferred project design for the proposal. Key changes include:

- A reduction in the number of turbines from 126 to 109;
- A number of minor infrastructure layout changes aimed at minimising and/or avoiding negative environmental and community impacts where possible.

Additional investigations

Additional investigations undertaken to address proposal changes, submissions received and to facilitate a revised assessment of the potential impacts of the proposal include:

- Habitat assessment for the Striped Legless Lizard and Golden Sun Moth (NGH Environmental September 2014)
- Targeted surveys for the Crimson Spider Orchid (NGH Environmental February 2015)
- Field validation of additional infrastructure areas
- Hollow-bearing Tree Survey and Assessment

A revised desktop assessment including searches of relevant state and Commonwealth threatened species databases was also undertaken to facilitate the revised impact assessment for the proposal.

Two additional threatened species have been identified as occurring within or in close proximity to the project site; Southern Pygmy Perch and Yellow-spotted Bell Frog. Impacts to these species are considered to be manageable. There is also potential for the Crimson Spider Orchid to occur within the project site. Further survey is required to determine the presence or absence of this species. No other threatened species or Endangered Ecological Communities (EECs) additional to those previously identified in the original BA were considered to have the potential to occur at the development site.

Revised impact assessment

The primary impact types and the general nature of these impacts remain the same as identified in the original BA. The key factors that have changed as a result of the new preferred project layout are the quantum of direct clearing of vegetation and fauna habitats (including important habitat features such as hollow-bearing trees). In general, the clearing of the extent of threatened fauna habitats has decreased. The clearing of endangered ecological communities has increased by 10.2 hectares although this is largely within poor condition derived grassland. This is largely due to an increase in assumed worst case impacts

of the development (e.g. an increase in estimated median track with from 8m to 12m). Impacts in better quality woodland have been reduced.

The results of the Hollow-bearing Tree Survey and Assessment provided a more precise estimate of impacts on this important resource. The result was a reduction in the total number of hollow-bearing trees estimated to be impacted by the proposal. It was identified that the majority of hollows supported by hollow-bearing trees at the site were small to medium with proportionally few large hollows suitable for larger species such as cockatoos and owls.

The revised impact assessment identified no change to the conclusions of the assessments of significance completed in the original BA. Significant impacts to threatened species and endangered ecological communities are considered unlikely.

Additional mitigation measures

It is the recommendation of this addendum that several additional mitigation measures are included as commitments of the project to ensure that the impacts associated with the preferred project are managed appropriately. These include:

1. Prior to construction verification of potential habitats for threatened flora in a new area of CEEC identified to the south-west of turbines 85 – 87.
2. Pre-construction, additional targeted surveys for the Crimson Spider Orchid
3. Pre-construction, consultation with NSW Fisheries with regard to the design of waterway crossings proposed along Blakney Creek and its tributaries.
4. Specific consideration to be included in the Construction Environmental Management Plan for the project to protect Blakney Creek and its tributaries from sedimentation and pollution.
5. Further analysis of the topographic situation of turbine 90 to assess the collision risks to avifauna from this turbine.

A revised offset strategy has been prepared for the project following consultation with the NSW OEH and DPE. This strategy demonstrates that required offsets for the proposal are considered feasible within the site boundaries. Upper estimates and precautionary assumptions have been used and on this basis, not all entities are currently considered able to be met within the candidate offset sites. However, subject to final design and targeted surveys, it is considered highly likely the actual offset requirements of the final project footprint will be met. A detailed offset package demonstrating this and including a plan of management and, demonstration that funding for management will be available to manage the site in accordance with the plan of management, would be finalised prior to impacts occurring.

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

AoS	Assessment of Significance (pursuant to the *Threatened Species Conservation Act 1995* (NSW) or *Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
BA	Biodiversity Assessment
BBAM	BioBanking Assessment Methodology
BBAMP	Bird and Bat Adaptive Management Program
CEMP	Construction Environmental Management Plan
Cwth	Commonwealth
DECC	Refer to OEH
DECCW	Refer to OEH
DGEARs	Director General Environmental Assessment Requirements
DPE	(NSW) Department of Planning and Environment
DoE	(Cwth) Department of Environment
EEC	Endangered Ecological Community – as defined under relevant law applying to the proposal
EA	Environmental assessment
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FBA	Framework for Biodiversity Assessment (developed by OEH for Major Projects)
ha	hectares
HBT	Hollow-bearing tree
km	kilometres
NSW	New South Wales
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
RSA	Rotor Swept Area
SEWPAC	Refer DoE
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 INTRODUCTION

1.1 ASSESSMENT CONTEXT AND SCOPE OF THIS REPORT

In January 2014, Epuron submitted an Environmental Assessment (EA) to construct and operate the Rye Park Wind Farm (the project). The EA for the project was prepared in accordance with Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) according to Director Generals Environmental Assessment Requirements (DGEARs) issued by the then NSW Department of Planning and Infrastructure (DP&I) on 14 February 2011. The Part 3A assessment process was repealed and replaced by the State significant development and State Significant Infrastructure assessment systems on 1 October 2011. The assessment of the project was then governed by 'transitional' arrangements. On 13 March 2014, by order of the Minister for DP&I, the project ceased to be a transitional Part 3A project and became a 'State Significant Development'. On 13 March 2014, the DP&I also advised that the EA was adequate for public exhibition.

The publically exhibited EA contained as assessment of potential biodiversity impacts associated with the development of the Rye Park Wind Farm. This Biodiversity Assessment (BA) was finalised in January 2014. In common with the EA, the content of the assessment was informed by the DGEARs. The BA was placed on public exhibition with the EA in March 2014. A number of public and government agency submissions were subsequently received.

1.1.1 Submissions to be addressed

This addendum is intended to address submissions relevant to the BA, as part of the proponent's Submissions Report, to assist the Department of Planning and Environment (DPE) in considering whether to approve the Rye Park Wind Farm project. Specifically, it addresses submissions from the NSW Office of Environment and Heritage (OEH). Additional submissions relating to biodiversity received from other stakeholders are addressed in the Submissions Report being prepared by the proponent. Where information in this report is relevant to other agency or public submissions, the Submissions Report will refer to this report.

Submissions from the OEH addressed by this report are appended as Appendix A. Responses to each item raised in the submissions are included in Appendix B and identify where each item is addressed in this report.

1.1.2 Report structure

This Biodiversity Addendum provides specific detailed information and a revised assessment of potential impacts of the project including:

- A summary of key changes to the project, justification for these changes and how impacts to biodiversity have been avoided and minimised with respect to these changes. — Section 2
- Summaries of all additional studies undertaken since the submission of the BA. — Section 3

• Detailed responses to key submissions where further analysis and/or documentation was required.	Section 4
• A revised assessment of the impacts of the project, based on the new preferred project layout.	Section 5
• Recommendations for revised and/or additional mitigation and compensatory measures.	Section 6

1.1.3 Key resources in the preparation of this report

To avoid duplication of information, where possible, this addendum report will refer to information contained in the original BA for the proposal (NGH Environmental 2014: Biodiversity Assessment, Rye Park Wind Farm. Report prepared for Epuron January 2014). This report assessed the original layout proposed in the EA.

State and Commonwealth policies and guidelines that have been consulted in the preparation of this report include:

- Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE 2013)
- Threatened Biodiversity Survey and Assessment: Guidelines for developments and activities (DEC 2004)
- Threatened species assessment guidelines (DECC 2007)
- BioBanking Assessment Methodology (OEH 2014)
- EPBC Act Environmental Offsets Policy (SEWPaC 2012)

State and Commonwealth threatened species databases were also consulted including:

- NSW OEH Wildlife Atlas
- NSW OEH Threatened Species Profiles Database (TSPD)
- DoE Species Profile and Threats (SPRAT) database

2 CHANGES TO THE PROJECT

2.1 KEY CHANGES TO THE PROJECT

The original BA for the proposal (NGH Environmental 2014) assessed the proposed construction of five primary infrastructure components:

- Wind turbine footings and placement for up to 126 turbines.
- Creation of new tracks and widening of existing tracks.
- Installation of low voltage powerlines (33kV).
- Installation and clearing corridor for high voltage (330kV) electricity transmission line.
- Construction of substations.

This BA Addendum considers the following specific changes to the parameters of the infrastructure components:

- A reduction in the number of turbines from 126 to 109;
- A number of minor infrastructure layout changes aimed at minimising and/or avoiding negative environmental and community impacts where possible.

2.2 JUSTIFICATION FOR CHANGES

The number of proposed wind turbines was reduced for a number of reasons, including specific feedback provided following the exhibition of the EA. The reasons included:

- At the landowner's request
- To reduce potential habitat for the Stripped Legless Lizard
- To reduce impacts to vegetation of high conservation significance
- To increase the buffer distance to existing Wedge-tail Eagle nests
- To reduce impacts on Superb Parrot flight paths
- To increase the buffer distance to the Bango Reserve

Other wind farm infrastructure layout changes have been made following feedback received during the exhibition of the EA in order to eliminate of minimise negative environmental impacts while at the same time maximising the positive environmental benefits of the proposal.

2.3 AVOIDANCE AND MINIMISATION OF IMPACTS

A number of design measures have been implemented to avoid and minimise biodiversity impacts as detailed below.

2.3.1 Impact avoidance

- Turbine 27 and the associated track have been removed to avoid the habitat for the SLL in the vicinity of the known record and to minimise impacts to the broader area of known SLL habitat.
- Turbines within the high constraint CEEC and identified Superb Parrot/ painted Honeyeater corridor have been removed from the proposed layout avoiding impacts in these areas.

- Infrastructure has been removed avoiding impacts to high constraint Golden Sun Moth areas west of turbines 98 and 99.
- All infrastructure now outside of a 200m buffer for the Wedge-tailed Eagle as agreed at the site visit between NGH Environmental and OEH on the 24 February 2014. The nearest turbine (turbine 90) is now over 500m away which is consistent with buffer distances previously applied between nests and turbines at other wind farms for the Tasmanian threatened sub-species of the Wedge-tailed Eagle (MacMahon 2010).
- The access track and underground reticulation from turbine 102 and 103 has been redirected to avoid a dense patch of forest vegetation.

2.3.2 Impact minimisation

- The 330 kV transmission line has been relocated to reduce the potential impacts to a minimum. The transmission line cannot be removed as a connection of the wind farm to the existing grid is required to enable export of the energy produced by the wind farm. It is not possible to completely avoid the CEEC however, the transmission line has been relocated so it crosses the narrowest area of the community minimising the impacts to the CEEC.
- All turbines moved at least 70m from high constraint continuous forest (except for 96, refer to site specific analysis in Section 4.4)

3 ADDITIONAL STUDIES UNDERTAKEN

Since 2014, four additional investigations have been undertaken to address concerns from the OEH and to assess the relocation of some components of the project that are now outside of the area assessed in the original BA. These additional investigations included:

- Habitat assessment for the Striped Legless Lizard and Golden Sun Moth (NGH Environmental September 2014, refer Appendix C.1)
- Targeted surveys for the Crimson Spider Orchid (NGH Environmental February 2015, refer Appendix C.2)
- Field validation of additional infrastructure areas (documented within this addendum)
- Hollow-bearing Tree Survey and Assessment (documented within this addendum).

Additionally, a revised desktop assessment, including searches of relevant state and Commonwealth threatened species databases was undertaken to ensure all relevant species and their nearest location had been considered.

The approach and results of these additional studies are summarised below and appended in full. A revised impact assessment, incorporating the results of these additional studies, is documented in Section 4 of this report.

3.1 HABITAT ASSESSMENT FOR THE STRIPED LEGLESS LIZARD AND GOLDEN SUN MOTH

3.1.1 Background

As part of the original BA, specific commitments regarding further survey work for the Striped Legless Lizard and Golden Sun Moth were made (detailed in Table 8-3 of the BA). They centred on confirming presence or absence, using the information gained to minimise or avoid where possible impacts to these species and inform offsetting requirements, should the species be found to be impacted.

Commitments included:

- Micro-habitat surveys of the wind farm site for the Striped Legless Lizard

This commitment was addressed in 2014 and is documented below. It is noted that the micro-habitat surveys for the Striped Legless Lizard Golden were extended to cover the Golden Sun Moth, both species being highly dependent on specific vegetation understorey structure and composition.

3.1.2 Approach

This work included field survey and mapping components.

Habitat assessment for the Striped Legless Lizard and Golden Sun Moth were undertaken at Rye Park Wind Farm during 12-15 March 2014. The survey timing was planned to coincide with the flowering season of grasses onsite, especially native species. The survey method employed was developed in consultation with Rod Pietsch (Senior Threatened Species Officer) from OEH prior to the survey. A mixture of transect and quadrat surveys were conducted.

Habitat quality was defined for the Striped Legless Lizard using four categories and included:

Excellent	Tussock forming native grasses dominant (exotic species may be present but in lower abundance). Tussock forming species relatively dense and continuous (≥ 50 % cover). Rock and ground timber present. Low - mod grazing pressure.
Good	Tussock forming native or exotic grasses dominant. Tussock forming species relatively dense and continuous (≥ 50% cover), rock and ground timber present or absent. Or if tussock forming species not continuous, rock and ground timber present. Low - mod grazing pressure.
Moderate	Tussock forming grasses present (native or exotic species). Tussock forming species moderately dense (≤ 50% cover). Rock and ground timber generally absent or in low abundance. Low - mod grazing pressure.
Low	No to little tussock forming species or rock or ground timber shelter available. Mod-high grazing pressure.

Habitat quality was defined differently for the Golden Sun Moth, as it is known to occur in a variety of grasslands in varying condition. Wallaby Grass (*Rytidosperma* spp.) is a key grass species used by the Golden Sun Moth and is an indicator of potential habitat even if present in low abundance. The abundance of Wallaby Grass was therefore used as an indicator of habitat quality for this species. Wallaby Grass abundance categories were developed and included:

Not present	0%
Low abundance	1% – 25%
Moderate abundance	26% – 50%
Good abundance	51% – 75%
Excellent abundance	76% – 100%

Using vegetation data obtained in the March 2014 survey, the above classifications were mapped across the project site to provide a map of potential habitat for each species. The mapping includes information on whether the data are 'field based' or 'extrapolated'. Some areas of the wind farm could not be accessed and grassland condition was inferred from previous survey data collated during the biodiversity assessment phase of the project and from adjacent surveyed areas.

3.1.3 Results

The results of the surveys are detailed and mapped in the full report included as Appendix C.1. Potential impact areas were calculated for each of the defined habitat categories. As the full report in Appendix C.1. is based on the original infrastructure layout, a revision of the impact areas has been undertaken based on the new preferred project layout in Table 3-1 and Table 3-2 below.

Table 3-1. Striped Legless Lizard habitat available within the project area and extent of impact.

Striped Legless Lizard habitat quality	Area within site boundary (ha)	Area permanently impacted (ha)	Area not impacted (ha)
Excellent	1,140.02	18.29	1,121.72
Good	1,271.23	20.74	1,250.49
Moderate	2,546.79	40.17	2,506.62
Low	1,449.19	32.87	1,416.33
Total	**6,407.23**	**112.07**	**6,295.16**

Table 3-2. Golden Sun Moth habitat available within the project area and extent of impact.

Wallaby Grass abundance	Area within site boundary (ha)	Area permanently impacted (ha)	Area not impacted (ha)
Low (1%-25%)	2,023.74	36.06	1,987.68
Moderate (26%-50%)	1,613.54	26.24	1,587.29
Good (51%-75%)	1,570.26	23.21	1,547.05
Excellent (76%-100%)	280.84	17.48	263.35
Total	**5,488.37**	**103.00**	**5,385.37**

It should be noted that not all of the habitat quality classes above are considered to provide likely habitat for these species. Habitat suitable for the Striped Legless Lizard is discussed further in Section 4.2. Habitat suitable for the Golden Sun Moth is considered to be habitat where Wallaby Grass abundance exceeds 25%. A comparison of the impacts from the new preferred project above and the project layout originally assessed in the BA is provided in Section 5.

The results of the surveys and impact calculations have been utilised to determine suitable and adequate offsets for the proposal. This is discussed further in Section 6.2 and detailed in the offset strategy for the proposal included as Appendix D.

3.2 TARGETED SURVEYS FOR THE CRIMSON SPIDER ORCHID

3.2.1 Background

A population of the threatened Crimson Spider Orchid (*Caladenia concolor*) was detected in the Bango Nature Reserve (which adjoins the proposal site) in 2013, after the original BA survey program had been completed. Targeted surveys had not been undertaken for the species as at the time of writing the BA as it was considered unlikely to occur onsite. Nearest records of the Crimson Spider Orchid (CSO) were approximately 95 kilometres west of the site and habitat at the site was not typical of that which it had been found in previously. In light of the new record of the species in Bango Nature Reserve, it was considered necessary to assess the potential for the species to occur at the Rye Park Wind Farm site and be impacted by the proposal.

3.2.2 Approach

A two staged approach was proposed to determine if the CSO had potential to be impacted by the proposal.

1. Assess the CSO habitat within Bango NR to determine if similar habitat occurs at the proposal site.
2. In areas of suitable habitat at the proposal site, conduct targeted searches for the CSO (this was limited to those areas where infrastructure was proposed and did not cover the broader project site).

3.2.3 Results

The full survey results are detailed in the report included as Appendix C.2 and are summarised below.

CSO habitat within Bango NR was inspected. Suitable habitat for the CSO was deemed to be present at the wind farm site based on the presence of Red Stringybark (*Eucalyptus macrorhyncha*). This tree species seems to be a consistent habitat feature where this species occurs.

Targeted surveys were undertaken from the 7 – 9 October 2014 at 19 locations across the proposal site where infrastructure was proposed and Red Stringybark was known to be a dominant habitat feature.

The CSO was not detected during these surveys at the proposal site. However, repeat surveys at Bango NR by OEH during October 2014 also failed to relocate the known record.

In general, it was concluded that that CSO habitat across the majority of the Rye Park Wind Farm site is marginal. Although Red Stringybark is present in many areas, the understorey often lacks the density and diversity of the habitat within Bango NR where the record was found. Particularly, a lesser number of other orchid species were found on the wind farm site, in comparison to the Bango NR.

There are however, three areas within the wind farm site where it was identified that there was higher potential for the CSO to occur. It is a recommendation of the report that repeat surveys be conducted in these three areas in late September – early October prior to the commencement of construction to confirm the assumption that the CSO is unlikely to be impacted by the development of the wind farm.

3.3 FIELD VALIDATION OF ADDITIONAL INFRASTRUCTURE AREAS

3.3.1 Background

More detailed project planning by the proponent resulted in changes to the project (detailed in Section 2) that resulted in infrastructure being proposed in areas that were not surveyed during the original BA field survey program. In some cases, it was considered that sufficient data existed from adjacent areas and where new areas were contiguous with areas previously surveyed and mapped (based on interpretation of aerial imagery) these data were extrapolated however, a precautionary approach was applied in this extrapolation. In a number of instances, particularly if surveys had not been previously conducted in these areas or if there was the potential for EECs or threatened species habitat, further ground based validation was considered to be required.

3.3.2 Approach

A field survey was undertaken in conjunction with the hollow-bearing tree (HBT) survey (refer Section 3.4) from 17 to 22 June 2015, to assess areas that were outside of the previous development. The additional survey areas surveyed and their relationship to previous BA survey locations are illustrated in the map set in Appendix E.

Flora surveys consisted of a random meander in each new area, noting dominant flora species in all strata for the purposes of classifying vegetation type and condition. A general fauna habitat assessment was undertaken across each area and any important habitat features such as riparian corridors, rocky outcrops etc. were identified to facilitate the identification of potential threatened species habitat. No detailed flora or targeted fauna surveys were undertaken.

It is acknowledged that the timing of the survey was not optimum with regard to identifying flora species and accurately ascertaining vegetation condition relevant to levels of diversity. However, all of the additional areas surveyed were adjacent to areas previously surveyed in detail at appropriate times for the original BA. This enabled a comparative assessment to be made between adjacent previously surveyed areas and the new additional areas, increasing the accuracy of condition classifications. This work was completed by a senior botanist involved in both the original and these additional flora surveys of the site.

3.3.3 Results

The vegetation types identified during the survey and their general condition are largely consistent with those identified in the original BA. Updated vegetation mapping for the modified project is included in Appendix E. For consistency, the same vegetation classifications utilised and mapped in the BA are utilised in this report.

The White Box, Yellow Box, Blakely's Red Gum Woodland (Box-Gum Woodland) EEC listed under the TSC Act and EPBC Act is considered to largely occur within the project site as described and mapped in the original BA. This community remains the dominant community across the project site ranging from highly disturbed degraded derived grasslands to good condition woodland remnants.

One additional area of the EEC which also meets the criteria of the community listed under the EPBC Act (based on the presence of overstorey regeneration and density only) was identified within the area previously assessed for the proposed transmission line corridor to the south-west of turbines 85 – 87. Specific flora surveys had not been conducted in this area previously and the area was mapped as Scribbly Gum Forest based on vegetation mapping completed as part of the original BA. Based on updated vegetation mapping, up to 110 hectares of Box-Gum Woodland with a native understorey and intact overstorey occurs in this area along with potentially another 200 hectares or more of Box-Gum Woodland as a native ground cover without an overstorey that is continuous with the treed vegetation. The occurrence of the community in this area has been considered in the revised impact assessment in Section 5.

No threatened flora species were observed during the additional survey, although it is acknowledged that the survey timing was not suitable to detect the majority of species with the potential to occur. Habitats within the majority new areas surveyed were considered unlikely to be suitable for threatened flora species. However, given the unsuitable timing of the survey, it was not possible to accurately ascertain the condition of the understorey vegetation in the new area of CEEC identified to the south-west of turbines 85 – 87. A follow-up survey in spring has been included as a recommendation in Section 6 of this addendum to determine the potential for the area to support threatened flora species.

No additional threatened fauna species were recorded during the validation surveys. Habitats for threatened fauna were similar to those previously surveyed and assessed in the original BA and no further follow up fauna surveys are considered to be required.

The original BA identified two weeds listed as noxious within the Booroowa local control area (LCA) that were recorded within the proposal site; Scotch Thistle and Blackberry. Two additional weed species listed as noxious within the Booroowa LCA were also recorded within the proposal boundary, Serrated Tussock (**Nassella trichotoma*) and St. John's Wort (**Hypericum perforatum*). These species were not observed to occur within the areas proposed for development however, as they are known to occur on involved properties and not all areas within the proposal site have been surveyed in detail, there is the potential for these noxious weeds to occur and be spread during the proposed development. These species would be included in the weed management measures recommended in the original BA.

3.4 HOLLOW-BEARING TREE SURVEY AND ASSESSMENT

The following documents the additional hollow-bearing tree survey and assessment in its entirety. No separate report was prepared for this additional work.

3.4.1 Background

In their submission on 22 July 2014, the NSW OEH stated that:

"*All [Hollow-bearing Trees] HBTs within 100m of all infrastructure should be assessed and quantified. It appears that the majority of clearing of forest and woodland, including HBTs, is for tracks and easements, rather than turbines. Therefore, all HBTs to be removed on the alignments of these components of the development should be assessed for threatened species habitat value and mapped to allow the design to avoid, mitigate and offset appropriately.*"

A GIS based desktop assessment methodology (similar to that developed for Epuron's Yass Valley Wind Farm development) was proposed to estimate the number of HBT's to be impacted by the Rye Park Wind Farm proposal. This approach is based on high resolution aerial imagery which allows individual trees in paddock and woodland to be discerned. At the site meeting with OEH on the 10 February 2015, the suitability of using this methodology at the Rye Park Wind Farm site for woodland vegetation was agreed. However, it was not considered appropriate for forest vegetation at the Rye Park Wind Farm site due to the variability of the vegetation across the site. It was decided that field validation was required but that a degree of extrapolation was acceptable. Extrapolation could be undertaken where it could be demonstrated that:

- Patches of vegetation were contiguous, and
- Had been subject to similar past and present management, and
- Vegetation was of a similar composition, and
- Vegetation was on a similar aspect (i.e. north facing, south facing etc.).

Further consultation with OEH occurred regarding the areas to be surveyed, areas across which results would be extrapolated and the specific field methodologies to be employed.

3.4.2 Approach

Desktop assessment for woodland vegetation

The methodology for performing the desktop assessment for HBT impact is based on a method developed for the Yass Valley Wind Farm, developed during a site visit to the Yass Valley Wind Farm site on 17 & 18 June 2014 and confirmed during a teleconference with the Office of Environment & Heritage, the Department of Planning & Environment, nghenvironmental & Epuron on 24 June 2014. This methodology has been adapted for the Rye Park Wind Farm turbine sites and expanded to include an assessment of other permanent infrastructure (i.e. the number of HBTs proposed to be impacted by transmission lines, access tracks, substations etc.).

The desktop methodology was applied to all areas of mapped woodland vegetation in which infrastructure is to be located. The general methodology applied is as follows:

<u>Trees to be counted as hollow-bearing</u>

- All trees with a canopy diameter over 15 m (as discernible from aerial imagery and measured in a GIS) were counted as being hollow-bearing.
- All stags (standing dead trees) identifiable from the aerial imagery were counted as being hollow-bearing.
- Where tree density was sufficiently high that individual trees cannot be discerned, the treed area was outlined and 15 m diameter circles applied to fill the space. This was

considered conservative as in these denser areas, many canopies are likely to be less than 15 m.

Area in which trees are considered to be impacted

- Where a wind turbine is on the top of a hill with land sloping away from the location, a 50 m radius from the wind turbine was used as the potential impact zone within which suitable trees should be identified and counted. This method has been used if the surrounding terrain falls by 10 m in altitude over a length of 50m i.e. gradient >=20%.
- Where the wind turbine is located on flat land or the adjacent land slopes upwards, a 100 m radius from the wind turbine was used as the potential impact zone within which suitable trees should be identified and counted.
- Where the wind turbine is on land which slopes up on one side and down on the other (i.e. side of a hill), a 100 m radius from the WTG on the flat and uphill side and a 50 m radius on the downward sloping side was used as the potential impact zone within which suitable trees should be identified and counted.
- For all other infrastructure (tracks, transmission lines etc.), the construction footprint was used as the basis for determining the extent of impact.

Field surveys of forest vegetation

GIS modelling

Prior to conducting surveys, the forest vegetation within the infrastructure footprint was broken up into a series of 'patches' that were considered to generally contain vegetation of similar condition and age class. Patches were defined in a GIS based on previous survey results, apparent disturbance history (e.g. degree of clearing) and landowner boundary fences that, based on previous observations at the site, often marked a change in land management practices.

Using topographic data within a GIS, all the areas within a patch were further divided based on aspect as either north, east, south or west. Areas for field survey were allocated to cover a sample area of each of these aspects.

For wind turbines, survey areas were focussed on the 100m buffer around turbines as this provided a relatively large sample area (3.14 hectares) for extrapolation. In addition, survey areas also considered:

1. Coverage of trees – areas containing the highest tree coverage were prioritised to provide a 'worst case' sample
2. Variation across the patch – areas were spread out across the patch where possible
3. Ease of access – for survey efficiency areas that were easier to access were favoured

The average HBT density and number of hollows at the wind turbine sites were extrapolated to other infrastructure components, such as tracks and transmission line corridors. There were however, some instances where turbines did not occur in a particular patch and were not able to be extrapolated. Field surveys (detailed below) targeted these areas to address this gap.

The defined patches and survey areas are shown on the mapping in Appendix E. Images of each patch are included in Appendix F.

Field surveys

Field surveys of the defined survey areas were undertaken from the 17 – 22 June 2015 (refer to Appendix E for field survey locations). For wind turbine sites, all trees within a 100m radius of the turbine were surveyed. For track sites, a 100m transect was established along the proposed track route and an all trees

within approximately 20m each side of the centreline were surveyed. For transmission lines, a transect of at least 100m was established along the proposed route and all trees occurring within the width of the proposed conductor clearance corridor were surveyed.

For each tree surveyed that was identified as hollow-bearing, the following data was collected:

- GPS location
- Species
- Diameter at breast height (DBH)
- Height
- Aspect
- Type of number of hollows observed, as either a small (<10cm), medium (10-20cm) or large (>20cm) hollow, and as either a limb or trunk hollow

During the process of refining the survey methodology in consultation with OEH, it was advised that:

"*In terms of demonstrating that patches are suitable for extrapolation, OEH has previously advised that vegetation age and condition must be consistent throughout the extrapolated area. Based on the air photo imagery of patches, they seem quite variable. Your results will need to demonstrate that these vegetation characteristics are consistent within each patch.*"

The field survey aimed to sample the track and transmission infrastructure footprint as comprehensively as possible, to confirm similar age class and condition. General notes were recorded and digital images taken. This information is detailed in Appendix F. It is noted that, if the areas surveyed contained vegetation that was mature and of mixed age class and contained abundant hollows, additional areas in that patch were not investigated further as extrapolating this area provided a 'worst case' scenario.

It was not possible to survey all areas within a patch due to time constraints and access restrictions however, if during the survey it appeared that there may be a reasonable degree of variation in terms of age class and condition across a patch, these areas were prioritised for verification.

The on ground results collected during the field verification process resulted in a number of patches being redefined and new patches being created in the following areas:

- Turbine 129
- Turbine 2 and 4 (separate from Turbine 11 and 12)
- Turbine 83
- Turbine 90
- Turbine 104
- Access along Flakney Creek and High Rock Road

In addition, a number of turbines surveyed found no hollow-bearing trees were present and these were also separated out from the predefined patches

- Turbine 82
- Turbine 98
- Turbine 99
- Turbine 101
- Turbine 127
- Turbine 142

Extrapolation of field survey data across forested areas

All surveyed HBTs that fell within the impact area of the project were utilized for extrapolation. At wind turbine sites, the density was determined for each aspect type. To calculate density, the following formula was applied:

$$\text{Density} = \frac{\text{HBTs impacted (surveyed)}}{\text{Area Surveyed (ha)}}$$

For any additional permanent infrastructure that was not surveyed (i.e. transmission lines, access tracks, substations etc.), the density was assumed to be the average HBT density at turbine sites located within the same patch. In instances where turbines did not occur in a particular patch, additional permanent infrastructure was surveyed instead.

To estimate the total number of HBTs across all turbine sites and additional infrastructure, the following formula was applied:

HBTs (extrapolated) = Density x Area Impacted (ha)

To estimate the total number of hollows across all turbine sites and additional infrastructure, the following formula was applied:

Total estimated hollows = HBTs (extrapolated) x Average number of hollows

3.4.3 Results

Woodland vegetation

The desktop assessment estimated that a total number of 132 HBTs would be impacted by the new preferred project layout in woodland vegetation. The desktop assessment identifying the trees to be impacted is included in Appendix E.

- Woodland – wind turbine footprint 3 HBTs
- Woodland – other infrastructure 70 HBTs
- Woodland – total 73 HBTs

Forest vegetation

The field verified assessment estimated that a total number of 723 HBTs would be impacted by the new preferred project layout in forest vegetation. The patch and field survey locations are included in Appendix F.

- Forest – wind turbine footprint 180 HBTs
- Forest – other infrastructure 543 HBTs
- Forest – total 723 HBTs

Hollow-bearing trees recorded across the site

The results of the hollow-bearing tree surveys and extrapolation of the results are provided in full in Appendix F and mapped in Appendix E. A summary of the results is provided in Table 3-3 below. The implications of the results with regards to impacts on threatened species are discussed further in Section 5.

Table 3-3 Summary of the results of the hollow-bearing tree surveys and extrapolation

						Estimated number of hollows impacted								
Patch	Avg. density (HBTs/ha)	Area impacted (ha)	No. HBTs impacted	Avg. DBH	Avg. Height	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure
A1	1.1	1.3	**2.3**	70.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0
A2	0.0	0.1	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B1	0.0	0.6	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B2	10.1	0.4	**4.0**	52.5	11.8	2.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0
B3	2.5	2.5	**6.4**	110.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S1	5.2	0.8	**7.4**	50.0	10.2	2.5	3.7	0.0	2.5	1.2	0.0	1.2	0.0	0.0
S2	0.0	2.3	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S3	0.0	6.0	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S4	8.5	3.5	**31.8**	48.5	12.7	6.0	21.3	3.8	14.3	3.8	3.8	0.0	0.0	0.0
S5	5.0	2.5	**14.0**	73.8	13.1	11.0	8.0	1.0	3.0	2.0	3.0	1.0	0.0	0.0
S6	0.7	1.5	**1.0**	150.0	18.0	1.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
S7	25.4	2.8	**67.1**	73.4	14.8	10.1	16.8	23.5	30.2	20.1	13.4	6.7	6.7	3.4
S8	6.1	3.8	**19.6**	75.0	14.9	7.8	3.7	0.0	15.1	8.2	0.0	0.0	0.0	0.0
S9	13.4	3.1	**30.0**	114.7	18.4	2.4	16.5	0.0	9.2	2.4	6.7	2.4	0.0	0.0
S10	0.0	19.9	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S11	7.8	6.2	**40.3**	45.8	12.5	10.1	10.1	0.0	30.2	23.5	0.0	0.0	0.0	13.4
S12	3.6	10.2	**35.8**	65.0	14.3	9.2	9.2	0.0	35.8	0.0	0.0	9.2	0.0	0.0
S13	0.0	11.7	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S14	35.8	3.2	**115.2**	52.0	8.0	46.1	92.2	0.0	0.0	46.1	0.0	0.0	0.0	0.0
S15	23.4	4.5	**74.2**	52.2	11.4	35.6	25.6	0.0	25.1	9.1	0.0	7.5	1.0	0.0
S16	0.0	2.7	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S17	0.0	0.4	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S18	9.0	0.9	**7.7**	68.3	15.3	0.0	2.6	0.0	0.0	2.6	0.0	0.0	2.6	0.0
S19	0.0	3.9	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S20	0.0	2.4	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S21	0.0	1.6	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S22	2.1	4.9	**10.8**	86.0	17.1	3.0	0.0	0.0	7.8	3.0	1.5	0.0	0.0	0.0

Patch	Avg. density (HBTs/ha)	Area impacted (ha)	No. HBTs impacted	Avg. DBH	Avg. Height	Estimated number of hollows impacted								
						Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure
S23	15.9	17.1	**242.9**	61.0	11.0	103.6	121.9	0.0	0.0	139.3	39.6	0.0	0.0	0.0
S24	1.4	1.4	**2.0**	70.0	14.5	2.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0
S25	2.2	2.6	**4.4**	103.3	12.7	2.6	0.0	0.0	3.9	0.0	0.0	1.3	0.0	0.0
S26	7.1	0.1	**2.0**	70.0	12.5	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
BX1	2.0	1.5	**3.0**	81.7	13.0	1.0	1.0	0.0	4.0	1.0	0.0	0.0	1.0	0.0
BX2	0.0	0.3	**0.0**	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BX3	0.7	1.5	**1.1**	140.0	18.0	0.0	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0
Total		**128.2**	**723**			**257**	**335**	**29**	**187**	**267**	**68**	**29**	**11**	**18**
						Total Number of Hollows:			**1202**					

3.5 UPDATED DESKTOP ASSESSMENT

A revised desktop assessment, including searches of relevant state and Commonwealth threatened species databases, was undertaken to ensure all relevant species and their nearest location had been considered.

3.5.1 Approach

Searches of State and Commonwealth threatened species databases were undertaken for the original BA to identify threatened and migratory species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), The NSW *Fisheries Management Act 1994* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) with the potential to occur within the new preferred project layout. Searches undertaken included:

1) Atlas *of NSW Wildlife database*, searched by the Upper Slopes sub- region of the Lachlan CMA (searched 23 July 2015). For flora species additional searches were also undertaken for the Murrumbateman sub-region of the Lachlan CMA and the Upper Slopes and Murrumbateman sub regions of the Murrumbidgee CMA (14 October 2014) to account for the lesser dispersal capabilities of plants as the proposal site occurs close to the boundary of these sub-regions.
2) Searches of the Department of Primary Industries – Fisheries and Aquaculture *threatened and protected species records viewer* (23 July 2015). Searches were undertaken for the Lachlan and Murrumbidgee CMA areas for species known to occur in these CMAs.
3) EPBC Act *Protected Matters Search Tool,* using the project area boundary as the search area with a 10 km buffer (searched 23 July 2015).

Given that almost five years has elapsed since these searches were undertaken and the potential for additional species and communities to have been listed during this time, it was considered prudent that updated searches be conducted.

3.5.2 Results

The data base searches returned an additional two threatened flora species, three threatened birds, one threatened amphibian, one microbat and three other mammals compared to the searches undertaken for the original BA. These species are detailed in Table 3-4 below.

Table 3-4 Additional threatened species and communities returned from the updated database searches

Species		Status	
Scientific name	**Common name**	**TSC Act**	**EPBC Act**
FLORA			
Pelargonium sp. Striatellum (G.W. Carr 10345)	Omeo Stork's bill	Not listed	Endangered
Prasophyllum sp. Wybong (C. Phelps ORG 5269)	A leek-orchid	Not listed	Critically Endangered

Species		Status	
Scientific name	**Common name**	**TSC Act**	**EPBC Act**
FAUNA			
Aves			
Ardeotis australis	Australian Bustard	Endangered	Not listed
Ixobrychus flavicollis	Black Bittern	Vulnerable	Not listed
Falco subniger	Black Falcon	Vulnerable	Not listed
Amphibians			
Litoria raniformis	Southern Bell Frog	Endangered	Vulnerable
Mammals (microbats)			
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	Vulnerable
Mammals (other)			
Bettongia lesueur graii	Boodie, Burrowing Bettong (mainland)	Presumed extinct	Extinct
Petrogale penicillata	Brush-tailed Rock-wallaby	Endangered	Vulnerable
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	Not listed

The potential for these species to occur at the project site and be impacted by the development is assessed through habitat evaluation in Appendix G. Based on the habitat evaluation, none of the additional threatened flora or fauna species returned from the updated database searches are considered likely to occur at the project site.

- Omeo Stork's bill – habitat does not occur onsite, very low likelihood of occurrence or impact.
- Leek-orchid – nearest record over 200km from site, very low likelihood of occurrence or impact.
- Australian Bustard – habitat does not occur onsite, very low likelihood of occurrence or impact.
- Black Bittern, Black Falcon – not detected during extensive surveys 2013-2015, very low likelihood of occurrence or impact.
- Green and Golden Bell Frog – not detected during extensive surveys 2013-2015, very low likelihood of occurrence or impact.
- Corben's Long-eared Bat – not detected during extensive surveys 2013-2015, range does not coincide with the project location, very low likelihood of occurrence or impact.
- Burrowing Bettong – presumed extinct, very low likelihood of occurrence or impact.
- Brush-tailed Rock-wallaby, New Holland Mouse – not detected during extensive surveys 2013-2015, habitat not optimal and nearest records some distance from the project site. Very low likelihood of occurrence or impact

Additional threatened species known to occur in the study area

Desktop investigations and additional information provided by South East Local Land Services, OEH and NSW Fisheries identified the presence of an additional threatened that should be considered:

- Southern Pygmy Perch (*Nannoperca australis,* listed as Vulnerable under the TSC Act), within Blakney and Pudman Creeks (DPI 2015) which cross the study area.
- Yellow-spotted Tree Frog (*Litoria castanea,* listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act) within Blakney Creek.

Neither of these species were returned by the database searches. These species have been included in the habitat evaluation in Appendix G and are discussed further in Section 5.7 of this addendum.

4 ADDITIONAL INFORMATION IN RESPONSE TO SUBMISSIONS

Responses to the submissions from OEH are provided in Appendix B. Where additional detail and/or analysis was required, it is provided in this section. This includes the following key issues:

- Potential impacts to the Superb Parrot nest tree west of turbine 143
- Impacts to known Striped Legless Lizard habitat
- Impacts to high constraint Golden Sun Moth areas
- Turbines in close proximity to high constraint contiguous woodland
- Impacts to habitat around turbines 102, 103 and 104
- Revised vegetation classification and condition
- Impacts to local and regional Wedge-tailed Eagle ecology

4.1 POTENTIAL IMPACTS TO THE SUPERB PARROT NEST TREE WEST OF TURBINE 143

Issues raised by OEH

The high constraint Superb Parrot nest-tree buffer west of turbine 143 appears to have a road and underground cable running through it. Other hollow-bearing trees that may be potential Superb Parrot nest trees should be preserved within buffers and construction should be excluded.

Response to issues

The original mitigation measures (Table 8-3 in the BA) states “Maintain a 100 m buffer around identified and potential Superb Parrot nest trees (refer Appendix E.4) in the southern section of the project area”. The tree in question is mapped in Appendix E.4 of the original BA and it is acknowledged that an access track and transmission line do cross the buffer area, though they would not require the removal of this tree.

The objective of the 100m buffer was to reduce the potential impacts of turbines on fauna that may be utilising hollows in close proximity to turbines. The two main potential impacts to avifauna associated with having turbines in close proximity were identified in the original BA as:

- Blade strike
- Effective removal of nesting resources through avoidance behaviours

Both of these potential impacts are associated with turbines. The presence of an access track and transmission line would not result in these potential impacts. Impacts to known and potential Superb Parrot nest trees from tracks and transmission lines would result only from direct clearing of these trees. The tree in question is outside of the conductor clearance areas for both the preferred and alternate transmission line routes and the footprint of the proposed tracks (refer Figure 4-1).

The mitigation measure that specifies the 100m buffer has been reworded to apply specifically to turbine infrastructure. The measure applies to all identified potential Superb Parrot nest trees.

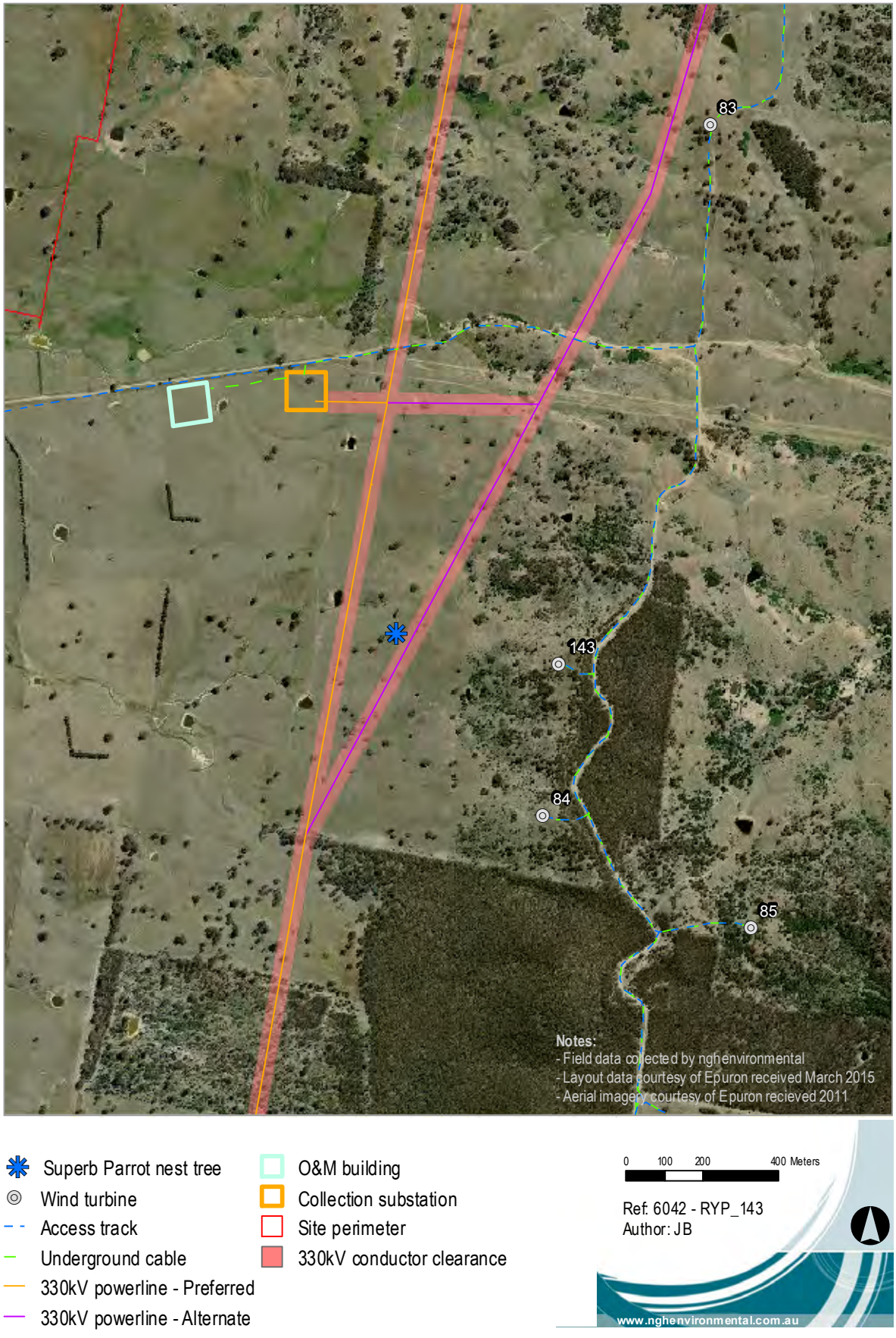


Figure 4-1 Infrastructure in proximity to the Superb Parrot nest tree west of turbine 143

4.2 IMPACTS TO KNOWN STRIPED LEGLESS LIZARD HABITAT

Issues raised by OEH

The high constraint area for Striped Legless Lizard (SLL) at turbine 27 is impacted by construction of turbines and tracks. Given this is considered another 'significant' impact; a well-defined offset area of known habitat must be included to demonstrate that an 'improve or maintain' outcome will be achieved for this species.

Response to issues

Turbine 27 and associated infrastructure has been removed from the proposal to avoid impacts to known Striped Legless Lizard habitat in close proximity to the known record.

Advice was sought from OEH regarding how the extent of 'known habitat' should extend from the record. Advice received from Rod Pietsch – OEH Senior Threatened Species Officer on the 30 September 2015 states that "*The species was recorded therefore all suitable habitat is known habitat regardless of distance from the record*". Information was provided to assist in the identification of suitable habitat as follows:

"In the past, the species was thought to be a native grassland specialist occurring only in native tussock grasslands dominated by plant species such as Austrostipa bigeniculata (tall spear grass) and Themeda triandra (kangaroo grass) (e.g. Osborne et al. 1983; Coulson 1990). These grassland types are still considered to be the primary habitat for the species (Dorrough and Ash 1999; O'Shea 2005, 2013; Evans unpublished ms.), and this is therefore of importance in the mapping and conservation of regional populations of striped legless lizards (Candy 2008). Grasses that comprise the main tussock over-storey (the major ground cover) in native grasslands (and native pasture) where striped legless lizards have been recorded in the Canberra region include tall spear grass (Austrostipa bigeniculata), kangaroo grass (Themeda australis), wallaby Grasses (Rytidosperma spp.) and red-leg grass (Bothriochloa macra). Recent surveys also indicate that breeding populations of striped legless lizard can survive in some exotic tussock grasslands that are contiguous with, or near, occupied sites in native pasture or native grassland. In the ACT large breeding populations have been found in grasslands dominated by phalaris aquatica. These sites also often include other introduced grasses such as Cocksfoot (Dactylis glomerata), Brome Grass (Bromus spp.), Wild Oats (Avena sp) and Yorkshire Fog Grass (Holcus lanatus) (e.g. Rauhala et al. 1995, Nunan 1995; Dunford et al. 2001; Biosis 2012). ***It is now considered that the presence of a relatively dense and continuous structure of moderate to tall tussock grasses, rather than the floristic composition of the grasslands, may be a more important factor in determining the occurrence of the species*** *(Dorrough and Ash 1999; O'Shea 2013). In addition, Dorrough (1995) and Dorrough and Ash (1999) considered that disturbances, such as ploughing and denudation of ground cover through heavy grazing, have had a major negative influence on the occurrence of the species, regardless of vegetation composition."*

As part of the original BA, specific surveys were undertaken and habitat for this species was mapped across the site boundary within areas proposed for development and those available for offsetting (refer Appendix C.1). Habitat was mapped based on the following condition classes:

Excellent	Tussock forming native grasses dominant (exotic species may be present but in lower abundance). Tussock forming species relatively dense and continuous (≥ 50 % cover). Rock and ground timber present. Low - mod grazing pressure.
Good	Tussock forming native or exotic grasses dominant. Tussock forming species relatively dense and continuous (≥ 50% cover), rock and ground timber present or absent. Or if tussock forming species not continuous, rock and ground timber present. Low - mod grazing pressure.
Moderate	Tussock forming grasses present (native or exotic species). Tussock forming species moderately dense (≤ 50% cover). Rock and ground timber generally absent or in low abundance. Low - mod grazing pressure.
Low	No to little tussock forming species or rock or ground timber shelter available. Mod-high grazing pressure.

Based on the advice from OEH, tussock structure appears to be the most important factor in defining suitable habitat for this species. Habitat mapped as excellent or good condition is that where a relatively dense and continuous (≥ 50%) cover of tussock forming species is present and as such these areas are considered to constitute suitable habitat for the SLL.

The advice from OEH states that "*all suitable habitat is known habitat regardless of distance from the record*" however, the suitable habitat at the site is present as disjunct patches across a very broad areas separated by expanses of less suitable habitat (refer to mapping in Appendix E). Therefore, known habitat has been defined as all suitable habitat that is contiguous with that in which the known record was found. This approach was supported by OEH (Rod Pietsch – Senior Threatened Species Officer pers. comm. 13.10.15). This includes areas mapped as excellent and good condition habitat separated by no more than 30 meters. The area of known habitat is mapped on Figure 4-2 and in Appendix E and comprises approximately 512 hectares.

Although infrastructure was removed from the immediate vicinity of the known record to avoid impacts to the known SLL record, other infrastructure components remain within the defined known habitat area, as shown below. As such, approximately 10.5 hectares of known habitat would be impacted by the current proposal. Impacts to the SLL are discussed further in Section 5.4.

The revised offset strategy for the proposal includes provision for offsetting SLL habitat (refer to Appendix D). The Offset Strategy demonstrates that it appears feasible to offset the predicted 18.67 ha of habitat within the project boundaries.

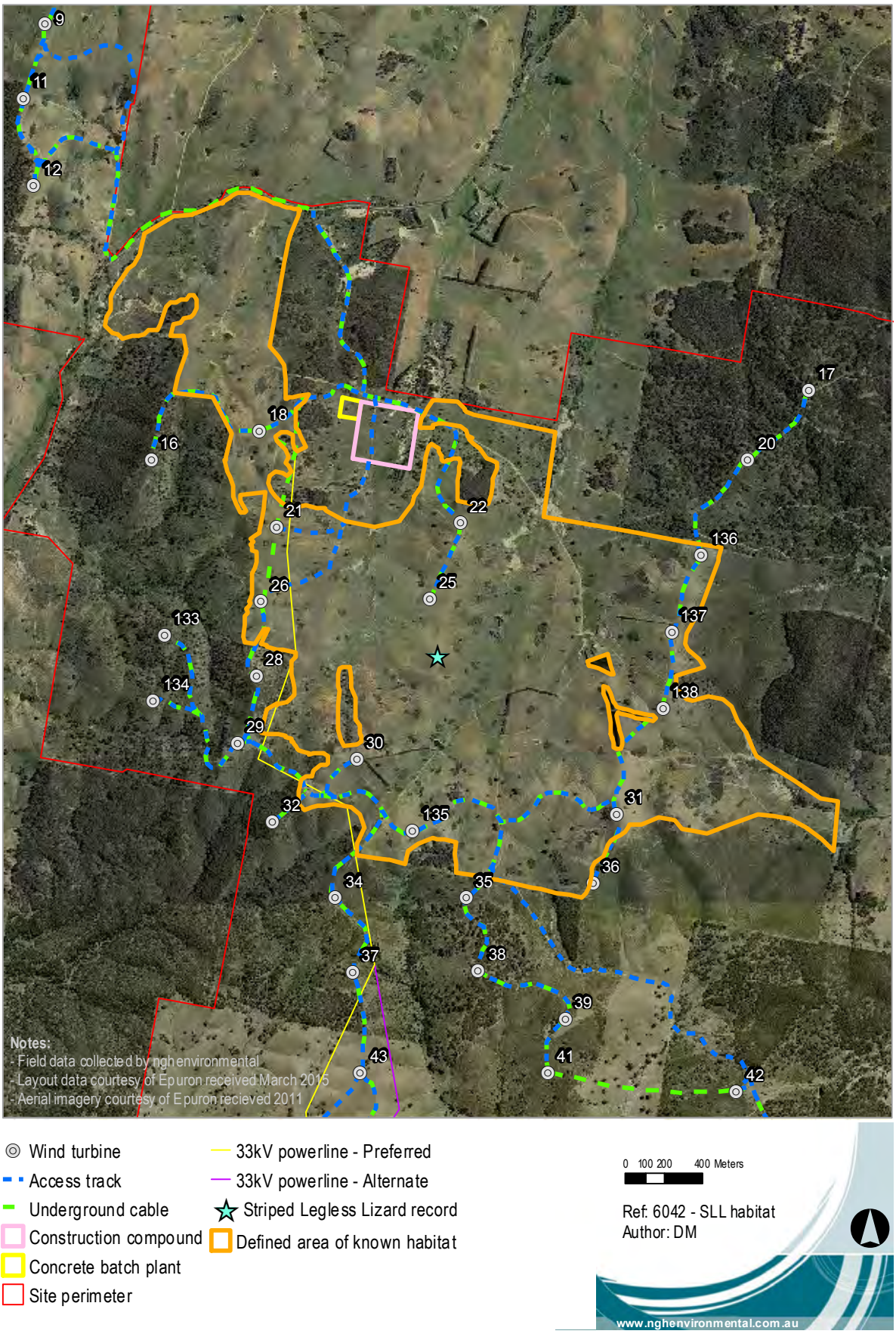


Figure 4-2 Habitat defined as known habitat for the Striped Legless Lizard

4.3 IMPACTS TO HIGH CONSTRAINT GOLDEN SUN MOTH AREAS

Issues raised by OEH

Road and cables going through high constraint Golden Sun Moth areas northwest of turbine 73, west of turbine 98 and 99, and south of turbine 47. Infrastructure should be re-routed outside of these constraints areas if possible. If not these areas are required to be offset with Golden sun moth habitat.

Response to issues

Infrastructure has been removed, avoiding impacts to high constraint known Golden Sun Moth habitat west of turbines 98 and 99. However some residual impacts remain in the potential Golden Sun Moth areas northwest of turbine 73 and south of turbine 47. In these areas it is not possible to relocate the overhead powerline without creating greater impacts to other high constraint vegetation areas.

Impacts in these areas will be offset with Golden Sun Moth habitat as detailed in the revised offset strategy for the proposal (refer Appendix D). The strategy demonstrates that required offsets for the proposal are considered feasible within the site boundaries. Upper estimates and precautionary assumptions have been used and on this basis, potential Golden Sun Moth offset areas do not fully satisfy the 'worst case' offset requirement. However, subject to final design and targeted surveys, it is considered highly likely the actual offset requirements of the final project footprint will be met.

4.4 TURBINES IN CLOSE PROXIMITY TO HIGH CONSTRAINT CONTIGUOUS WOODLAND

Issues raised by OEH

High constraint mapping within large contiguous woodland and forest blocks should consider the edge effects from widening of roads and also indirect impacts of close proximity to turbines from noise and disturbance. The distance of disturbance impacts should be at least 100 m and so the constraint mapping needs to be checked at a finer scale to see where turbines may overlap.

Response to issues

Most tracks near areas of large contiguous woodland already exist and do not need substantial widening. The greatest impact would occur from new tracks, diverging from the main track, to access turbine sites. This impact cannot be reduced further without moving or removing wind turbines.

Regarding wind turbines, appropriate buffer distances were discussed during an on-site visit with OEH and NGH Environmental (February 2014) where it was decided to apply the formula presented in Natural England (2012). In the absence of any other research-based guideline, this was chosen as an appropriate approach is it is the best information currently available. The formula was applied which resulted in a buffer distance of 70m.

All turbines were subsequently repositioned at least 70m from areas mapped as high constraint contiguous woodland with the exception of Turbine 96. This turbine was inspected by OEH, Trustpower and NGH environmental (February 2015). During the site visit it was apparent that this turbine was situated in a partially cleared area but there were areas of continuous vegetation surrounding the site. It was also noted that the placement of the turbine appeared to lower in the landscape than two adjacent hill tops which could potentially result in the rotor sweep area being lower than surrounding vegetation which would substantially increase collision risks in the area. It was decided that a 'site specific analysis' should be

undertaken considering topography and surrounding vegetation to analyse the potential for collision risks in this area.

The topographic situation of the currently proposed position of turbine 96 is presented as Figure 4-3. The profile was selected to illustrate the greatest changes in positive elevation either side of the turbine. Maximum dimensions of a 130 metre rotor diameter at a hub height of 92 meters were used to account for a worst case scenario. Similarly, a maximum vegetation height of 20m has been used where typically trees were estimated to be at a maximum height of approximately 18m in the area (based on the results of the HBT surveys that were conducted at the turbine site). Based on the analysis in Figure 4-3, the base of the turbine is approximately four to five metres below the two topographic high points to the north and south. In this position, the rotor sweep area remains above the worst case tree height of 20 metres by 5m. It also remains above the line connecting the two highest points of the canopy by approximately three meters. As such, avifauna flying within the confines of the tree canopy are considered unlikely to be at risk of collision. Avifauna that fly above the canopy will be at an increased risk of collision however, this risk is only increased by a distance of five metres compared to turbines that are positioned on the hilltops in vegetated areas.

A revised assessment of the general collision risks to threatened avifauna based on the changes to the turbine dimensions is provided in Section 5.6. No threatened bird or bat species were recorded during the surveys in the vicinity of turbine 96. A moderate density of HBTs are present in the surrounding more intact vegetation that support a range of mostly small to medium hollows and occasional large hollows suitable for hollow-dependant fauna.

Other turbines requiring consideration

During the detailed HBT surveys (refer Section 3.4) it was observed the turbine 90 was also located in a topographic situation where the land appeared to slope upwards from the proposed location of the turbine on the northern and southern sides. The overstorey in this area, although partially cleared, was comprised of mature trees with the heights of the HBTs recorded in the range of 18 to 22 metres (which was at the upper range of all HBTs recorded). It is recommended that further investigation be conducted with regard to the potential for collision risks for this turbine. This has been included as a recommendation in Section 6 of this addendum.

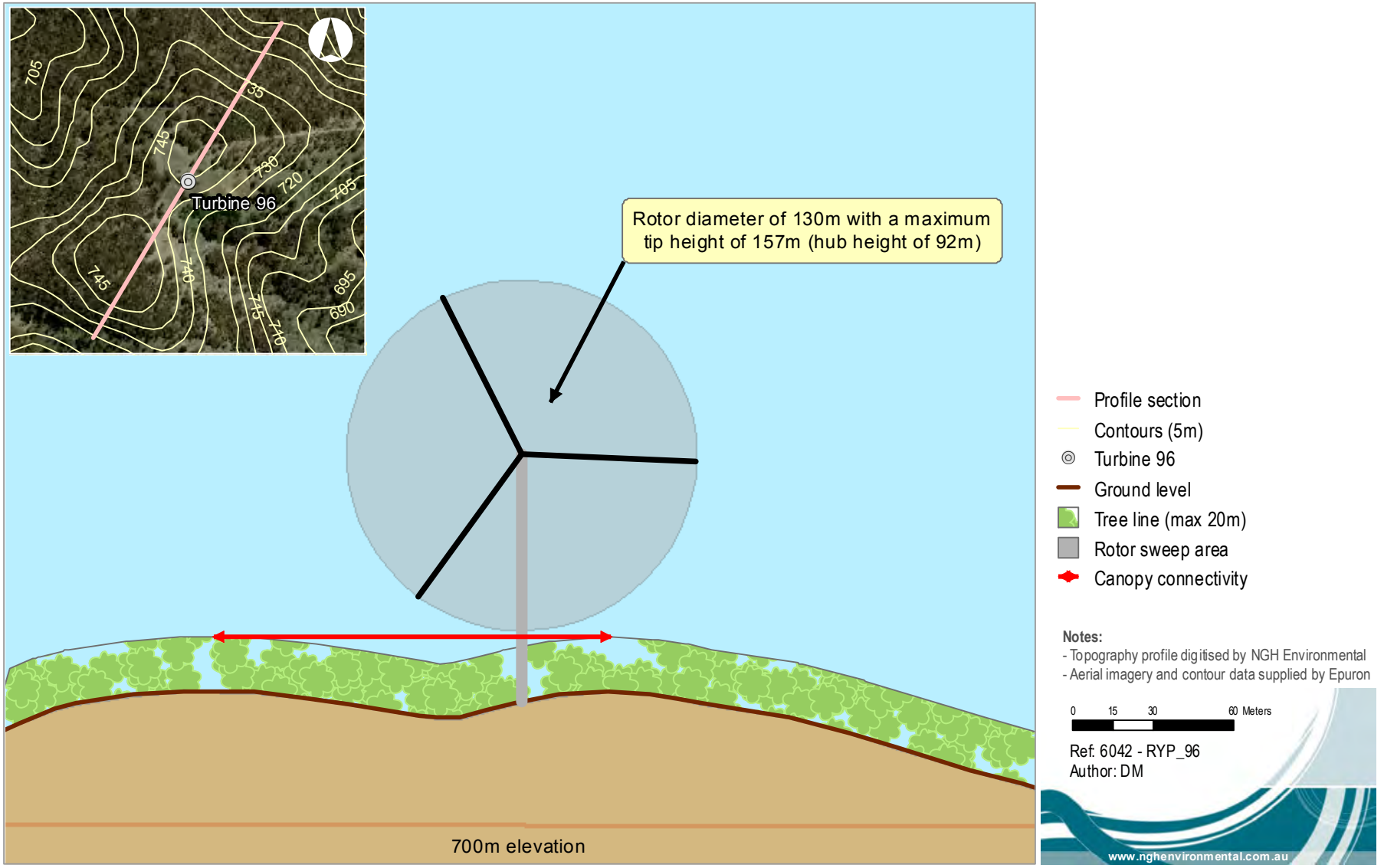


Figure 4-3 Site specific topographic analysis for turbine 96

4.5 IMPACTS TO HABITAT AROUND TURBINES 102, 103 AND 104

Issues raised by OEH

The EIS clearly identifies the moderate constraint area forest/woodland remnant in proximity to turbines 102, 103 and 104 as known habitat for threatened woodland birds and containing high numbers of threatened species. Construction of turbines and the creation of new easements through this remnant will inflict edge effects such as weed invasion and provision of suitable habitat for the aggressive Noisy Miner, whose impacts on small woodland birds is listed as a Key Threatening Process under both NSW and Commonwealth legislation.

Response to issues

The Brown Treecreeper was observed in the area closest to turbine areas; however, the other species (Hooded Robin, Scarlet Robin and Flame Robin) were observed to be generally downslope of turbines in areas that would not be impacted by the development.

The areas in which the Hooded Robin, Scarlet Robin and Flame Robin were observed are already subject to high levels of disturbance (i.e. the presence of widespread Sifton bush and past clearing). In particular, the area where the Hooded Robin and Flame Robin were observed was within a cleared paddock where timber was prevalent on the ground from ringbarked trees. This area is already highly disturbed and surrounded by ringbarked trees and will not be directly affected by the proposal. Further, birds were not observed to fly within the impact area (i.e. rotor-swept area). They generally were observed lower in the landscape and within the height of the canopy. No direct impact is considered likely for these species, and a higher constraint level is not considered justifiable. Regarding indirect impacts, as stated, the area is already subject to high levels of disturbance.

Siting of turbines in this area has targeted the areas of highest disturbance within the project area to avoid better quality habitat.

Mitigation measures to control weeds and manage edge effects are already prescribed. But, these woodland birds were observed in areas of high degradation already, obviously feeding and foraging from the fallen timber from ringbarked trees.

NGH acknowledges the Noisy Miner as a key threatening process to woodland birds, yet the Noisy Miner was not commonly observed at the wind farm site and the threatened birds in question were optimising already disturbed habitat that the Noisy Miner is said to thrive in (i.e. cleared grassy areas near woodlands). The development in this area will cause some disturbance but is unlikely to contribute more threatening processes than those that already exist at the site in this location.

4.6 REVISED VEGETATION CLASSIFICATION AND CONDITION

4.6.1 Biometric vegetation types

The original BA for the project described and mapped the vegetation based on the dominant species present and where possible classified the communities present using the NSW Vegetation Classification and Assessment developed for the South Western Slopes (Upper Slopes) Bioregion by Benson (2008) and Benson *et al.* (2010). The Benson classifications were used as, at the time, they provided recent context for each vegetation type, particularly in terms of areal estimates of remaining extent and reservation, which were critical for assessments of conservation status and impact significance.

The Biometric Vegetation Types Database (OEH 2012) classification supersedes that of Benson (2008) and Benson *et al.* (2010), draws upon a number of previous classifications, including those of Benson. It is the preferred classification of the NSW OEH and has also been used in the assessment of suitable offsets for the project (refer to Section 6.2). As such it is considered to be the most relevant vegetation classification for the proposal. The original classifications used in the BA and their Biometric vegetation type equivalents are detailed in Table 4-1 below.

Table 4-1 Native vegetation types mapped within the project site and the Biometric equivalents

Vegetation types as mapped and classified in the BA and this addendum	Benson ID	Equivalent Biometric vegetation type
Inland Scribbly Gum – Red Stringybark open forest	349	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)
Blakely's Red Gum - Yellow Box grassy tall woodland (and derived grassland)	277	Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (LA120)
Argyle Apple – *Acacia mearnsii* valley open forest	344	Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands and South Western Slopes (LA102)
Brittle Gum - peppermint open forest	296	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands (LA124)
Red Box Woodland – likely a form of Inland Scribbly Gum – Red Stringybark open forest	349	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)
Phragmites Swamp - could be a component of Tussock grass- sedgeland fen – rushland – reedland wetland	335	Atypical form of Wetlands on alluvial valley floors of the South Eastern Highlands (LA214)
Native Pasture – derived from the clearing of Inland Scribbly Gum – Red Stringybark open forest	349	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)

4.6.2 Revised condition classes for Box-Gum Woodland

In their submission OEH requested that:

EEC within the project area would be classified under OEH Biometric definition. References to poor and low quality ECC is confusing. Adequate description of the quality of the Box gum woodland need to be provided, the moderate to good condition Box gum woodland should be described to explain the condition of the vegetation. The Box gum woodland should be described as

- *Box gum woodland with a native understorey and intact overstorey,*
- *Box gum woodland with an intact overstorey and non-native in the groundcover and*
- *Box gum woodland as a native ground cover without an overstorey.*

These condition classes have been assigned to the Box-Gum Woodland EEC. The results are mapped in Appendix E. Impacts to the Box-Gum Woodland EEC are discussed with reference to these categories in Section 5.2.1.

4.7 IMPACTS TO LOCAL AND REGIONAL WEDGE-TAILED EAGLE ECOLOGY

Issues raised by OEH

Some analysis [required] *regarding the potential impact of collision risk of 0.05 Wedge-tailed Eagles per turbine per year on the local and regional ecology.*

Response to issues

Collision risk

Using information available at the time of the original Biodiversity Assessment (2014), a collision risk of 0.05 Wedge-tailed Eagles per turbine per year (WTE/turb/yr) was calculated. It is acknowledged that this figure was based on limited data that impacts on its precision.

To provide a response, this figure has been reviewed in light of more recent data. We have considered the following:

- Published data by Hydro Tasmania and associates
    - Studland Bay and Bluff Point wind farms – 10 year averages (Hull & Muir 2013)
    - Musselroe wind farm – two years monitoring 2013 – 2015 (Woolnorth Wind Farm Holding 2014; 2015)
- Unpublished data collected by NGH Environmental
    - Wind farm on Southern Tablelands – nine months monitoring in 2015
    - Wind farm on Southern Highlands – two years monitoring DATE RANGE

Table 4-2 Updated collision monitoring data to calculate average collision risk for Wedge-tailed Eagle

Hydro Tasmania			NGH Environmental		
Studland Bay[1]	Bluff Point [1]	Musselroe[2]	unpubl. [3]	unpubl. [4]	Average
25 turbines	37 turbines	56 turbines	15 turbine	67 turbines	
0.04	0.04	0.04	0.13	0.02	0.054

[1] Hull & Muir 2013, [2] Woolnorth Wind Farm Holding 2014; 2015 [3] Wind farm on Southern Highlands monitored by nghenvironmental [4] Wind farm on Southern Tablelands monitored by nghenvironmental

Using all of the available information, 0.05 WTE/turb/yr remains an average collision risk figure, as shown in Table 4-2. There are limitations to this figure, in particular the use of short-term data. It is our experience that one major event can drive up averages that would otherwise even out over a long-term dataset. The 0.13 WTE/turb/yr cited above was as a result of a specific combination of cold and windy weather and high lambing mortalities in paddocks near turbines that drew in three WTEs in rapid succession. Subject to improved onsite management, as similar event has not been noted as occurring again. Therefore, this case reflects poor management and specific risk factors more so than general WTE flight behaviour and ecology.

Using only the published long term monitoring data at Studland Bay and Bluff Point wind farms, a lower figure of 0.04 (WTE/turb/yr) is derived. However, this is still limited – Hull & Muir (2013) state the *"inconsistent results [that were] found across studies suggests that the response by eagles to wind farms is*

highly variable, and likely to be species or site-specific." We agree that results cannot be reliably extrapolated to other areas and accurate information comes from onsite monitoring and reflects onsite management.

The site-specific collision risk at Rye Park is expected to be much lower than averages cited above. It has been possible to build upon lessons learnt elsewhere to reduce the risk of collision at Rye Park by minimising high risk turbine placements. The Biodiversity Assessment states:

> "*To minimise risk to Wedge-tailed Eagles, proposed turbine locations at Rye Park were classed as high or moderate risk ... Turbines [proposed] in high risk locations have been moved"* (p.102).

For example, one Wedge-tailed Eagle nest was found along the upper slope of between Turbine 90 and Turbine 92. This nest was inactive at the time of the survey. A proposed turbine was moved and the closest turbine (Turbine 90) is now more than 500m away from this nest. This is consistent with the standard buffer used for the Tasmanian threatened sub-species (MacMahon, A. 2010) and is believed to reduce collision risk to resident individuals.

Although not identified in extensive onsite surveys, it is acknowledged that there are likely to be other Wedge-tailed Eagle nests in the wind farm area, as pairs of Wedge-tailed Eagles would usually have two or more nests in their breeding territory (Jerry Olsen pers. comm. to Bianca Heinze, 2010). However, none have been found close to proposed turbine locations to date.

Potential impact on local and regional ecology

Notwithstanding limitations, some general assumptions can be made about the population of Wedge-tailed Eagles at the Rye Park site (the 'local population'). Assumptions can be made based on the following ecological information:

- An exclusive territory is occupied within a larger, possibly overlapping, home-range by breeding pairs or non-breeding birds (Fuentes at al 2007; Australian Museum 2010).
- Estimated territory sizes vary in studies from three square kilometres to 1200 square kilometres, although most studies estimate between 30 and 35 square kilometres (Cherriman 2004).
- Differences in territory size estimations arise from methods used to calculate territories, as well as geographical and biological differences such as habitat type and resource availability (Cherriman 2004).
- Leopold & Wolfe (1970) estimated 31 square kilometres territory size in rural areas near Canberra. Given the proximity and similarity of habitat type to our site, their estimations are the most appropriate to extrapolate for Rye Park.

The broader Rye Park Wind Farm project site boundaries measure 14 000 ha or 140 km2. Using a conservative estimate of 30 km2 territories, there could be 4.6 territories over site occupied by breeding pairs or non-breeding individuals. Rye Park Wind Farm could have a resident population of four to nine adult Wedge-tailed Eagles, with additional dependent young. Average annual breeding success for the species has been estimated at between 0.73 – 1.1 young per pair (Cherriman 2013). Assuming four breeding pairs, there could be three to four fledglings each year. Thus the local population can be estimated at four to 13 individuals. Limitations to these estimates include: actual territories have not been observed; not all habitat in the wind farm area would be occupied by eagles and; population dynamics have not considered.

The Biodiversity Assessment (2014) concluded:

> *"Mortality through collision of some bird species with low reproductive rates, such as raptors, could represent a 'mortality sink'... [although] mortalities are not expected to affect local or regional populations by outstripping the reproductive capacity of any species"* (p.108).

At this stage, there is insufficient detailed site specific information to further analyse the effect of potential collision deaths of Wedge-tailed Eagles on the local and regional ecology beyond the analysis already undertaken within the Biodiversity Assessment. Further analysis for Rye Park could be undertaken using abundance and collision data collected during baseline (pre-construction) and operational phase monitoring as part of a Bird and Bat Monitoring Program. The proponent has committed to the development of a Bird and Bat Monitoring Program prior to construction of the wind farm. This data requirement could be built into the monitoring requirements, addressing important knowledge gaps for this species in this area.

Information gathered during Bird and Bat Monitoring Plans should be made publically available. As noted by Woehler and Belbin (undated), "*The availability of bird and bat strike data from all Australian wind farms is fundamental to furthering research into bird strikes*". The more data that is shared, the more reliable extrapolation there will be for future impact assessments.

4.8 HABITAT VALUES OF SIFTON BUSH SHRUBLAND FOR THREATENED WOODLAND BIRDS

Issues raised by OEH

Sifton Bush shrubland, despite being a disturbed shrubland community, is known to be an important habitat for threatened woodland birds – recent research from Victoria has shown the importance of these shrublands in overcleared landscapes.

Response to issues

The preferential siting of turbines and infrastructure in areas colonised by Sifton Bush (*Cassinia arcuata*) follows the principle of avoid, minimise and mitigate. Turbines and infrastructure have been located in the more disturbed areas that have been subject to intense and ongoing disturbance to avoid better areas of less disturbed forest and woodland habitat.

Sifton Bush is widespread across the proposal site and the removal of 27.9 hectares is considered to be minor in the context of the 2030 hectares mapped as remaining which will continue to provide habitat for woodland birds. During the surveys, threatened woodland birds were only recorded within Sifton Bush shrubland near Turbine 104 and a large continuous patch of Sifton Bush is present in the area of the known bird records. Given the majority of the Sifton Bush shrubland was not found to support threatened woodland birds, clearance of a limited amount of this shrubland is considered a better alternative than clearance of less disturbed vegetation types that provide higher quality habitat for threatened woodland birds.

Further, as Sifton Bush is a vigorous coloniser which out-competes other native plant species it is likely this shrubland will become more prevalent across the site and potentially prevent other forest and woodland vegetation types from regenerating in previously cleared areas. Colonising Sifton Bush was observed at a number of locations in previously cleared pastures where grazing intensity appeared to be too low to control the establishment of young plants (refer Figure 4-4).

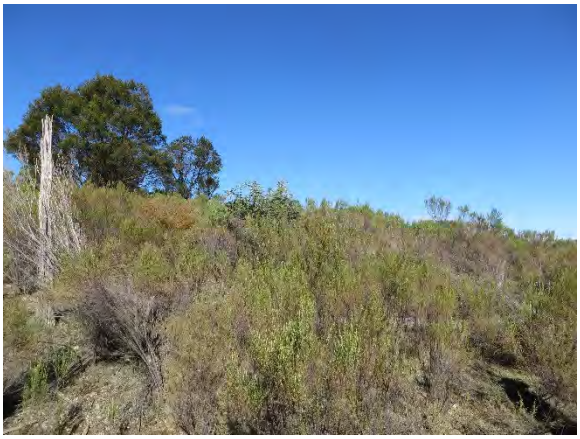



Figure 4-4 Areas densely colonised by Sifton Bush in the project area

4.9 ADEQUACY OF THREATENED FLORA SURVEYS

Issues raised by OEH

Several comments were made in the submission from OEH relevant to the adequacy of the threatened flora surveys:

1. (The) *Environmental Assessment (EA) must provide further information and clarification on the threatened flora surveys undertaken to date, including the timing of surveys and the species targeted.*
2. *All areas of woodland and grassland potentially impacted by the development must be surveyed for specified threatened flora species, including the Crimson Spider Orchid, in the appropriate season*
3. *OEH considers that the information on threatened flora surveys provided in the EA and Biodiversity Assessment (BA) does not satisfy the DGEARs.*

Response to issues

With respect to threatened flora species, the DGEARs (14 February 2011) for the proposal state that the following threatened flora species were to be considered:

Subject species

Hoary Sunray	*Leucochrysum albicans* var. *tricolor*	Endangered (EPBC)
Crimson Spider Orchid	*Caladenia concolor*	Endangered (TSC) Vulnerable (EPBC)
Doubletail Buttercup	*Diuris aequalis*	Endangered (TSC)
Silky Swainson-pea	*Swainsona sericea*	Vulnerable (TSC)
Yass Daisy	*Ammobium craspedioides*	Vulnerable (TSC)

Additional species

Dwarf Kerrawang	*Rulingia prostrate*	Endangered (TSC)
Mountain Swainson Pea	*Swainsona recta*	Endangered (TSC)
Tarengo Leek Orchid	*Prasophyllum petilum*	Endangered (TSC)

Button Wrinklewort	*Rutidosis leptorrhynchoides*	Vulnerable (TSC)
Aromatic Peppercress	*Lepidium hyssopifolium*	Vulnerable (TSC)
Robertson's Gum	*Eucalyptus robertsonii* subsp. *hemisphaerica*	Vulnerable (TSC)
Black Gum	*Eucalyptus aggregata*	Vulnerable (TSC)

In line with the requirements of the DGEARs that "*consideration shall be given to the habitat types present within the study area, recent records of threatened species, populations or ecological communities in the locality and the known distributions of threatened species*", all of the above species were considered for their potential to occur at the proposal site.

The majority of the above species were included within a threatened species habitat evaluation (included as Appendix B in the original BA) with the exception of the Doubletail Buttercup, Dwarf Kerrawang, Aromatic Peppercress and Robertson's Gum. These species were not returned from database searches due to the fact that the western most known distribution of the Doubletail Buttercup and Dwarf Kerrawang is approximately 50km and 60km east of the site respectively, the nearest record of the Aromatic Peppercress is approximately 50 kilometres north-west of the site and the southernmost extent of the known distribution of Robertson's Gum is approximately 70 kilometres north-west of the site. Given the known distributions of these species, it was considered highly unlikely that these species would occur at the site and they were not assessed further. Numerous other species additional to those listed in the DGEARs were however, returned by the database searches and were evaluated for their potential to occur at the site. In this way, we consider the assessment is more appropriate to the site than addressing verbatim the provisions in the DGEARs.

Based on the threatened species habitat evaluation, which considered the habitat types present, all known records and the known distributions of all threatened species returned by the database searches, three threatened flora species were considered to have potential to occur at the site; Hoary Sunray, Yass Daisy and Tarengo Leek Orchid. At the time the original BA was written the Crimson Spider Orchid was considered unlikely to occur at the site as the nearest known record for the species was 95 kilometres west of the site however, the species was recorded more recently in Bango Nature Reserve which adjoins the wind farm site and it was concluded that this species also had the potential to occur (this species now addressed specifically in Section 3.2 of this addendum).

The DGEARs for the proposal detailed the survey requirements for the above four species. These requirements are included below as Table 4-3.

Table 4-3 Survey Requirements for Subject Species – *extract from DGEARs for Rye Park Wind Farm*

FLORA	SURVEY REQUIREMENTS
Silky Swainson Pea *(Swainsona sericea*), Mountain Swainson Pea *(Swainsona recta),* Tarengo Leek Orchid *(Prasophyllum petilum),* Crimson Spider Orchid *(Caladenia concolor),* and Yass Daisy {*Ammobium craspedioides).*	Systematic surveys using evenly spaced transects located about 10 m apart through all areas of woodland/grassland must be undertaken. Survey should be undertaken during the flowering periods; Silky Swainson Pea — September to December Mountain Swainson Pea and Tarengo Leek Orchid - October Crimson Spider Orchid - late August - September Yass Daisy - Spring. but also recognisable several months before hand and after flowering by its foliage Where possible, flowering should be confirmed at the nearest known site prior to surveys being undertaken. DECCW should be consulted to known population and seasons, and appropriate survey methods.

The survey methodologies employed for these species are detailed in Table 4-4 below. The DGEARs specified that surveys were to be undertaken through **all** areas of woodland/grassland however, this was not considered to be appropriate given the high levels of degradation and disturbance across the majority of the woodland and grassland at the site. Further, the Crimson Spider Orchid was known to occur within forest vegetation at the known location adjacent to the site. **All** woodland, grassland and forest habitats that were considered to provide the **most suitable** habitat for the threatened flora species with potential to occur at the site were surveyed in areas where impacts were proposed. The surveys are considered to meet the survey requirements of the DGEARs as other woodland and grassland areas to be impacted were considered unlikely to support threatened flora species.

Table 4-4 Details of targeted surveys undertaken at Rye Park Wind Farm

Target species	Survey date	Survey areas	Survey methodology	Known flowering confirmed?
Hoary Sunray **Yass Daisy** **Tarengo Leek Orchid**	31 October – 4 November 2011	High quality Box-Gum woodland derived grassland within originally proposed eastern substation site (removed during layout modifications to avoid sensitive areas)	Evenly spaced transects approximately 10m apart	Yass Daisy known to be flowering at other project sites in Yass Hoary Sunray confirmed flowering throughout Queanbeyan Known populations of Tarengo Leek Orchid not checked however, is known to flower October - November
	5 November 2013	Proposed transmission corridors between turbine 109 (now removed to avoid Superb Parrot habitat) and turbine 120	Evenly spaced transects approximately 10m apart	Yass Daisy confirmed flowering along Blakney Creek North Road Hoary Sunray confirmed flowering throughout Queanbeyan Known populations of Tarengo Leek Orchid not checked however, is known to flower October - November
Crimson Spider Orchid **(timing also suitable for other threatened flora species)**	7 – 9 October 2014	19 locations across the proposal site where infrastructure was proposed and Red Stringybark was known to be a dominant habitat feature.	Evenly spaced transects approximately 10m apart	Known location of the species in Bango Nature reserve was checked in conjunction with OEH however, the species was not confirmed to be flowering. Survey timing was consistent with when the species was known to be flowering in 2013.

5 UPDATED AND REVISED IMPACT ASSESSMENT

This addendum assumes a 'worst case' scenario for the project to ensure that all possible impacts are accounted for and where required, able to be offset. For example:

- All impacts are considered to be permanent. This does not apply any 'discount' for the temporary impact areas that will be rehabilitated after construction, particularly areas including underground cable installation, temporary laydown areas, temporary construction compounds and potentially some of the roads, road widths and hardstand areas.
- Where multiple track or transmission line options are still under consideration, either all options or the largest impact option is included.

In considering the impacts of the Rye Park Wind Farm proposal it is important to acknowledge that the project site (13,528 hectares) is widespread and spans almost 40 kilometres from north to south. The general impact figures quoted are not concentrated into any particular area. They are dispersed across the project site and need to be considered in the context of the area the project spans. This was considered in the original impact assessment for the proposal and is similarly considered below.

5.1 IMPACT TYPES

The primary impact types and the general nature of these impacts remain the same as identified in the original BA and include:

1. Vegetation clearance (habitat loss);
2. Blade-strike (bird and bat collision with turbines and barotrauma); and
3. Alienation or barrier effects (behaviour change in fauna).

The key factors that have changed as a result of the new preferred project layout are the quantum of direct clearing of vegetation and fauna habitats (including important habitat features such as hollow-bearing trees) and the potential for significant impacts to threatened species and communities resulting from that clearing. Updated estimates of direct impacts to vegetation communities and fauna habitats are provided in Section 5.2. Impacts relating to the loss of hollow-bearing trees are discussed in Section 5.2.1.

As documented in Section 2, the total number of turbines proposed has reduced from 126 to 109 which reduces the magnitude of collision risks to avifauna however, potential changes in the proposed rotor dimensions of the turbines has resulted in a lower rotor sweep area which increases the collision risks for low flying species. This is discussed further in Section 5.6 particularly with respect to threatened species.

5.2 ESTIMATED IMPACT AREA OF THE PROJECT

Estimates of permanent and temporary habitat loss for each of the affected vegetation types are presented in Table 5-1 to Table 5-4 below, based on the new preferred project layout of the proposal. Impact areas have been calculated by the proponent using GIS software overlaying the final infrastructure layers onto the revised vegetation mapping completed by NGH Environmental.

A comparison of the quantum of permanent habitat loss for threatened species and Endangered Ecological Communities between the original and new preferred project is provided in Table 5-5 and discussed further in Section 5.7.

Table 5-1 Estimated 'worst case' impact area of the development by vegetation type

Infrastructure	Quantity	Width (m)	Length (m)	Area (ha)	BGW (ha)	DGL (ha)	ISG (ha)	AA (ha)	BGF (ha)	SB (ha)	NP (ha)	EX (ha)	AS (ha)	PN (ha)
Turbine footing	109	20	20	4.4	0.0	0.0	0.7	0.0	0.0	1.2	2.1	0.2	0.0	0.0
Crane hardstand (in woodland and forest)	16	25	45	1.8	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane hardstand (in pasture areas)	93	25	45	10.5	0.0	0.0	0.0	0.0	0.0	3.7	6.2	0.4	0.1	0.1
New tracks (permanent formed width)	1	12	103,400	113.2	4.1	7.9	22.5	0.4	0.9	22.0	48.4	6.1	0.9	0.1
Existing tracks (widening)	1	2	15,390	3.0	0.7	0.4	0.7	0.0	0.0	0.0	0.5	0.7	0.0	0.0
Underground reticulation (outside of tracks)	1	12	5,227	5.8	0.4	0.0	1.5	0.1	0.0	1.6	1.6	0.6	0.0	0.0
Transmission (33kV) (in woodland and forest)	1	30	694	2.0	0.3	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transmission (330kV) (in woodland and forest)	1	60	12,510	73.0	16.7	0.0	54.4	0.0	1.9	0.0	0.0	0.0	0.0	0.0
New tracks for transmission connectivity (33kV)	1	4	5,681	2.2	0.0	0.3	0.0	0.0	0.0	0.6	1.3	0.0	0.0	0.0
New tracks for transmission connectivity (330kV)	1	4	18,610	6.3	0.0	0.7	0.0	0.0	0.0	0.4	4.6	0.3	0.3	0.0
Connection substation (330kV)	1	200	200	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind farm substations	3	100	100	3.0	0.1	1.0	0.0	0.0	0.0	0.0	1.0	0.9	0.0	0.0
Operation and maintenance facility	2	100	100	2.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Concrete batch plant	2	100	100	2.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Construction compound	3			23.6	2.5	9.0	1.5	0.0	0.0	0.0	4.9	5.6	0.0	0.0
Total				**256.8**	**24.9**	**25.3**	**84.9**	**0.4**	**2.8**	**29.6**	**71.6**	**15.8**	**1.3**	**0.2**
Vegetation remaining within site boundary				**13,184.6**	**1,105.1**	**1,332.4**	**3,664.6**	**58.2**	**162.9**	**1,998.3**	**3,804.1**	**1,000.2**	**51.2**	**7.5**

KEY:

BGW	Box Gum Woodland	**ISG**	Inland Scribbly Gum Forest
DGL	Box Gum Woodland Derived Grassland	**SB**	Sifton Bush Shrubland
BGF	Brittle Gum Forest	**NP**	Native pasture
AA	Argyle Apple Forest	**EX**	Exotic

Table 5-2 Estimated 'worst case' permanent impact areas by vegetation condition[1]

Vegetation types	Permanent habitat loss within each condition class (ha)					Total of each vegetation type within the site boundary (ha)
	Good	Moderate	Poor	Unknown	Total	
Acacia scrub	1.1	0.2	0	0	1.3	52.5
Argyle Apple Forest	0	0.4	0	0	0.4	58.6
Box-Gum Woodland	1.9	8.3	14.7	0	24.9	1130
Brittle Gum Forest	0	0.0	2.8	0	2.8	165.7
Derived Grassland	0	3.0	22.3	0	25.3	1357.7
Exotic pasture	0	0.0	0.0	15.8	15.8	1015.9
Native pasture	1.8	18.9	50.8	0.1	71.6	3875.7
Planted native vegetation	0	0	0	0.2	0.2	7.6
Scribbly Gum Forest	39.5	24.5	20.5	0.3	84.9	3749.5
Sifton Bush Shrubland	14.4	14.4	0.4	0.4	29.6	2027.9
Total	**58.6**	**69.9**	**111.5**	**17.7**	**256.8**	**13441.3**

[1] All of the condition classes in Table 5-2 and Table 5-3 (NGH condition classes good, moderate and poor) excluding the 'exotic' class would equate to the 'moderate to good' definition specified within the Biometric Guidelines due to the dominance of native vegetation in the groundlayer or having a native overstorey with a percent foliage cover greater than 25% of the lower value of the over-storey percent foliage cover benchmark of that vegetation type. Exotic dominated vegetation would equate to 'low' condition.

Table 5-3 Estimated 'worst case' TSC Act EEC and EPBC Act CEEC permanent impact areas by condition class

EEC	Permanent habitat loss within each condition class (ha)				Total
	Good	Moderate	Poor	Unknown	
Box Gum Woodland and Derived Grassland EEC TSC Act	1.9	11.3	37.0	0.0	50.2
Box Gum Woodland and Derived Grassland CEEC EPBC Act	1.9	7.6	0.0	0.0	9.5
Total area within the site boundary	**286.5**	**101.4**	**417.7**	**1682.1**	**2487.7**

Table 5-4 Estimated 'worst case' TSC Act EEC and EPBC Act CEEC permanent impact areas by condition classes requested by OEH in their submission[2]

EEC	Permanent habitat loss within each condition class (ha)			Total
	Box-Gum Woodland with a native understorey and intact overstorey	Box-Gum Woodland as a native ground cover without an overstorey	Box-Gum Woodland with an intact overstorey and non-native in the groundcover	
Box Gum Woodland and Derived Grassland EEC TSC Act	24.8	25.2	0.3	50.2
Box Gum Woodland and Derived Grassland CEEC EPBC Act	9.5	0.0	0.0	9.5
Total area within the site boundary	**1009.9**	**1357.7**	**120.1**	**2487.7**

[2] Refer to Section 4.6.2

Table 5-5 Comparison of 'worst case' permanent impacts to threatened species and Endangered Ecological Communities considered to have the potential to be impacted between the original and preferred project

Community/species	Habitat type	Estimated known extent in project site (ha)	Quantified permanent habitat loss (ha)/numbers of HBTs		Equal, greater or lesser impact (ha)
			Original proposal	New preferred project	(=, > or <)
Box-Gum Woodland (TSC Act)	All Box-Gum woodland and derived grassland	2488	40	50.2	**>10.2**
Box-Gum Woodland (EPBC Act)	Box-Gum woodland and derived grassland meeting the criteria for the EPBC listed CEEC	377	10	9.5	**<0.5**
Yass Daisy	Moderate and good condition (NGH condition criteria) Box-Gum Woodland and derived grassland	387	12	13.2	**>1.2**
Superb Parrot	Box-Gum woodland (all condition classes, moderate and good condition higher quality) HBTs in woodland and pasture (breeding)	1130	25 314 HBTs	24.9 10.2 higher quality 170 HBTs**	**=** **<144 HBTs**
Painted Honeyeater	Box-Gum woodland (all condition classes)	1130	25	24.9	**=**
Regent Honeyeater	Box-Gum woodland (all condition classes)	1130	25	24.9	**=**

Community/species	Habitat type	Estimated known extent in project site (ha)	Quantified permanent habitat loss (ha)/numbers of HBTs		Equal, greater or lesser impact (ha)
			Original proposal	New preferred project	(=, > or <)
Little Eagle	All forest and woodland habitat (breeding). All habitat (foraging).	5045 13441	117 238	113 257.7	**<4.0** **>19.7**
Eastern Bentwing-bat	Primarily Scribbly Gum forest.	3750	90	84.9	**<5.1**
Yellow-bellied Sheathtail-bat	All forest and woodland habitat (breeding). All habitat types (HBTs).	5045	117 1029 HBTs	113 893 HBTs**	**<4.0** **<136 HBTs**
Striped Legless Lizard	Box-Gum woodland derived grassland and native pasture mapped as excellent or good habitat for the SLL (refer Section 4.2).	512 known habitat 2411 total suitable habitat	66 assumed potential habitat	10.5 known habitat 39.0 total suitable habitat	**<27.0**
Golden Sun Moth	Box-Gum woodland derived grassland and native pasture where Wallaby Grass cover exceeds 25%.	3465	66 assumed potential habitat	66.9	**>0.9**

** Includes quantified HBTs as detailed in Section 3.4.3 and estimated HBTs in derived grassland **and** native pasture based on a 1 HBT/ha density as calculated in the original BA. This is discussed further in Section 5.5.

5.2.1 Loss of native vegetation as a key threatening process

Further analysis of the Key Threatening Process (KTP) clearing of native vegetation was requested by OEH in the submission on the EA:

> *OEH considers that the documents do not adequately address the impact of the proposal on the KTP of clearing of native vegetation. Further analysis and correction of figures should be provided.*

As stated in the original BA for the proposal, clearing can lead to direct habitat loss, habitat fragmentation and associated genetic impacts, habitat degradation, loss of the leaf litter layer, increased habitat for invasive species and off-site impacts such as downstream sedimentation. It was a conclusion of the original BA that the proposal would not contribute significantly to the operation of clearing as a threatening process at the local or regional level, since the majority of the project area is already cleared and highly modified by agricultural practices.

The preferred project would remove up to 240.8 hectares of native vegetation including 50.2 ha of predominately low quality Box Gum Woodland and derived grassland, an endangered ecological community (discussed further in Section 5.3 below). It is acknowledged that on its own this is a considerable amount of native vegetation to be cleared however, when considered in the context of the estimated 12,425 hectares of native vegetation that occurs within the site boundary and that the impacts are spread over a linear distance of almost 40 kilometres through an already highly modified landscape, the contribution of the proposal to the KTP is recognised but not considered to be substantial in this context.

5.3 IMPACTS TO ENDANGERED ECOLOGICAL COMMUNITIES (BOX-GUM WOODLAND EEC/CEEC)

5.3.1 Community listed under the TSC Act

The original BA for the proposal assessed a 'worst case' impact to the Box-Gum Woodland EEC listed under the TSC Act of 40 hectares. According to the condition classes defined by NGH Environmental, 10 hectares was in good condition, two in moderate condition with the majority of 28 hectares in poor condition. The assessment identifies that the majority of impacts are as a result of the clearing of overstorey vegetation for overhead transmission line conductor clearances. The 'worst case' approach assumed the total loss of the vegetation within these areas where in reality the vegetation is open woodland meaning that generally only scattered trees would need to be cleared. The understorey would also be mostly retained excluding small areas required for footings and tracks. It was considered likely that the community would maintain its existing functionality following construction. Although actual impacts may be considerably less than assumed by the worst case approach, assuming a worst case scenario provides surety that adequate offsets are identified and available which can then be refined down if actual impacts are less than those estimated.

Similarly, this addendum maintains a 'worst case' approach. A total of 50.2 hectares of Box-Gum woodland and derived grassland will be impacted by the preferred project of which 16.7 hectares is accounted for by the establishment of overhead transmission line conductor clearances. As stated above, this component of the impacts is likely to be overestimated. The increase in impacts is largely due to a revised assumed track width of 12 metres compared to the 8 metres assessed in the original BA and also additional areas associated with substations and construction compounds. An additional area of Box-Gum woodland was also identified during recent HBT/validation surveys (refer to Section 3.3). Of the 50.2 hectares that could be impacted by the proposal, 1.9 hectares is in good condition, 11.3 hectares in moderate condition with

the remaining 37 hectares in poor condition (according to NGH Environmental condition classes). There has been a substantial reduction in impacts to good condition Box-Gum woodland.

The original BA for the proposal concluded a non-significant impact to the TSC Act listed EEC based on:

1. *The areas to be impacted predominately contain a moderate to low tree density with an understorey of native grass dominated pasture with a relatively low native forb and shrub diversity (0 – 11 non-grass species in poor and moderate condition). This structural and understorey configuration is common and widespread within the locality and there are large expanses of this vegetation type with or without tree cover. The extent of clearing is not anticipated to impact the long-term survival of this ecological community in the locality.*
2. *The areas of habitat within the site are already fragmented due to previous clearing, grazing pressure, the planting of exotic pastures, the ingress of weeds and the occurrence of other vegetation communities in habitats not suitable for Box-Gum Woodland. The proposal would not further fragment or isolate habitat for this community. The majority of suitable habitat likely to be removed by the proposal is in poor condition and not considered important habitat.*

Despite the increase in the area to be impacted by the preferred project, these conclusions are still considered to apply. The wind farm site spans almost 40 kilometres from north to south and covers an area inclusive of approximately 12,425 hectares of native vegetation. As such the impacts to the Box-Gum woodland EEC are dispersed over a large area and considerable areas of the community remain within the project site (refer to Table 5-3 and Table 5-4). Impacts are largely confined to poor quality habitat and the 'worst case' assessment documented herein is likely to have overestimated the actual impacts of the proposal. The 'worst case' assessment has also been applied to the evaluation of offset feasibility to ensure that the residual impacts of the proposal are adequately offset (refer to Section 6.2 and Appendix D).

No additional mitigation is considered to be warranted.

5.3.2 Community listed under the EPBC Act

The original BA concluded a non-significant impact to the EPBC listed Box-Gum woodland community as follows:

> "*The proposal would result in the permanent removal of up to 10 hectares of the Box-Gum Woodland CEEC causing a localised reduction in the occurrence of this community. The majority of this impact would result from the establishment of a 45m wide easement for the 132kV overhead power line and as a precautionary approach, this assessment has considered that the worst case scenario would be the total loss of this vegetation type within the easement however, in reality, the actual impact is likely to be considerably less.The proposal will not impact on the broader extent of the CEEC within the proposal site. Localised disturbance to hydrological patterns that support the EEC may result from the proposal but are unlikely to be substantial. The risks associated with the ingress of invasive species and disease and potential impacts from chemicals and fertilizers are considered to be acceptable if the recommendations included within Section 8 of this report are adhered to."*

The new preferred project will result in a 'worst case' impact to the CEEC of 9.5 hectares, slightly less than the 10 hectares originally assessed. This is due to impacts within the areas defined as the CEEC in the original BA being reduced due to the removal of infrastructure in these areas (refer to Section 2). The impacts have been reduced despite an additional area of Box-Gum woodland CEEC being identified during recent HBT/validation surveys (refer to Section 3.3). The additional surveys also identified that there is also an extensive occurrence of the CEEC in the additional area identified (up to 110 hectares). In this context, the conclusion of a non-significant impact to the CEEC in the original BA is still considered applicable to the preferred project.

No additional mitigation is considered to be warranted.

5.4 LOSS OF HABITAT FOR THREATENED FAUNA

The impacts from habitat loss specific to threatened species are discussed in detail in the original BA for the proposal. These discussions are not repeated here. The information presented below considers any changes to the impact type or extent as a consequence of the new preferred project design and identifies if alterations to the conclusions reached in the original BA or additional mitigation strategies are warranted.

5.4.1 Superb Parrot, Regent Honeyeater and Painted Honeyeater

Within the project site, habitat for the Superb Parrot, Regent Honeyeater and Painted Honeyeater is largely associated with Box-Gum woodland. The Superb Parrot is the only of the three species that depends on hollows for breeding and the impacts associated with the loss of HBTs with regard to this species is discussed further in Section 5.5.1.

Impacts to Box-Gum woodland from the preferred project are essentially the same as assessed in the original BA. The original BA for the proposal concluded a non-significant impact for the Superb Parrot, Regent Honeyeater and Painted Honeyeater on the basis that the core areas these species were observed to be utilising within the project site have been avoided by the proposal. Remaining impacts to habitats suitable for these species are in lower quality habitat that is widespread throughout the locality. This remains the case with regard to the preferred project layout and the conclusion of a non-significant impact is still considered relevant to the preferred project design with regard to habitat for the Regent Honeyeater and Painted Honeyeater and general foraging habitat and movement corridors for the Superb Parrot.

No additional mitigation is considered to be warranted.

5.4.2 Little Eagle

Impacts to habitats for the Little Eagle were not definitively defined in the original BA. The figures provided in Table 5-5 for the original proposal were determined based on the original impact calculations for the vegetation types that provide habitat for this species. Similarly the impacts to habitats as a result of the preferred project have been inferred from the vegetation types that provide suitable habitat for this species.

Little Eagles were not recorded during surveys but are known to occur in the locality. Therefore impacts are considered to be restricted to potential habitat for this species. Impacts to potential breeding habitat as a result of the preferred project has been reduced by four hectares while overall impacts to foraging habitats have increased by 19.7. The original BA for the proposal concluded:

> *"Areas of habitat to be removed for turbines, access tracks, power infrastructure, and transmission line associated with the proposal are well represented in the overall project area and surrounding locality, including within large areas of conservation reserves and state forests such as Bango NR. The majority of the habitat to be removed in the project area is degraded and has been subject to ongoing disturbance from agricultural land use. As a result, the majority of potential habitat within the project area is considered unlikely to support the fauna species assessed, considering land use history, condition assessments and the results of the field surveys."*

The increase in the loss of potential foraging habitat is not considered to be substantial in the context of the extensive similar habitats that remain in the locality and the broad area over which the impact would be distributed. Impacts to potential breeding habitat have been reduced.

No additional mitigation is considered to be warranted.

5.4.3 Eastern Bentwing-bat and Yellow-bellied Sheathtail-bat

Habitat for the Eastern Bentwing-bat is considered to primarily be associated with the Scribbly Gum Forest across the site. Impacts to this habitat type have decreased by approximately 5.1 hectares. The conclusion of the original BA that the habitats to be removed are not of particular importance and are widespread in the locality are still considered relevant.

Habitat removal for the Yellow-bellied Sheathtail-bat has decreased by four hectares, largely due to the reduction of infrastructure in forest vegetation. The number of hollow-bearing trees to be removed that were assessed as potentially suitable for this species has also reduced from 1029 to 893. The conclusion of a non-significant impact reached in the original BA is still relevant.

No additional mitigation is considered to be warranted.

5.4.4 Striped Legless Lizard

As discussed in Section 4.2, known and potential habitat for the Striped Legless Lizard has been surveyed and mapped across the project site. The assessment in the original BA assumed an impact of 66 hectares in the context of 5,887 hectares within the project site. Based on the revised mapping of SLL habitat across the project area, 10.5 hectares of known habitat and an additional 28.5 hectares of potential suitable habitat will be impacted in the context of 512 hectares of known and 2,411 hectares of potential suitable habitat. Proposed infrastructure has been removed from the immediate vicinity of the one location the SLL was recorded to avoid impacts to this species.

The original BA concluded:

> *As the species was not located at the other nine tile sites, the overall impact to this species is not expected to be significant especially when considering the amount of available habitat remaining within the project area. Furthermore, the ability to offset the impact will ensure the species is conserved in the locality. In light of this, the proposal is unlikely to have an adverse effect on the life cycle of the Striped Legless Lizard such that a viable local population of the species is likely to be placed at risk of extinction, however further survey work is required to confirm the assumptions of this assessment.*

This conclusion is still considered relevant to the proposal given that infrastructure has been removed to avoid known habitat and offsets have been demonstrated as achievable (refer to Appendix D).

No additional mitigation is considered to be warranted.

5.4.5 Golden Sun Moth

Similarly to the Striped Legless Lizard, potential habitat for the Golden Sun Moth has been surveyed and mapped across the project site. The assessment in the original BA assumed an impact of 66 hectares in the context of 5887 hectares within the project site. Based on the revised mapping of GSM habitat across the project area, 66.9 hectares of suitable habitat will be impacted in the context of 3,465hectares of suitable habitat within the project site.

The Golden Sun Moth was observed at seven of the ten sites surveyed. It is considered likely that the species is widespread across the project site and occurs in areas outside of the areas surveyed. The original BA concluded:

> "*To determine the extent of impact and specifically quantify habitat for this species within the project area, management measures have been prescribed to undertake further preconstruction surveys of the final infrastructure layout in accordance with the relevant survey guidelines (Significant Impact Guidelines for the critically endangered Golden Sun Moth Synemon plana; DEWHA 2009) for this species. The results of these surveys would be used to minimise impacts and ensure offsetting requirements, where avoidance is not possible. The management protocols for this species would be documented within a management plan, to be implemented as part of the construction process.*
>
> *Given the most likely impact to this species will occur from overhead transmission lines which are generally limited to discrete impact from pole footings, a relatively large number of moths were observed across the project area, and the species is expected to be more widespread in other areas of the project area and broader locality, the action proposed is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*."

These conclusions are still considered relevant to the preferred project design.

No additional mitigation is considered to be warranted.

5.5 LOSS OF HOLLOW-BEARING TREES

The original BA estimated 1029 hollow-bearing trees would be cleared. The more accurate quantification documented in this addendum (refer Section 3.4) identifies a reduction in the number of hollow-bearing trees estimated to be impacted to 796 however, this does not include an assessment of what was defined as 'paddock' areas in the original BA (Box-Gum woodland derived grassland and native pasture with scattered trees). As a precautionary approach, the average density of one HBT per hectare has been applied to these habitat types which equates to an additional 97 HBTs (25 hectares of derived grassland and 72 hectares of native pasture). This brings the total number of HBTs now estimated to be impacted by the proposal to 893.

Two hollow dependant fauna were considered to have the potential to be impacted by the proposal; Brown Treecreeper and Superb Parrot. These were the only two species of hollow dependant fauna observed during the surveys. It was recognised in the original BA that hollow-bearing trees within the Inland Scribbly Gum forest could be utilised by some additional bird and mammal species, however, hollows typically preferred by threatened large forest owls, threatened arboreal mammals, and parrot species such as the Glossy-black Cockatoo need to occur in better quality forest vegetation to be utilised by these species. In general, it was observed that the majority of hollows were of small to medium hollow entrance size within forest remnants, most likely to be utilised by small to medium birds and microchiropteran bats, rather than owls and gliders. The dominance of small and medium hollows has been verified during the targeted forest HBT surveys with only 29 large limb and 68 large trunk hollows out of the total 1202 hollows estimated to be impacted in forest vegetation. The Offset Strategy in Appendix D considers that the offset package will be required to contain sufficient hollows to offset this loss, as determined in consultation with OEH.

5.5.1 Impacts on breeding resources for the Superb Parrot

Superb Parrots were observed to use habitats in the project area and locality during their nesting season (September to January). Based on the known ecology and records of the species it is known that they disperse to foraging grounds west of the proposal site outside of nesting season. Flight path mapping

identified that the Superb Parrot is regularly observed in high numbers to the west of the project area, but less commonly within it.

The desktop assessment combined with densities calculated in the original BA identified an estimated 170 HBTs within the Box-Gum woodland and open pasture habitats preferred by the Superb Parrot. This is a reduction on the 314 HBTs estimated in the BA. As documented in the BA, hollow density within the Box Gum Woodland is generally low given this community is largely fragmented and exists as scattered trees. In particular, large hollows in this vegetation type occur in low abundance. During the HBT surveys for the BA, it was observed that while large mature trees occur across the project area in Box Gum Woodland they often supported no hollows, or small hollows. As the desktop assessment was based on assuming all large trees within Box-Gum Woodland were hollow-bearing this may be an overestimation and is therefore considered a worst case.

During the specific Superb Parrot utilisation surveys and throughout the numerous other diurnal bird surveys undertaken during November 2011 and November 2013, the Superb Parrot was regularly observed but primarily outside of the project area, to the west of the site along Rye Park Road, Flakney Creek Road, or other roads west of the project area. The focus of Superb Parrot surveys was to sample areas across the entire wind farm to determine the areas the parrots were using. Transects and bird surveys were undertaken in areas of known records and habitat, as well as in areas not known to be utilised by the parrot. In this way, it was possible to narrow down the habitat estimates based on actual use. It was then possible to confidently identify the high usage areas the parrots were continuously observed within. Hollow-bearing tree assessments were conducted in these areas and highlighted both known and potential nest trees in areas of Superb Parrot activity. It is likely, as mentioned above, other nests trees could occur in the project area, but are likely to be predominately outside of impact areas or irregularly used.

The assessment of significance for the Superb Parrot concluded a non-significant impact on the basis that the better quality areas of habitat that were being preferentially utilised by the species had been avoided by the project. Other identified known and potential nest trees had also been buffered and avoided, Impacts to additional breeding resources were acknowledged as possible however, as the core usage areas had been surveyed and habitats avoided, the residual impacts were considered likely to be low. Collision risks were also considered to be low and this is discussed in further detail in Section 5.6 below. The conclusion of a non-significant impact to the Superb Parrot reached in the original BA is considered to be applicable to the preferred project.

No additional mitigation is considered to be warranted.

5.5.2 Loss of hollow-bearing trees as a key threatening process

The original BA estimated 1029 hollow-bearing trees would be cleared. The more accurate quantification documented in this addendum (refer Section 3.4) identifies a reduction in the number of hollow-bearing trees estimated to be impacted to 893. This equates to less than 1% of the 111,284 hollow-bearing trees estimated in the original BA to be present across the whole 13,528 hectare site.

The clearing of 893 hollow-bearing trees is considered unlikely to result in an unacceptably high loss of habit or loss of habitat function for native fauna, and unlikely to cause loss of stand structural complexity, as for the most part the forests already have a low level of complexity. The surveys for the original BA and those documented in this addendum demonstrate that although a large number of hollow-bearing trees were recorded, mature old-growth trees are uncommon in the site. Hollow-bearing trees are a limiting habitat resource for many Australian fauna because many animals depend on old growth characteristics, such as deep hollows (Goldingay 2009; Smith et al. 2007). Trees with such characteristics generally have a

DBH of 50cm or greater (Goldingay 2009). Generally, trees with a larger DBH have a higher chance of bearing useable hollows (Treby 2014). Thus it can be assumed that many of the hollow-bearing trees to be cleared at Rye Park that have a smaller DBH may not be preferentially occupied.

Birds are the faunal assemblage with the greatest reliance on hollow-bearing trees, which for most species are used seasonally for breeding purposes (rather than year-found for roosting) (Goldingay 2009; Gibbons & Lindenmayer 2000). The birds most likely to be impacted by hollow loss at Rye Park are common birds such as Crimson Rosella, Sulphur-crested Cockatoo and the introduced Common Starling, observed in large numbers on site. The loss of approximately 1% of the potentially available resource is unlikely to have population scale impacts on common birds that are widely distributed and abundant.

The proposal is considered to contribute to this KTP however, the contribution is not considered to be appreciable given the scale of the proposal and the abundance of the resource across the site. The 99% of trees remaining will continue to mature and develop deeper and larger hollows suitable for a wider range of hollow-dependant fauna. This is particularly relevant within the offset areas where these trees will be protected in perpetuity. As stated above, the Offset Strategy in Appendix D considers that the offset package will be required to contain sufficient hollows to offset this loss, as determined in consultation with OEH

5.6 COLLISION RISKS

Collison risks from blade strike were discussed in detail within the original BA. As documented in Section 2, the total number of turbines proposed has reduced from 126 to 109 which reduces the magnitude of collision risks to avifauna however, potential changes in the proposed rotor dimensions of the turbines has resulted in a lower rotor sweep area which increases the collision risks for low flying species.

The original BA assessed the inclusion of turbines with typical hub height of 90 m – 101 m and a typical blade length of between 45 to 56 m. The tallest wind turbine tip height combination under consideration was (and still is) 157 m. 'At risk' flight heights (i.e. within the rotor-swept area (RSA)) were identified as being between 40 m and 157 m. Advances in wind turbine technology have resulted in more recent turbine models having longer blade lengths producing more energy per turbine. As such, the new preferred project proposes to utilise turbines with a maximum rotor diameter of 130m. In maintaining a maximum tip height of 157m, this now defines the RSA as being between 27m and 157m, 13m lower than previously assessed.

5.6.1 Revised assessment of bird utilisation data

Within the RSA

Within the original BA it was documented that during the general bird utilisation surveys a total of five species were observed flying within the rotor-swept-area, or about 2% of the total number of birds observed during all surveys. These species included the: Nankeen Kestrel, Sulphur-crested Cockatoo, Wedge-tailed Eagle, Welcome Swallow and White-browed Woodswallow. An additional species, the Superb Parrot was also observed to fly within the RSA during targeted surveys, although this was restricted to specific areas.

Below the RSA

As documented in the original BA, the majority of bird species were observed to fly below 20m however, there were additional species recorded within the 21m – 40m height range that were previously considered to not fly within the RSA including:

- Pied Currawong
- Australian Magpie
- Crimson Rosella
- Australian Raven
- Galah
- Eastern Spinebill
- Noisy Friarbird

In accounting for impacts from the revised range of possible turbine dimensions, these species are also now considered at risk of collision during operation of the Rye Park wind farm. All of these species are common species which were also observed flying at lower elevations.

Collision risks to threatened and migratory species

The species listed below were considered in the original BA to be the threatened and migratory species most at risk from collision.

- Superb Parrot.
- Powerful Owl and Barking Owl.
- Painted Honeyeater.
- Swift Parrot (Migratory).
- White-throated Needletail (Migratory).
- Regent Honeyeater (Migratory).
- Rainbow Bee-eater (Migratory).

The collision risk to each of these species is discussed further below in the context of the revised range of turbine dimensions and possible lowered RSA proposed as part of the preferred project.

Superb Parrot

The original BA provided analysis of flight path mapping across the site in relation to the proposed layout. The analysis found that the Superb Parrot appears to favour habitat outside or adjacent to the western boundary of the project area within open grassland or Box Gum Woodland, except for a discrete area in the southern end of the project area where parrots were commonly recorded. This was the only location over the whole site where Superb Parrots were recorded flying at higher elevations (up to 50m) that could put them at collision risk.

The conclusion of the original BA was that the potential collision risk to this species overall is non-significant, as the majority of the population within the locality occurs outside the project area and was observed flying within the tree canopy or below 20 metres on most occasions. With the revised turbine RSA there may be a moderate increase in collision risk for individuals in the southern end of the project area; however it does not affect factors upon which the original conclusion was drawn. The revised design is unlikely to result in a significant impact to the Superb Parrot.

Powerful Owl and Barking Owl

Iterative designs for the proposal have moved the majority of turbines away from woodland and forest areas. Large hollow-bearing trees and suitable nesting and roost sites for Powerful and Barking Owls are absent where turbines are located. Given that the owls favour woodland / forest edges and interior for foraging, changes to the RSA would not create a collision risk for these species.

Painted Honeyeater

The original BA found that blade-strikes pose a non-significant risk to the Painted Honeyeater due to its irregular occurrence at the site, favoured habitat being away from proposed turbine locations and observed low height flight behaviour. The original BA notes that it is unknown what heights the species flies at when making nomadic movements. Although it is possible the species would fly at blade height during migration, most honeyeaters tend to tree hop and skim above the canopy when moving between areas (Probets 2006). In all opportunistic observations at Rye Park in which flight height was recorded the maximum flight height for Painted Honeyeater was 15 m.

When present within an area for foraging it is expected the species would remain at canopy level where it forages within mistletoe, which was the behaviour observed on site. Painted Honeyeaters are usually observed as singles or in pairs; only occasionally are they observed in small flocks as they were at Rye Park (Barea 2012). In light of the above, changes to the RSA are not considered to alter the conclusion of the original BA.

Swift Parrot

The project area is not considered to support important foraging habitat for the Swift Parrot; this species was not observed during targeted surveys. The abundance of flowering feed trees within the project area for the Swift Parrot is low and the species is more likely to use roadside vegetation or larger remnants where greater diversity of feed trees are present. The original BA found that impact to this species from the proposal would not be significant. Changes to the RSA would not alter the non-significant impact conclusion of the original BA.

White-throated Needletail

The Biodiversity Assessment noted that the White-throated Needletail appears to have a high collision risk based on operational carcass monitoring results at some other Australian wind farms (calculated to around four collisions of White-throated Needletails per year at Rye Park). However; given the very large area of occupancy for the species and its status as abundant (SEWPAC 2012), the original BA found that the Rye Park wind farm would be unlikely to affect an ecologically significant proportion of the population. The revised RSA design would not change the conclusion of the original assessment.

Regent Honeyeater

The original BA concluded that the proposal presented a low risk of blade-strike to the Regent Honeyeater as the site does not support primary breeding and foraging habitat. Although it is possible they may migrate through the locality, as for other honeyeaters, the Regent Honeyeater is likely to fly in “short hops at treetop level, resting frequently and regrouping in prominent trees” (Probets 2006). Changes to the RSA would not affect the non-significant assessment of the original BA.

Rainbow Bee-eater

The Rainbow Bee-eater was detected in the locality and potential habitat for this species occurs on site. The original BA found the Rainbow Bee-eater to be most at risk from blade-strike. However, a non-significant impact was concluded as the Rainbow Bee-eater is highly manoeuvrable in flight and a common, secure and widespread within its Australian and global distribution. Turbine design changes would not alter the conclusion that it is unlikely the proposal would result in impact such that there would be a population scale effect on the Rainbow Bee-eater.

No additional mitigation is considered to be warranted for these species considered in this section, with regard to altered collision risk. It is noted that the proponent has committed to the development of a Bird and Bat Monitoring Program prior to construction of the wind farm. Collected data would be used to verify

the assumptions of the assessment or otherwise adapt management actions onsite to address specific collision events or predicted events, as required.

5.7 ADDITIONAL THREATENED SPECIES KNOWN TO OCCUR WITHIN THE PROJECT AREA

As discussed in Section 3.5, desktop investigations and additional provision of information/consultation with South East Local Land Services, OEH and NSW Fisheries identified the presence of an additional threatened fish species, Southern Pygmy Perch (*Nannoperca australis,* listed as Vulnerable under the TSC Act), within Blakney and Pudman Creeks (DPI 2015) which cross the study area. Additional investigations also identified the recent rediscovery of the Yellow-spotted Tree Frog (*Litoria castanea,* listed as Endangered under the TSC Act and Critically Endangered under the EPBC Act) within Blakney Creek. These species were included within the threatened species habitat evaluation which concluded that there was a moderate potential for the proposal to impact these species. This conclusion was largely due to the potential for proposed track crossings across Blakney Creek and its tributaries. Potential impacts are discussed further below for each of these species.

5.7.1 Southern Pygmy Perch

The Endangered Southern Pygmy Perch is known to occur within Blakney Creek and has also been introduced into Pudman Creek. Due to pressures on the population due to completion from the exotic Red-fin Perch, NSW Fisheries have attempted to establish a population within Pudman Creek given the suitability of habitat and close proximity to the Blakney Creek population however recent monitoring by NSW Fisheries suggests that the species is not moving away from the introduction site. The known distribution of the Southern Pygmy Perch from monitoring conducted in 2013 is shown on Figure 5-1.

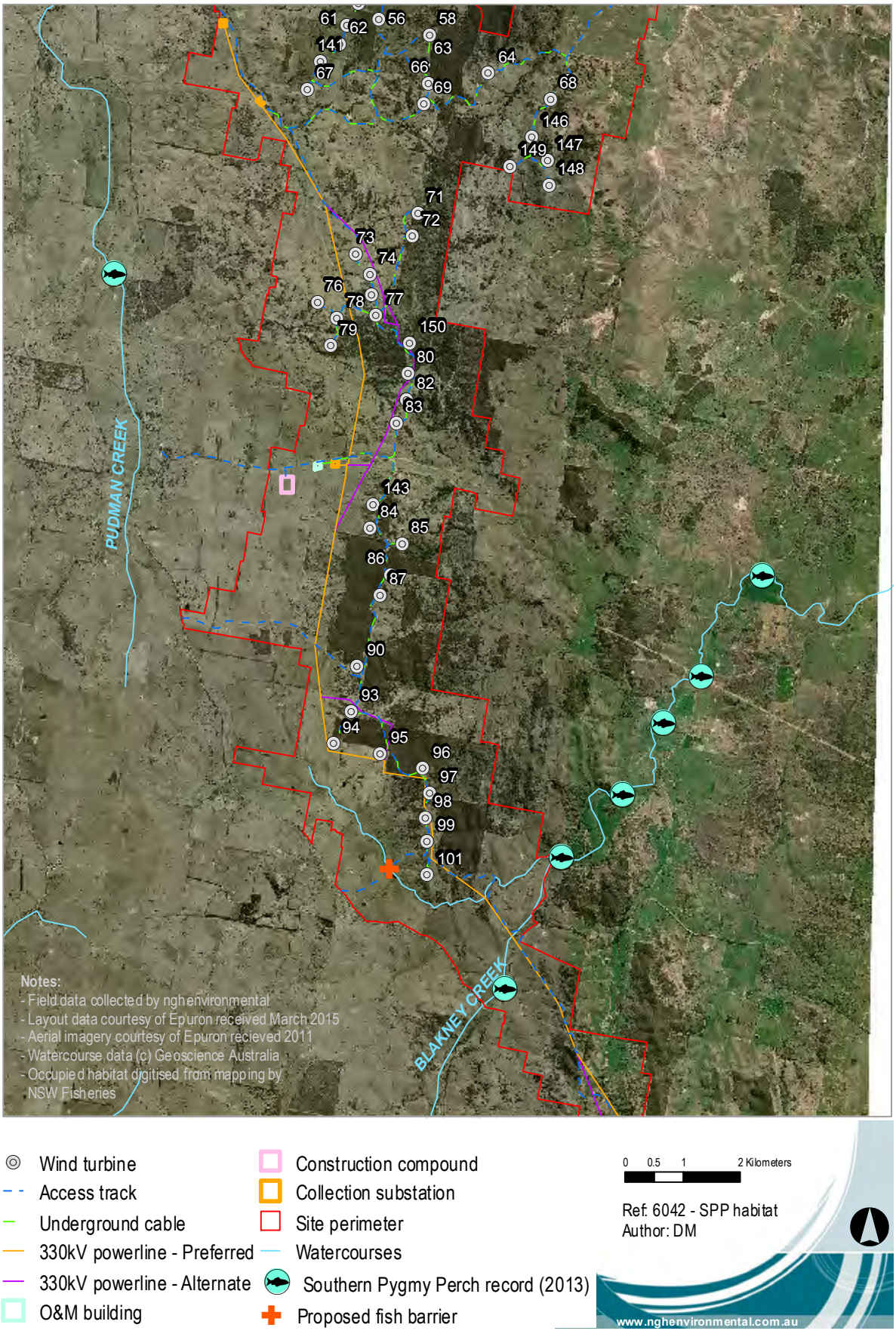


Figure 5-1 Records of the Southern Pygmy Perch in Blakney and Pudman Creeks from monitoring in 2013

Blakney Creek traverses the project area. The Southern Pygmy Perch is also known to occur within a tributary to Blakney Creek as shown on Figure 5-1.

The main risks to the Southern Pygmy Perch from the project are considered to be from indirect impacts as a result of construction in and adjacent to waterways which could result in sedimentation and/or pollution downstream from the works areas. There is one crossing proposed on Blakney Creek and two crossings on Urumwalla Creek, a tributary to Blakney Creek. To a lesser degree, there is also the potential for sediments to be mobilised in the catchment areas for these waterways in areas subject to more extensive earthworks such as for turbine hardstands. These impacts are considered to be highly manageable with the implementation of strict sediment and erosion controls and spill protocols. Recommendations have been included in Section 6 of this addendum to ensure that appropriate measures are included in the Construction Environmental Management Plan (CEMP) for the project to address these risks.

A permit under the Fisheries Management Act will be required to undertake works within Blakney Creek and its tributaries. This permit will detail the requirements of NSW Fisheries to protect habitats for the Southern Pygmy Perch. Recommendations have also been included in Section 6 of this addendum to consult with NSW Fisheries in the design phase of the crossing to ensure that the crossings are fish friendly in their design. The proponent has also engaged in discussions with the LLS regarding the possibility of incorporating a fish barrier in the construction of the crossing structure over Urumwalla Creek (refer to Figure 5-1). Introduced Red Fin Perch (which compete with the Southern Pygmy Perch) are known to be present downstream of the proposed barrier and it is hoped that the installation of the barrier will prevent the Red Fin Perch from moving further upstream along the tributary thus protecting the Southern Pygmy Perch in this area.

No other threatened fish listed under the FM Act are anticipated in the minor creek lines of the study area.

5.7.2 Yellow-spotted Bell Frog

The Yellow-spotted Bell Frog currently has a very restricted distribution along Blakney Creek, approximately four kilometres north-west of the project area. No direct impacts would occur to the currently known habitats for this species. Similarly to the Southern Pygmy Perch, the main risks to this species from the project are considered to be from indirect impacts as a result of construction in and adjacent to waterways which could result in sedimentation and/or pollution downstream from the works areas. The recommendations included in Section 6 to address these risks for the Southern Pygmy Perch also apply to the Yellow-spotted Bell Frog. With the implementation of these recommendations the risks to this species are considered to be low.

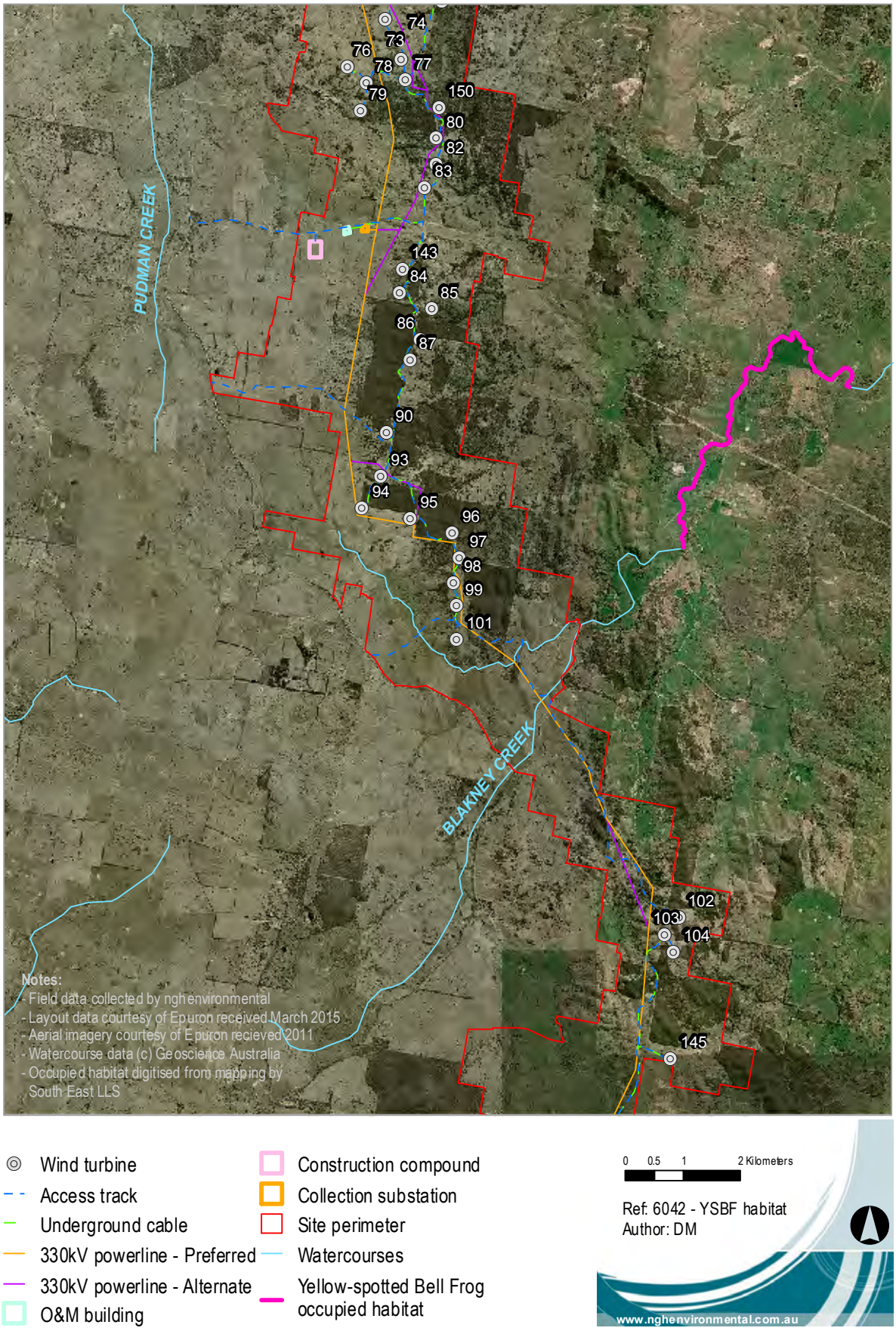


Figure 5-2 Current known distribution of the Yellow-spotted Bell Frog along Blakney Creek

5.8 SUMMARY OF POTENTIAL IMPACTS TO THREATENED ENTITIES

Based on the information in the section above, a summary of the conclusions of the original 2014 assessments of significance and whether or not the there are any changes to these conclusions as a result of the new preferred project layout is provided in Table 5-6 below.

Table 5-6 Summary of impact significance assessments for threatened species and communities assessed in the original BA, indicating whether there is any change from final conclusions drawn in the BA

Subject species / community	Status	Significant impact?	Change to conclusions from BA?	Changes to mitigation measures?
Community				
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	EEC TSC	No	No	No
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC EPBC	No	No	No
Flora				
Yass Daisy	V TSC V EPBC	No	No	No
Fauna				
Superb Parrot	V TSC V EPBC	No	No	No
Painted Honeyeater	V TSC	No	No	No
Regent Honeyeater	E TSC E EPBC	No	No	No
Little Eagle	V TSC	No	No	No
Eastern Bentwing-bat	V TSC	No	No	No
Yellow-bellied Sheathtail-bat	V TSC	No	No	No
Striped Legless Lizard	V TSC V EPBC	No	No	No
Golden Sun Moth	E TSC CE EPBC	No	No	No

6 REVISED MITIGATION AND COMPENSATORY MEASURES

6.1 ADDITIONAL MITIGATION MEASURES

A comprehensive list of mitigation measures designed to avoid and minimise impacts to threatened species was provided in Section 8 of NGH Environmental (2014). Based on the results of the additional surveys and analyses, several additional mitigation measures are recommended below to ensure that the impacts associated with the new preferred project are managed appropriately:

1. Prior to construction, verify the potential for the habitats in the new area of CEEC identified to the south-west of turbines 85 – 87, to support threatened flora. Given the unsuitable timing of the survey, it was not possible to accurately ascertain the condition of the understorey vegetation and a follow up survey is recommended in spring. If the habitat is deemed to be suitable for threatened flora species, targeted searches according to the methodologies detailed in the DGEARs for the project would be undertaken.
2. Prior to construction, conduct additional targeted surveys for the Crimson Spider Orchid as recommended in the 2014 survey report (refer to Appendix C.2) to determine if the species is present in areas proposed for infrastructure. If the species is identified at the site, impacts would be avoided. If avoidance is not possible, impacts would be offset according to the methodologies detailed in the revised offset strategy for the proposal (refer Appendix D).
3. Prior to construction, NSW Fisheries would be consulted with regard to the design of waterway crossings proposed along Blakney Creek and its tributaries. The proponent would adhere to any additional requirements of NSW Fisheries with regard to the construction and maintenance of waterway crossings.
4. The CEMP for the project would contain:
    a. Strict sediment and erosion and spill containment controls that specifically consider the potential for sediments and pollutants to enter Blakney Creek and/or its tributaries.
    b. Detailed strategies to account for how sedimentation and/or pollution risks to Blakney creek and its tributaries would be managed in high rainfall events or during the event of the failure of the controls specified in (a) above.
5. Further analysis of the topographic situation of turbine 90 to assess the collision risks to avifauna from this turbine. If collision risks are deemed to be high this turbine would be relocated to reduce the risks to a manageable level

6.2 REVISED OFFSET STRATEGY

An offset outline was prepared for the project (Appendix F, NGH Environmental 2014) which identified appropriate offset ratios and measures to manage the offset area for preservation and improvement. Specifically, it was a commitment of the BA to:

- Develop an offset strategy and finalise prior to any construction impacts by an ecological professional, in accordance with Appendix F (of NGH Environmental 2014).
- Develop an offset plan prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site.
- Ensure the offset strategy complies with the Principles for the use of biodiversity offsets in NSW guidance document.
- The offset ratio will be determined with reference to: the conservation status of the vegetation, the condition of the vegetation, and the actual threatened species habitat value lost (i.e. known threatened species habitat, not potential habitat).
- Where vegetation is listed as an EEC, a ratio of 1:5 to 1:10 is proposed, depending on quality of habitat.
- Where non-threatened vegetation is cleared an offset ratio to be applied at 1:2.
- Where hollow-bearing trees are to be cleared and cannot be avoided an offset ratio to be applied at 1:1 and is supplementary to other areas offset.
- Include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth offset policy.

The proponents and authors have consulted closely with OEH, and this has resulted in refinement of the offset approach. Key changes to the offset strategy are:

- Utilisation of the Framework for Biodiversity Assessment (FBA) to determine the offset requirement for the project and demonstrate the suitability of proposed offsets.
- A commitment to offset hollow-bearing trees at a ratio to be determined in consultation with OEH.

The revised offset strategy is included as Appendix D and reflects these changes. This will form the basis of the offset plan for the project once a final offset site is negotiated with the relevant landowners. The offset strategy demonstrates ample ability to meet the offset requirements within the site boundaries. An implementation plan has been provided in the strategy to ensure that that actual impact areas are offset in accordance with OEH endorsed survey methods and tools. It is understood that several management options may be considered for transitional major project offsets and the proponent commits to working with the DPE and OEH to find a suitable security mechanism for the project.

7 CONCLUSION

This Biodiversity Assessment Addendum documents additional biodiversity studies undertaken and addresses submission received from the NSW Office of Environment and Heritage on the exhibited Environmental Assessment for the proposed Rye Park Wind Farm. It documents where impacts have been avoided and minimised though changes to the proposed design of the wind farm and provides a revised assessment of the potential impacts to biodiversity associated with changes to the proposal including:

- Modifications to the proposed road network,
- Modifications to the proposed cable layout
- Changes to the location of the construction and operational compounds and substations
- Changes with regard to the specific dimensions of the turbines.

Additional investigations

Additional investigations were undertaken to to address concerns from the OEH and to assess additional components of the project not assessed in the existing BA. These additional investigations included:

- Habitat assessment for the Striped Legless Lizard and Golden Sun Moth (NGH Environmental September 2014)
- Targeted surveys for the Crimson Spider Orchid (NGH Environmental February 2015)
- Field validation of additional infrastructure areas
- Hollow-bearing Tree Survey and Assessment

A revised desktop assessment including searches of relevant state and Commonwealth threatened species databases was also undertaken to facilitate a revised impact assessment for the proposal.

Additional threatened species considered

Two additional threatened species have been identified as occurring within or in close proximity to the project site; Southern Pygmy Perch and Yellow-spotted Bell Frog. Impacts to these species are considered to be manageable. There is also potential for the Crimson Spider Orchid to occur within the project site. Further survey is required to determine the presence or absence of this species. No other threatened species or Endangered Ecological Communities (EECs) additional to those previously identified in the original BA were considered to have the potential to occur at the development site.

Revised impact assessment

Impacts to the Box-Gum Woodland EEC listed under the TSC Act have increased by 10.2 hectares, mostly due to additional impacts in poor condition derived grassland. Impacts in better quality woodland have been reduced. Impacts to the EPBC listed Box-Gum Woodland CEEC have also been reduced. Impacts to threatened species habitat have for the most part been reduced with only minor increases in impacts to potential habitat for the Yass Daisy and foraging habitat for the Little Eagle. The revised impact assessment identified no change to the conclusions of the assessments of significance completed in the original BA. Significant impacts to threatened species and endangered ecological communities are considered unlikely.

Mitigation of impacts and offsetting

It is the recommendation of this addendum that several additional mitigation measures are included as commitments of the project to ensure that the impacts associated with the preferred project are managed appropriately.

A revised offset strategy has been prepared for the project following consultation with the NSW OEH and DPE. This strategy demonstrates that suitable offsets for the proposal are achievable. A detailed offset package, including a plan of management (and demonstration that funding for management will be available to manage the site in accordance with the plan of management) would be finalised prior to impacts occurring.

8 REFERENCES

Australian Museum (2010) Wedge-tailed Eagle, accessed online at http://australianmuseum.net.au/wedge-tailed-eagle on 12 October 2015.

Barea (2012) 'Habitat influences on nest-site selection by the Painted Honeyeater (Grantiella picta): do food resources matter?' Emu 112: 39-45

Cherriman, S. C. (2007). Territory size and diet throughout the year of the Wedge-tailed Eagle Aquila audax in the Perth region, Western Australia. Honours thesis, Curtin University.

Cherriman, S. C. (2013). Nest site characteristics and breeding productivity of Wedge-tailed Eagle Aquila audax near Perth, Western Australia. Western Australian Journal of Ornithology, 5: 23 -28.

DECC (2007) Threatened Species Assessment Guidelines – The Assessment of Significance. NSW Department of Environment and Climate Change, Sydney.

DoE (2013). Matters of National Environmental Significance, Significant Impact guidelines 1.1 – Environment Protection and Biodiversity Conservation Act 1999. Cwth Department of the Environment.

Fuentes, E., Olsen, J., and Rose, A. B. (2007). Diet, occupancy, and breeding performance of Wedge-tailed Eagles Aquila audax near Canberra, Australia 2002–2003: four decades after Leopold and Wolf. Corella 31, 65–72.

Gibbons, P. & Lindenmayer, D. (2000) Tree Hollows and Wildlife Conservation in Australia, CSIRO Publishing, Collingwood, Victoria, Australia

Goldingay, R. L. (2009) 'Characteristics of tree hollows used by Australian birds and bats', Wildlife Research 36: 394-409

Hull, C.L., Muir, S.C. (2013) Behaviour and Turbine Avoidance Rates of Eagles at Two Wind Farms in Tasmania, Australia, Wind Energy and Wildlife Conservation special, Wildlife Society Bulletin 37: 1: 49-58.

Leopold, A. S., and Wolfe, T. O. (1970). Food habits of nesting Wedge-tailed Eagles, Aquila audax, in south-eastern Australia. CSIRO Wildlife Research 15, 1–17.MacMahon, A. (2010) Expert Witness Statement: Yaloak South Wind Farm: Review of Wedge-tailed Eagle Assessment [online]. Available from http://www.moorabool.vic.gov.au/CA257489001FD37D/Lookup/YaloakWindFarmApplication/$file/Ecology%20Australia%20Expert%20Witness%20Statement.pdf [accessed 10 October 2015].

NGH Environmental (2014): Biodiversity Assessment, Rye Park Wind Farm. Report prepared for Epuron January 2014.

OEH (2014) BioBanking Assessment Methodology 2014. NSW Office of Environment and Heritage, Sydney.

Pain, J. (2008) in Hastings Point Progress Association Inc v Tweed Shire Council and Ors [2008] NSWLEC 180, in Beeson, A. (undated) 'A Legal Perspective on the Assessment of Cumulative Environmental Impacts', Environmental Defenders Office, Tasmania. Accessed online at http://www.edotas.org.au/wp-content/uploads/2014/10/141030-EIANZ-2014-conference-Adam-Beeson-Slides-2.ppt on 15 October 2015

Probets, C. (2006) An autumn phenomenon: Yellow-faced and White-naped Honeyeater migration through the Blue Mountains. Available from http://www.bmbirding.com.au/hemig.html or http://www.bmbirding.com.au/articles.html [accessed 15 October 2015].

SEWPaC (2012) Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. Cwth Department of Sustainability, Environment, Water, Population and Communities.

SEWPAC (2012) Species Profile and Threats Database [online]. Available from http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl [accessed November 2011 - October 2012].

Smith, G.C., Mathieson, M., Hogan, L. (2007) 'Home range and habitat use of a low-density population of greater gliders, Petauroides volans (Pseudocheiridae: Marsupialia), in a hollow-limiting environment', Wildlife Research 34: 472-483.

Treby, D (2014) Hollow-bearing trees as a habitat resource along an urbanisation gradient, Griffith University, PhD thesis.

APPENDIX A SUBMISSION FROM NSW OEH

NSW OFFICE OF ENVIRONMENT AND HERITAGE – 22 JULY 2014

Office of Environment & Heritage

Your reference: MP 10_0223
Our reference: DOC 14/61441
Contact: Virginia Thomas 6229 7105

Attention: Tracy Bellamy

Neville Osborne
Team Leader, Infrastructure Projects
Development Assessment Systems & Approvals
Planning & Environment
GPO Box 39
Sydney NSW 2001

neville.osborne@planning.nsw.gov.au
tracy.bellamy@planning.nsw.gov.au

Dear Mr Osborne

RE: Rye Park Wind Farm (MP 10_0223) Environmental Impact Statement (EIS).

Thank you for your invitation to comment on the Rye Park Wind Farm EIS which is currently on exhibition. The Office of Environment and Heritage (OEH) has reviewed the relevant sections on biodiversity and Aboriginal cultural heritage and provides the following comments. OEH notes that the EIS is the same document as the Draft Environmental Assessment (v1.4, 24/1/14) that we provided a detailed submission to on 27/2/14 (**see Attachment 2**).

Biodiversity

OEH has significant concerns about this project, the project in its current layout will exert an unacceptably high impact on biodiversity.
Of greatest concern to OEH is the removal or impact to over 1,000 hollow-bearing trees and the construction of infrastructure within areas of High Biodiversity Constraint. High Constraint areas are defined as areas within which impacts are significant and within which infrastructure should be avoided (Biodiversity Assessment p. 39). These areas correspond to the classification of High Conservation Value. More detailed advice on biodiversity issues is provided in **Attachment 1**.

The proposed development does not demonstrate that feasible alternatives have been considered in areas of significant impact to threatened species, nor that the project has been designed to be consistent with the principles of avoid, mitigate and as a last resort offset. Furthermore, OEH does not believe the current proposal provides adequate mitigation measures for these significant impacts.

In reviewing the draft EA in February 2014, OEH advised that further survey and assessment work was required for Striped Legless Lizard and Golden Sun Moth, in order to meet the Director-General's Environmental Assessment Requirements (DGEARs). OEH experts met with nghenvironmental and attended a site visit at that time to discuss survey methodology. The result from the requested survey work has not yet been provided to OEH.

Aboriginal Cultural Heritage

OEH has outlined concerns regarding undertaking further Aboriginal heritage assessment investigations post approval in previous submissions. OEH maintains these overall concerns due to the

PO Box 733 Queanbeyan NSW 2620
11 Farrer Place Queanbeyan NSW
Tel: (02) 6229 7188 Fax: (02) 6229 7001
ABN 30 841 387 271
www.environment.nsw.gov.au

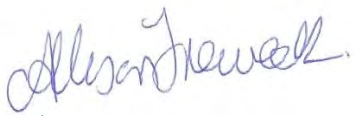
reduced capacity to consider all Aboriginal heritage values, including cumulative aspects, up front and thereby allow for appropriate consideration of management measures prior to proposed impacts.

OEH notes the commitment to conduct further archaeological assessment of any additional impact areas, including proposed micro-siting of any infrastructure be included in the post development approval management plans, to consider any potential additional impacts to Aboriginal heritage values prior to any construction activities. OEH considers, that management options would be limited if the Project design has already been finalised and approved. In particular, the cumulative impacts on Aboriginal cultural heritage values of this Project and other developments in the broader area cannot be fully understood when a complete survey of all of the proposed impact areas for the Rye Park Wind Farm has not been conducted.

As such, OEH recommends that if all required archaeological assessment investigations cannot be undertaken prior to the final approval of the proposed project design. A development condition must be included, indicating that all available management measures, including changing the project layout and avoiding of any significant areas, will be undertaken if any areas of significant Aboriginal objects or archaeological deposits are subsequently located during additional archaeological surveys and assessments.

OEH also advises that, whilst the thirteen Aboriginal sites located within the Project area have been assessed as low archaeological significance, OEH advocates for the avoidance of all impacts to Aboriginal heritage values where possible as there are very few Aboriginal sites recorded in the local region. The management of these Aboriginal sites, along with other proposed management measures for additional archaeological assessment, must be clearly documented within an Aboriginal Heritage Management Plan for the Project and prepared in consultation with OEH and the relevant Registered Aboriginal Parties.

Yours sincerely



2nd July 2014

ALLISON TREWEEK
Senior Team Leader, Planning - South East
Regional Operations and Heritage
OFFICE OF ENVIRONMENT AND HERITAGE

Attachment 1 – Detailed comments on biodiversity impacts – Rye Park Wind Farm Environmental Assessment (EA) and Biodiversity Assessment (BA)

Constraints analysis

- The proposal continues to include a 45m wide transmission line easement through High Constraint, Critically Endangered Box-Gum Woodland Ecological Community (CEEC). OEH considers that the alignment of this easement (and the alternative alignment) will result in an unacceptable level of disturbance to this high conservation value area, and is inconsistent with the principle of avoiding and minimising impacts. OEH reiterates our previous advice that this transmission line should be relocated out of the high constraint area. Furthermore, there is no information provided as to how this impacted CEEC will be offset

  The EA describes this significant area as follows: "*Of all the Box Gum Woodland mapped, this area supported the largest patches of this community within the project area* [i.e. within the surrounding 14,000 ha, Table 11.5] *and the highest abundance of mature box trees. This area was also identified as important habitat for the Superb Parrot and Painted Honeyeater. These areas have high conservation value and also qualify as the Commonwealth Box Gum Woodland CEEC and have been mapped as a high constraint*." (p.196)

  OEH does not consider that recommendations to "*micro-site all transmission lines and access tracks near all Yellow Box trees between the area of RYP_110 and RYP_120 even they do not appear to contain a hollow*" are sufficient to be considered "avoidance" measures (p. 87, BA).

- The high constraint Superb Parrot nest-tree buffer west of turbine 143 appears to have a road and underground cable running through it. Other hollow-bearing trees that may be potential Superb Parrot nest trees should be preserved within buffers and construction should be excluded.

- Likewise, there are road and cables going through high constraint Golden Sun Moth areas northwest of turbine 73, west of turbine 98 and 99, and south of turbine 47. Infrastructure should be re-routed outside of these constraints areas if possible. If not these areas are required to be offset with Golden sun moth habitat.

- The high constraint area for Striped Legless Lizard at turbine 27 is impacted by construction of turbines and tracks. Given this is considered another 'significant' impact; a well-defined offset area of known habitat must be included to demonstrate that an 'improve or maintain' outcome will be achieved for this species.

- If construction is to be undertaken in high constraint areas, offsets for this 'significant' loss should be calculated at a higher ratio than for moderate or low constraint.

- High constraint mapping within large contiguous woodland and forest blocks should consider the edge effects from widening of roads and also indirect impacts of close proximity to turbines from noise and disturbance. The distance of disturbance impacts should be at least 100 m and so the constraint mapping needs to be checked at a finer scale to see where turbines may overlap.

- The EIS clearly identifies the moderate constraint area forest/woodland remnant in proximity to turbines 102, 103 and 104 as known habitat for threatened woodland birds and containing high numbers of threatened species. Construction of turbines and the creation of new easements through this remnant will inflict edge effects such as weed invasion and provision of suitable habitat for the aggressive Noisy Miner, whose impacts on small woodland birds is listed as a Key Threatening Process under both NSW and Commonwealth legislation.

- The high constraints mapping does not consider the presence of mature hollow-bearing trees in scattered configurations within the impact zone. NGH should provide details on how many hollow-bearing paddock trees are within the impact zone and 100 m buffer areas around infrastructure and easements to be able to properly devise an adequate amelioration strategy using avoidance or offsetting methods.

Hollow Bearing Trees (HBT)

- OEH has previously provided advice detailing significant concerns about the numbers of HBT to be removed in this proposal. These concerns include both the methodology used to estimate numbers of HBT (particularly extrapolation and small sample size), and the potentially very large impact that the removal of over 1,000 HBT could have on the hollow-dependent fauna in this over-cleared landscape, particularly the threatened Superb Parrot. OEH considers that these concerns have not been adequately addressed by the proponent.
- Table 7.5 (p. 87 in the BA) purports to use clearing figures from Table 7.3 to estimate the numbers of HBT to be cleared, yet every figure appears to be incorrect. OEH has inserted the figures for vegetation extent, and extrapolations of HBT to be cleared from Tables 7.2 and 7.3 to illustrate this point. Using the figures presented in Tables 7.2 and 7.3, the total estimated number of HBT to be cleared is well over 1,600.
- OEH seeks clarification as to where the figures in the below table have been derived from. OEH does not consider extrapolation to be an appropriate form of vegetation or habitat mapping. Figures such as those listed below require adequate survey across the landscape to ground truth such claims regarding the amount of habitat and hollow bearing tress in the landscape.
- Without such ground truthing and adequate surveys and sampling including the use of plot data these figures cannot be used to estimate the impacts of the development. As indicated below, the hollow bearing tree extent is grossly overestimated and therefore the impact of the development is under estimated.

Vegetation	Av. HBT per ha	Veg extent (ha)	HBT extent	Clearing (ha)	No. HBT cleared	% total
Forest	13.5	4,654 *3,987*	62,829 *53,824.5*	53 *93*	715.5 *1,255.5*	1.1% *2.3%*
Woodland	13.5	3,048 *1,555*	41,148 *20,992.5*	21 *24 (Table 7.2) or 25 (Table 7.3)*	283.5 *324 (Table 7.2) or 337.5 (Table 7.3)*	0.7% *1.5 - 1.6%*
Paddock	1	7,307 *5,887*	7,307 *5,887*	30 *84 (Table 7.2) or 66 (Table 7.3)*	30 *66 - 84*	0.4% *1.12 - 1.43%*
Total worst-case HBT cleared			111,284 *80,704*	***183 to 202***	1,029 ***1,646 to 1,677***	0.9% *2.0 – 2.1%*

Information in black is in Table 7.5, p. 87 of the BA

Figures in *blue italics* are from Tables 7.2 and 7.3 (pp. 84-85).

- OEH reiterates previous advice on this matter of significant concern: 1,029 HBT is an unacceptable level of loss in a fragmented landscape - clearly, if the figure is over 1,600 HBT, OEH advises that the project cannot be supported unless it is modified to reduce the impact on this essential habitat resource.
- OEH does not consider the recommendation for pre-clearance surveys and micro-siting to be an appropriate "avoidance" measure. Prior to approval, the project design must demonstrate that high conservation biodiversity features, such as large HBT in an over-cleared landscape, have been avoided wherever possible.
- All HBTs within 100m of all infrastructure should be assessed and quantified. It appears that the majority of clearing of forest and woodland, including HBTs, is for tracks and easements, rather than turbines. Therefore, all HBT to be removed on the alignments of these components of the development should be assessed for threatened species habitat value and mapped to allow the design to avoid, mitigate and offset appropriately.
- As per our previous submissions, OEH strongly rejects the suggested generic offset ratio of 1:1 for HBT to be removed, supplemented by nest boxes when sufficient trees are not available. OEH advises that offset ratios for HBT that represent suitable potential habitat for threatened species range from 5:1 to over 10:1. The proposed use of artificial hollows as an offsetting strategy for the loss of natural hollows is not recommended or supported by OEH.
- The loss of HBT is a key threatening process (KTP) under the *Threatened Species Conservation Act (1995)* because it adversely affects threatened species, populations or ecological communities, and could cause species, populations or ecological communities that are not threatened to become threatened. A sudden loss of such a large number of HBTs, and the lag time in recruitment of younger trees to replace them (>100 years), will result in increased competition for hollow resources in this agricultural landscape in the medium to long term. This will impact on hollow-dependent fauna which are already threatened or declining. Owing to the slow process of hollow development, and the particular value provided by large old trees, adverse effects on local populations of hollow-dependent fauna in the local area from the loss of so many HBT are likely to be irreversible.
- In the KTP section [7.5.6], the report states that "*Recommendations have been given to minimise the impact of the proposal to an acceptable level, specifically in relation to hollow bearing trees. With implementation of recommendations, the proposal would not exacerbate existing key threatening processes*." OEH considers that the report does not adequately address the critical issue of clearance of over 1,000 HBT in this agricultural landscape, and that greater analysis should be provided in both the section on KTP (section 7.5.6) and the Cumulative impacts (section 7.5.8).

OEH seeks clarification on the number of plots surveyed to date for HBT. Table 5.1 indicates 39 plots (35 25x25 plots and 4 100x100 plots) but text refers to 35 plots. Were the 100x100m plots not included? If so, were only 3 plots included for paddock trees? Turbine removal

OEH affirms its previous advice that certain turbines should be removed from the array in order to lessen the impacts on threatened species and their habitat.

- The proposal continues to include several turbines within High Constraint, Critically Endangered Ecological Ecosystem (CEEC). OEH considers that the construction of these turbines will result in an unacceptable level of impact on threatened species, specifically Superb Parrot and Painted Honeyeater, and this is inconsistent with the principle of avoiding and minimising impacts. OEH reiterates our previous advice that turbine 110 should be removed and turbines 106, 107 and 109 should be removed or seasonally shutdown to avoid the breeding season of these threatened birds. The BA contained detailed mapping of the high use of this area by breeding Superb Parrots, including

evidence that they fly at rotor swept height in this location. OEH considers that the potential impacts from these turbines cannot be offset.

- Based on the close proximity to an area highlighted by the BA as having exceptionally high densities of mature HBTs with numerous hollows, OEH considers that turbine 104 should be removed to avoid impacts to hollow-dwelling fauna that would occupy this remnant high conservation value area.

Box Gum Woodland Endangered Ecological Community (BGW EEC)

OEH notes the following points regarding the mapping of Box Gum Woodland Endangered Ecological Community (BGW EEC) in the EA and BA:

- All areas of EEC identified within the project area would be classified as "Moderate to Good" condition under the NSW OEH Biometric definition [p. 188 EA]. Therefore, references to poor and low quality EEC throughout the documents are confusing and misleading. Adequate description of the quality of the Box gum woodland need to be provided, the moderate to good condition Box gum woodland should be described to explain the condition of the vegetation. The Box gum woodland should be described as

- Box gum woodland with a native understorey and intact overstorey,
- box gum woodland with an intact overstorey and non native in the groundcover and
- box gum woodland as a native ground cover without an overstorey. These descriptions give a further indication of the condition and therefore the conservation value of the area of Box gum woodland.

- The documents present inconsistent figures for the number of hectares of EEC to be impacted, which is confusing and misleading.
    - 40 ha of NSW-listed (TSC Act) BGW EEC will be permanently impacted, 12 ha of which meets the definition of Commonwealth-listed (EPBC Act) Critically Endangered Ecological Community (CEEC) (e.g. p.188 and 196 of EA, p. 84 of BA).
    - However in many places, the documents state that 31ha of BGW EEC will be permanently impacted: e.g. Table 7.3 [p.85 of BA] / Table 11.5 [p. 195 of EA] and Section 7.5.6 [KTP - p. 106, BA].

- OEH considers that the documents do not adequately address the impact of the proposal on the KTP of clearing of native vegetation. Further analysis and correction of figures should be provided:
  "*The proposal would not contribute significantly to the operation of clearing as a threatening process at the local or regional level, since the majority of the project area is already cleared and highly modified by agricultural practices. The proposal would remove up to 31 ha of predominately low quality Box Gum Woodland and derived grassland, an endangered ecological community*." (p. 106, BA).

Impact Assessment

- When the collision risk of 0.05 Wedge-tailed Eagles per turbine per year is extrapolated across the proposed 126 turbines, this equates to over 6 eagles killed each year at Rye Park Wind Farm. This is significant - some analysis should be provided regarding the potential impact of this rate of eagle deaths on the local and regional ecology.

- In general, OEH considers that Wedge-tailed Eagle nests should be buffered by 500m due to the high level of risk that turbines provide, particularly to young birds. However, our records show that during our meeting with Deb Frazer from nghenvironmental on24/2/14, a discussion on this subject reached a compromised position of 200m buffers around

nests. OEH does not consider that a 100m buffer around Wedge-tailed Eagle nests will provide adequate protection.

- There is a lack of information about which trees constitute potential nesting habitat for Superb Parrot, given that only sub-sampling was conducted. Any loss of trees with hollows > 6 cm should be quantified and appropriately offset at the recommended species-specific ratio.
- Sifton Bush shrubland, despite being a disturbed shrubland community, is known to be an important habitat for threatened woodland birds – recent research from Victoria has shown the importance of these shrublands in overcleared landscapes.
- Superb Parrot Test of Significance– given that the assessment of HBTs was restricted to focal areas, the conclusion that this proposal will not exert a significant impact cannot be substantiated as there may be nest trees that were not identified during the field surveys that may be cleared. Not all birds necessarily leave the region post-breeding – the Superb Parrot community monitoring program is detecting small numbers of birds in the Boorowa-Cowra region in autumn 2014.
-

<u>Avoidance, Mitigation and Offset</u>

- OEH strongly recommends that all biodiversity surveys and finalisation of the design layout for this development be completed prior to approval. OEH does not support the undertaking of more detailed surveys for threatened species and subsequent micro-siting of turbines post-approval. Furthermore, OEH does not support the post-approval survey and identification of suitable offset sites. OEH considers that this development should only be approved when the proponent has demonstrated that they have employed the principles of avoid, mitigate and offset to the satisfaction of the NSW government.
- OEH does not consider that the design measures to avoid impact to biodiversity listed in Section 8 (p. 110, BA) demonstrate that feasible alternatives have been considered where biodiversity impacts are going to be significant, or that the project has been designed to be consistent with the principles of avoid, mitigate and offset.
- OEH does not support the suggested generic offset ratios, particularly the 1:1 for HBTs. As stated previously, appropriate offset ratios for specific threatened species must be applied. OEH is happy to assist with providing these ratios to the proponent.
- Importantly, OEH does not support the use of nest boxes as an offset strategy. Loss of tree hollows must be offset with natural tree hollows in dead or living trees at ratios appropriate to the specific species impacted by the loss.
- Any loss of EEC or native vegetation that represents known or potential threatened species habitat must be offset using the appropriate entity-specific offset ratios in BioBanking or PVP tools. The proposed generic 1:1. 1:5 and 1:10 ratios may not achieve improve or maintain outcomes. In particular, the suggested 1:1 ratio for tree hollows is inadequate for hollow-dependent threatened fauna such as the Superb Parrot whose recommended offset ratio is 1:1.9.
- Vegetation condition must be mapped outside the impact zone, in potential offset areas, to ensure an appropriate offset is achieved. There is currently no detail provided on the condition or extent of possible BGW EEC offset areas.
- Further targeted surveys for Striped Legless Lizard outside the impact area are required to identify and quantify suitable offsets. Offsets for this species must contain habitat that is known to be used by the species. In the absence of suitable offsets for this species, the impact to the high constraint area at turbine 27 should not be approved.

- Some clusters of turbines (e.g. turbines 143 – 95) are very close to high constraint remnant woodland – distances between turbines and woodland edges seem very small and need to be stated in the report. Increasing these distances could help to minimise potential impact to flying fauna. As stated above, high constraint remnant woodland within 100m of turbines should be offset for both direct and indirect impacts.

Adequacy of surveys

A population of Crimson Spider Orchid has recently been recorded in Bango Nature Reserve, adjoining the proposed Rye Park Wind Farm site. In light of this new record, OEH has re-examined the Biodiversity Assessment to assess the level of survey undertaken for this species. The Crimson Spider Orchid was listed as a subject species in the Director-General's Requirements for Environmental Assessment (DGEARs 31/1/11), so it required targeted, systematic survey. The methodology specifies using evenly spaced transects located about 10 m apart through all areas of woodland/grassland in late August – September (flowering period).

OEH considers that the Environmental Assessment (EA) must provide further information and clarification on the threatened flora surveys undertaken to date, including the timing of surveys and the species targeted. All areas of woodland and grassland potentially impacted by the development must be surveyed for specified threatened flora species, including the Crimson Spider Orchid, in the appropriate season.

OEH considers that the information on threatened flora surveys provided in the EA and Biodiversity Assessment (BA) does not satisfy the DGEARs. OEH has previously provided advice on this matter in our submission of 22/5/13.

Further information

The BA states that survey for threatened flora has been undertaken in accordance with DGEARs (p. 32), however:

- Surveys were only done in moderate or good condition Box Gum Woodland and derived grassland (DGEARs specify all woodland and grassland),
- Only three threatened flora species were considered to "possibly occur in the project area" (p. 48) (Hoary Sunray, Yass Daisy and Tarengo Leek Orchid), and section 4.5 comments that targeted searches for these three species were conducted (DGEARs list five subject species and a further seven species to be considered).
- No information is provided about the timing of surveys, despite timing being different for each species and specified in DGEARs

Flora Species	DGEARs Survey Requirements
Silky Swainson Pea (Swainsona sericea), Mountain Swainson Pea (Swainsona recta), Tarengo Leek Orchid (Prasophyllum petilum), Crimson Spider Orchid (Caladenia concolor), and Yass Daisy (Ammobium crespedioides).	Systematic surveys using evenly spaced transects located about 10 m apart through all areas of woodland/grassland must be undertaken. Survey should be undertaken during the flowering periods; Silky Swainson Pea – September to December Mountain Swainson Pea and Tarengo Leek Orchid – October Crimson Spider Orchid – late August – September Yass Daisy – Spring, but also recognisable several months before hand and after flowering by its foliage Where possible, flowering should be confirmed at the nearest known site prior to surveys being undertaken. DECCW should be consulted to known population and seasons, and appropriate survey methods.

- OEH met with nghenvironmental on 24/2/14, as previously mentioned. This meeting was requested by ngh following previous OEH submissions on the adequacy of the draft Environmental Assessment. The aim of the meeting was to discuss what further survey or assessment work was required for Striped Legless Lizard and Golden Sun Moth in order to meet the Director General's Environmental Assessment Requirements (DGEARs). It was clearly stated to the consultant and in our submission to Department of Planning (27/2/14) that until this survey is conducted to our satisfaction, the DGEARs have not been adequately addressed.
- As agreed at that meeting, OEH officers attended a site visit with nhg staff on 12/3/14 to advise them on methodology for the surveys required to meet the DGEARs.
- The requested information from the additional survey work has not been provided to OEH.

Attachment 2 OEH previous submission on Rye Park Wind farm

Attachment 1 - OEH Comments on *Rye Park Wind Farm Environmental Assessment V 1.4 (24/1/14) and Appendix C - Biodiversity Assessment*

1. Adequacy of proposed offsets

The proposed offset ratios for the loss of hollow bearing trees (HBTs) in the EA are considered insufficient, particularly where they represent threatened fauna habitat. Typically, offset ratios for threatened fauna habitat features such as HBTs is between 5:1 and 10:1. OEH strongly recommends that DP&I and the proponent give consideration to applying the NSW Government's policy on offsetting, which are underpinned by a set of principles to assess impacts to biodiversity and determine acceptable offsets for major projects such as the current proposal. The full framework can be accessed here: http://www.environment.nsw.gov.au/biodivoffsets/nswoffsetprincip.htm.

In summary, OEH recommends that:

- after all feasible measures have been taken to avoid or minimise impacts to biodiversity, offsets should be used to compensate for any remaining impacts; information regarding how and where impacts have been avoided should be provided.
- offsetting decisions should be based on a reliable and transparent assessment of the direct and indirect loss to threatened species and their habitat due to the development proposal and the likely gain in threatened species habitat values through the offset; and
- established assessment tools, such as the BioBanking Assessment Methodology, are considered best practice.

2. Hollow-bearing tree (HBT) loss

The BA estimates that over 1,000 HBTs will be removed by this development. OEH considers that a loss of this magnitude of HBTs in a fragmented landscape will exert an unacceptably high level of impact to threatened species such as the Superb Parrot and other arboreal species (microbats, gliders, owls) that rely on these keystone habitat features. OEH acknowledges that this figure has been derived through extrapolation of the results of sub sampling and is therefore unlikely to be an accurate estimate of the total loss of HBTs. OEH seeks clarification on the quadrat size used for HBT surveys used in the extrapolative process to estimate total HBT loss, as it is reported differently throughout the BA:

- p.16 - quadrats of 10x10m in forest, 25x25m in woodland and 100x100m in paddocks,
- p.28 - 100x100m quadrats used,
- p.54 – 25x25m quadrats in forest and woodland, 25x25m and 100x100m quadrats in paddocks.

OEH considers that a rapid field-based assessment to quantify the actual total loss of HBTs is required to provide transparency about the impacts and ability to offset these impacts. Furthermore, the BA should also provide an estimate of the number of HBT that may be indirectly impacted for example through the hollows no longer being utilised by fauna as a result of the by wind turbine activity.

The BA suggests that the 1,029 HBT estimated to be removed would be offset at a rate of 1:1 (p. 112), with the use of artificial hollows if not enough HBT are available. OEH advises that offset ratios for HBT that represent suitable potential habitat for threatened species range from 5:1 to over 10:1. For example, the offset ratio for the loss of HBTs that provide breeding habitat for the

threatened Superb Parrot and large forest owls is approximately 10:1. The proposed use of artificial hollows as an offsetting strategy for the loss of natural hollows is not recommended or supported by OEH. There is an increasing body of research from long term monitoring of artificial nest boxes that has clearly demonstrated that very few native animals use these structures. They often attract feral bird species or European honeybees, and a very high proportion of boxes deteriorate and fall down within a few years.

Based on the close proximity to an area highlighted by the BA as having exceptionally high densities of mature HBTs with numerous hollows, OEH considers that RYP_104 should be removed to alleviate potential impacts to hollow-dwelling fauna that would occupy this remnant forest.

3. Constraints Mapping

OEH considers that the constraint mapping provided in the EA is adequate. However, the EA does not provide sufficient justification as to why the high constraint areas have not been avoided in the wind farm layout. As high constraint areas correspond to known threatened species locations and important breeding habitat for threatened species (Table 6.1 in the BA p. 74), OEH considers that these areas should be avoided wherever possible. However, the EA and BA indicate that transmission lines, turbines and access tracks are still proposed in high constraint areas.

For some high constraint areas, such as GSM habitat, OEH acknowledges that not all impacts can be avoided and that offsetting is likely to be required for mitigation. However, impacts to high constraint areas with multiple values such as Critcially Endangered Ecological Communities, important HBT resources and raptor nest trees, for example, should be minimised by removing or relocating infrastructure.

The BA states that impacts in high constraint areas are significant, and would be difficult or costly to mitigate, or require large offset areas, and should be avoided as a preference (p. 39). Even in moderate constraint areas, which are also extensive, the BA states that offsetting may require a larger offset ratio.

4. Potential impacts to Box Gum Woodland Endangered Ecological Community (EEC)

OEH is particularly concerned about the predicted impacts to the highest quality EEC areas on the southern extent of the site that would qualify as the Commonwealth-listed Box Gum Woodland CEEC. This area contains the largest EEC patches within the project area and the greatest abundance of mature box trees, and was identified as important habitat for the Superb Parrot and Painted Honeyeater (p. 81). Both proposed alignments for the overhead powerline (preferred and alternative) are within high constraint areas of mapped CEEC. OEH considers that the 45m wide easement for the 132kV overhead transmission line should be realigned to remove impacts to these high constraint areas.

OEH seeks clarification of the number of hectares of Box Gum Woodland and derived grassland EEC to be cleared. Why is the figure different in Tables 7.3 (32 ha) and 7.2 and 7.4 (40 ha) on p. 85?

The NSW government requires developers to avoid, mitigate or, as a last resort, offset the impacts of developments on biodiversity values. The two NSW government endorsed tools (the PVP Developer and BioBanking Credit Calculator) used to assess an “improve” or “maintain” environmental outcome resulting from a development proposal do not allow BGW EEC in moderate to good condition to be cleared; i.e. they are red flagged. A red flag in either of these tools indicates that the species or community is unable to withstand further loss of habitat or

individuals. If the BGW EEC is in low condition, then these tools will allow an offset for this community at approximately a 10:1 offset ratio.

5. Potential impacts to Superb Parrot and Painted Honeyeater

OEH considers that the Superb Parrot flight path mapping methodology and survey effort is adequate in meeting the requirements set out in the DGRs. However, it must be acknowledged that the information collected represents a snapshot from a single year and observations from multiple years would enhance the understanding about how the Superb Parrot uses the local landscape in different years when food and nesting resources may differ and hence influence movement pathways. The flight path mapping in the BA indicates a high-use area and mulitpile movement pathways in the south, in the vicinity of turbines RYP_106, RYP_107, RYP_109 and RYP_110. These have been appropriately highlighted in the BA as a high constraint area for the Superb Parrot. As discussed at the recent meeting with **ngh environmental**, OEH is concerned that there is potential for turbine collision impacts to the Superb Parrot in this area, particularly with regard to turbine 110, which is central located within the cluster of flight paths mapped in the BA. Removal of this turbine would reduce the likelihood of impacts to both the Superb Parrot and also the nomadic threatened Painted Honeyeater that was recorded in the high quality habitat immediately to the west. This species is known to fly at times within rotor sweep height when flying between foraging trees.

As an alternative to removing the three other turbines from this high constraints areas, owing to the seasonal breeding behaviour of the Superb Parrot and Painted Honeyeater in this region between August and January, it may be feasible to construct and operate turbines RYP_106, RYP_107 and RYP_109 but turn them off during the breeding season.

6. Golden Sun Moth (GSM) surveys and habitat mapping

OEH considers that the GSM surveys have adequately met the DGRs. However, additional information is required to characterise and map the habitat for GSM including the vegetation species composition, structure and management history. This information is important for quantifying the development impacts and for identifying suitable offsets where the species is confirmed to occur. OEH is currently developing a grassland habitat assessment method that could be useful for this task and will provide this to NGH as soon as it is fully developed..

7. Striped Legless Lizard (SLL) surveys and habitat mapping

OEH notes that **ngh**environmental intends to undertake more detailed habitat analysis for the SLL, in order to better understand the extent of habitat, the likely impacts and the mitigation options. If offsetting is being considered as a component of the mitigation for this species, it is important to note that the offset site must be an area where the species occurs. To avoid or reduce the direct and indirect impacts at the known SLL locality, OEH recommend that turbine RYP_27 and associated track and cabling infrastructure be removed or micro-sited. During construction, any cabling trenches must be checked daily for fauna, with particular attention to SLL. These and other such conditions should be included in the Construction Environmental Management Plan.

8. Cumulative Impacts

The cumulative impacts of this wind farm, along with potential impacts of all the other approved, constructed or proposed wind farms in the region, must be taken into consideration in the discussion of the cumulative impacts on the fragmented vegetation in this landscape. Including Rye Park, more than 200 turbines are proposed within 10km, more than 350 turbines within 30km, and more than 650 turbines within 50km of this site. The discussion should include

potential impacts on threatened and migratory species, HBT, EECs and regional populations of at-risk species such as Wedge-tailed Eagle.

9. Buffers between turbines and the edge of tree canopies and remnant woody vegetation

OEH would like to seek clarification as to how the distance of 70m was derived as an adequate buffer in the BA. OEH has previously provided **ngh** environmental with the recommended formula to determine minimum distances between infrastructure and certain habitat features, and we request confirmation that this was applied in the BA. To reduce the indirect impacts to breeding raptors, OEH recommends that a buffer of 500 m be applied to active raptor nests in which no development should occur. The BA does provide supporting information regarding the range and average buffer distances applied to other wind farm proposals internationally, which are on average 600 m.

10. Bango Nature Reserve

OEH considers that turbines RYP_123 and RYP_126, which are currently proposed to be located 70m from the Bango Nature Reserve, should be removed or relocated to at least 150 m or more from the boundary, as was recommended by **ngh** environmental. Bango Nature Reserve has a known population of Gang –Gang cockatoos, placing turbines within 70 metres of the reserve has the potential to quarantine the habitat values provided by Bango nature reserve for the Gang Gang cockatoo. The reserve is an important habitat remnant, in an over-cleared landscape, for species that may be impacted by the turbines, including raptors, cockatoos and large forest owls . Guidelines for use by planning authorities for assessment of development applications that may impact on National Parks and Nature Reserves can be found here: http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm

11. Bird and Bat Adaptive Monitoring Program (BBAMP)

OEH recommends that the proponent and their consultants contact us as soon as possible about the required Bird and Bat Adaptive Monitoring Program, which will be developed for this site. OEH recommends twelve months of baseline bird and bat utilisation surveys prior to construction and at least five years of monitoring post-construction. This includes carcass searches under turbines, as well as ongoing monitoring of at-risk species throughout the site. Close monitoring of the Superb Parrot breeding behaviour at known and potential nest trees and site utilisation would be an important component of the BBAMP.

APPENDIX B RESPONSE TO ADEQUACY REVIEW COMMENTS

Item	Issue	NGH Response	Further work proposed
	Constraints analysis		
1	a) 45m wide easement in high constraint Critically Endangered Box-Gum Woodland Ecological Community (CEEC) should be relocated. b) No information provided as to how this high constraint CEEC will be offset	a) It is necessary for the viability of the project to have a transmission line connecting the substation in the south of the project area to infrastructure in the north. It is not possible to completely avoid the CEEC however, the transmission line has been relocated so it crosses the narrowest area of the community minimising the impacts to the CEEC. b) An offset strategy is provided with this addendum (refer Appendix D that details how impacts to the CEEC will be offset.	No
2	Recommendations to 'micro-site all transmission line and access tracks near all Yellow Box trees between the area of RYP_110 and RYP_120 even they do not appear to contain a hollow' are not considered sufficient to be considered 'avoidance' measures.	As discussed in item 1 above, the transmission lines and tracks have now been relocated in this area to avoid impacts to Yellow Box trees. It is acknowledged that micro-siting is not avoidance but a minimisation measure.	No
3	The high constraint Superb Parrot nest-tree buffer west of turbine 143 appears to have a road and underground cable running through it. Other hollow-bearing trees that may be potential Superb Parrot nest trees should be preserved within buffers and construction should be excluded.	This tree will be retained. Further clarification is provided in Section 4.1.	No

Item	Issue	NGH Response	Further work proposed
4	Road and cables going through high constraint Golden Sun Moth areas northwest of turbine 73, west of turbine 98 and 99, and south of turbine 47. Infrastructure should be re-routed outside of these constraints areas if possible. If not these areas are required to be offset with Golden sun moth habitat.	Infrastructure has been removed avoiding impacts to high constraint Golden Sun Moth areas west of turbines 98 and 99. Impacts remain in the areas northwest of turbine 73 and south of turbine 47. Further information regarding impacts in these areas is provided in Section 4.3. Potential habitat for this species has been mapped across the site boundary within areas proposed for development and those available for offsetting (refer Appendix C.1). Impacts in these areas will be offset with Golden Sun Moth habitat as detailed in the revised offset strategy for the proposal (refer Appendix D).	No
5	The high constraint area for Striped Legless Lizard at turbine 27 is impacted by construction of turbines and tracks. Given this is considered another 'significant' impact; a well-defined offset area of known habitat must be included to demonstrate that an 'improve or maintain' outcome will be achieved for this species.	Turbine 27 and associated infrastructure has been removed from the proposal. Further information regarding impacts to known habitat for the Striped Legless Lizard is provided in Section 4.2.	No
6	If construction is to be undertaken in high constraint areas, offsets for this 'significant' loss should be calculated at a higher ratio than for moderate or low constraint.	The revised offset strategy (refer to Appendix D) utilises the Framework for Biodiversity Assessment for determining the suitability of offsets and is being prepared in consultation with OEH.	No
7	High constraint mapping within large contiguous woodland and forest blocks should consider the edge effects from widening of roads and also indirect impacts of close proximity to turbines from noise and disturbance. The distance of disturbance impacts should be at least 100 m and so the constraint mapping needs to be checked at a finer scale to see where turbines may overlap.	Discussions on the buffer distance were had during an on-site visit with OEH and NGH Environmental (February 2014) where it was decided to apply the formula presented in Natural England (2012). This formula was applied which resulted in a buffer distance of 70m. Further information pertaining to the calculation of the 70m buffer and the site specific analysis for turbine 96 is provided in Section 4.4.	No

Item	Issue	NGH Response	Further work proposed
8	The EIS clearly identifies the moderate constraint area forest/woodland remnant in proximity to turbines 102, 103 and 104 as known habitat for threatened woodland birds and containing high numbers of threatened species. Construction of turbines and the creation of new easements through this remnant will inflict edge effects such as weed invasion and provision of suitable habitat for the aggressive Noisy Miner, whose impacts on small woodland birds is listed as a Key Threatening Process under both NSW and Commonwealth legislation.	Further information regarding the habitat values in the vicinity of turbines 102, 103 and 104 is provided in Section 4.5 and a revised assessment of the potential impacts to threatened fauna species is provided in Section 5.	No
9	The high constraints mapping does not consider the presence of mature hollow-bearing trees in scattered configurations within the impact zone. NGH should provide details on how many hollow-bearing paddock trees are within the impact zone and 100 m buffer areas around infrastructure and easements to be able to properly devise an adequate amelioration strategy using avoidance or offsetting methods.	Impacts to HBTs have now been assessed according to the methodology agreed to by OEH as documented in Section 3.4.	No

Item	Issue	NGH Response	Further work proposed
	Hollow Bearing Trees		
10	Methodology used to estimate numbers of HBT (particularly extrapolation and small sample size), and the potentially very large impact that the removal of over 1,000 HBT could have on the hollow-dependent fauna in this over-cleared landscape, particularly the threatened Superb Parrot. OEH considers that these concerns have not been adequately addressed by the proponent.	It should be noted that the focus of Superb Parrot surveys was to sample areas across the entire wind farm to determine the areas the parrots were using. That is, transects and bird surveys were undertaken in areas of known records and habitat, as well as in areas not known to be utilised by the parrot. This way, it was possible to narrow down the habitat estimates based on actual usage data. We were then able to confidently identify the high usage areas the parrots were continuously observed within. We then conducted HBT assessments in these areas and highlighted both known and potential nest trees in areas of Superb Parrot activity. It is likely, other nests trees could occur in the project area, but are likely to be outside of impact areas or irregularly used. Impacts to HBTs in other areas have now been assessed according to the methodology agreed to by OEH as documented in Section 3.4. The revised impact assessment included in Section 5 considers these results in the context of impacts to the Superb Parrot.	No
11	Incorrect figures used in Table 7.5	This was likely an artefact of infrastructure revisions and site boundary changes. Table 7.5 is now redundant with the application of more detailed HBT assessment methodologies documented in this addendum.	No
12	Clarification of where figures in table 7.5 came from. OEH does not consider extrapolation to be an appropriate form of vegetation or habitat mapping.	See comment above.	No

Item	Issue	NGH Response	Further work proposed
13	Without such ground truthing and adequate surveys and sampling including the use of plot data these figures cannot be used to estimate the impacts of the development. As indicated below, the hollow bearing tree extent is grossly overestimated and therefore the impact of the development is under estimated.	This has been superseded by the application of the revised HBT assessment methodology (refer to Section 3.4).	No
14	1,029 HBT is an unacceptable level of loss in a fragmented landscape - clearly, if the figure is over 1,600 HBT, OEH advises that the project cannot be supported unless it is modified to reduce the impact on this essential habitat resource.	This has been accounted for in the application of the revised HBT assessment methodology and subsequent analysis (refer to Section 3.4). Impacts associated with the loss of HBTs are discussed in detail in Section 5.2.1.	No
15	Recommendation for pre-clearance surveys and micro-siting is not considered an appropriate "avoidance" measure. Prior to approval, the project design must demonstrate that high conservation biodiversity features have been avoided wherever possible.	How the project has avoided high conservation biodiversity features is documented in Section 2.3 of this addendum. Where impacts cannot be avoided, an explanation is provided.	No
16	All HBTs within 100m of all infrastructure should be assessed and quantified. It appears that the majority of clearing of forest and woodland, including HBTs, is for tracks and easements, rather than turbines. Therefore, all HBT to be removed on the alignments of these components of the development should be assessed for threatened species habitat value and mapped to allow the design to avoid, mitigate and offset appropriately.	The revised HBT assessment methodology determined in consultation with OEH has been applied to account for impacts to HBTs (refer to Section 3.4).	No
17	OEH advises that offset ratios for HBT that represent suitable potential habitat for threatened species range from 5:1 to over 10:1. The proposed use of artificial hollows as an offsetting strategy for the loss of natural hollows is not recommended or supported by OEH.	Noted. This has been accounted for in the revised offset strategy (refer to Appendix D) which is being prepared in consultation with OEH.	No

Item	Issue	NGH Response	Further work proposed
18	A sudden loss of such a large number of HBTs, and the lag time in recruitment of younger trees to replace them (>100 years), will result in increased competition for hollow resources in this agricultural landscape in the medium to long term. This will impact on hollow-dependent fauna which are already threatened or declining. Owing to the slow process of hollow development, and the particular value provided by large old trees, adverse effects on local populations of hollow-dependent fauna in the local area from the loss of so many HBT are likely to be irreversible.	Noted. This issue has been considered in the revised impact assessment completed in Section 5.5.1.	No
19	OEH considers that the report does not adequately address the critical issue of clearance of over 1,000 HBT in this agricultural landscape, and that greater analysis should be provided in both the section on KTP (section 7.5.6) and the Cumulative impacts (section 7.5.8).	This has been accounted for in the application of the revised HBT assessment methodology and subsequent analysis (refer to Section 3.4). Impacts associated with the loss of HBTs are discussed in detail in Sections 5.5.	No
20	OEH seeks clarification on the number of plots surveyed to date for HBT. Table 5.1 indicates 39 plots (35 25x25 plots and 4 100x100 plots) but text refers to 35 plots. Were the 100x100m plots not included? If so, were only 3 plots included for paddock trees?	This has been superseded by the application of the revised HBT assessment methodology (refer to Section 3.4).	No
	Turbine removal		
21	The proposal continues to include several turbines within High Constraint, Critically Endangered Ecological Ecosystem (CEEC). OEH considers that the construction of these turbines will result in an unacceptable level of impact on threatened species, specifically Superb Parrot and Painted Honeyeater, and this is inconsistent with the principle of avoiding and minimising impacts.	Turbines within the high constraint CEEC and identified Superb Parrot/ painted Honeyeater corridor have been removed from the proposed layout avoiding impacts in these areas.	No
22	Turbine 110 should be removed and turbines 106, 107 and 109 should be removed or seasonally shutdown to avoid the breeding season of these threatened birds.	As above	No

Item	Issue	NGH Response	Further work proposed
23	OEH considers that turbine 104 should be removed to avoid impacts to hollow-dwelling fauna that would occupy this remnant high conservation value area.	Turbine 104 is not sited in an area of high conservation value area or within a treed area, but on the other side of track from the wooded area with hollows. The turbine is sited in an already partially cleared area 80m from the nearest continuous woodland. Further information regarding the habitat values in the vicinity of turbines 102, 103 and 104 is provided in Section 4.5 and a revised assessment of the potential impacts to threatened fauna species is provided in Section 5.	No
	Box Gum Woodland Endangered Ecological Community (BGW EEC)		
24	EEC within the project area would be classified under OEH Biometric definition. References to poor and low quality ECC is confusing. Adequate description of the quality of the Box gum woodland need to be provided, the moderate to good condition Box gum woodland should be described to explain the condition of the vegetation. The Box gum woodland should be described as • Box gum woodland with a native understorey and intact overstorey, • Box gum woodland with an intact overstorey and non native in the groundcover and • Box gum woodland as a native ground cover without an overstorey.	The Box-Gum Woodland EEC condition has been re-classified according to the categories requested by OEH. This is mapped in Appendix E. Impacts to the Box-Gum woodland EEC are discussed with reference to these categories in Section 5.2.1.	No

Item	Issue	NGH Response	Further work proposed
25	Inconsistent figures 40 ha of NSW-listed (TSC Act) BGW EEC will be permanently impacted, 12 ha of which meets the definition of Commonwealth-listed (EPBC Act) Critically Endangered Ecological Community (CEEC) (e.g. p.188 and 196 of EA, p. 84 of BA). However in many places, the documents state that 31ha of BGW EEC will be permanently impacted: e.g. Table 7.3 [p.85 of BA] / Table 11.5 [p. 195 of EA] and Section 7.5.6 [KTP - p. 106, BA].	A revised impact assessment has been completed in Section 5 with updated figures which are now consistent throughout the document.	No
26	OEH considers that the documents do not adequately address the impact of the proposal on the KTP of clearing of native vegetation. Further analysis and correction of figures should be provided.	Further discussion on this KTP is provided in Section 5.2.1.	No
	Impact Assessment		
27	Some analysis regarding the potential impact of collision risk of 0.05 Wedge-tailed Eagles per turbine per year on the local and regional ecology.	Further analysis of potential Wedge-tailed Eagle impacts on local and regional ecology provided in Section 4.7.	No
28	OEH does not consider that a 100m buffer around Wedge-tailed Eagle nests will provide adequate protection. OEH records show that a compromise of 200m was reached at the site visit with NGH on the 24/2/14.	A 200m buffer was applied in revised constraints mapping for the proposal and all infrastructure is now located outside of this buffer. The nearest turbine (turbine 90) is over 500m away which is consistent with buffer distances previously applied between nests and turbines at other wind farms for the Tasmanian threatened sub-species of the Wedge-tailed Eagle (MacMahon 2010).	No
29	Any loss of trees with hollows > 6 cm should be quantified and appropriately offset at the recommended species-specific ratio.	This has been accounted for by the application of the revised HBT assessment methodology (refer to Section 3.4). Provision has been made in the revised offset strategy for the proposal to offset hollow-bearing trees at an appropriate ratio in consultation with OEH (refer Appendix D)	No

Item	Issue	NGH Response	Further work proposed
30	Sifton Bush shrubland, despite being a disturbed shrubland community, is known to be an important habitat for threatened woodland birds – recent research from Victoria has shown the importance of these shrublands in overcleared landscapes.	Further discussion regarding the habitat values provided by Sifton Bush shrubland in the context of the Rye Park Wind Farm site is provided in Section 4.8.	No
31	Superb Parrot Test of Significance– given that the assessment of HBTs was restricted to focal areas, the conclusion that this proposal will not exert a significant impact cannot be substantiated as there may be nest trees that were not identified during the field surveys that may be cleared.	The areas used by Superb Parrots were identified from the targeted survey work for this species and all HBTs were reviewed in areas Superb Parrots were occurring within the impact area. It is acknowledged however, that HBTs could be removed in areas that were not observed to be used by the parrot during our assessment. The revised HBT assessment methodology determined in consultation with OEH has been applied to account for impacts to HBTs outside the focal areas (refer to Section 3.4). The desktop assessment employed to account for HBT impacts in woodland (habitat for the Superb Parrot) is considered to be a worst case scenario. A revised assessment of impacts to the Superb Parrot has been undertaken to account for the results of the revised HBT assessment (refer to Section 5.5.1).	No
	Avoidance, Mitigation and offset		
32	OEH strongly recommends that all biodiversity surveys and finalisation of the design layout for this development be completed prior to approval. OEH considers that this development should only be approved when the proponent has demonstrated that they have employed the principles of avoid, mitigate and offset to the satisfaction of the NSW government.	This addendum addresses the preferred design for the proposal. Extensive additional surveys have been conducted as detailed in Section 3. Details regarding how the proposal has avoided and minimised impacts are detailed in Section 2.3 and a revised offset strategy is provided in Appendix D.	No

Item	Issue	NGH Response	Further work proposed
33	OEH does not consider that the design measures to avoid impact to biodiversity listed in Section 8 (p. 110, BA) demonstrate that feasible alternatives have been considered where biodiversity impacts are going to be significant, or that the project has been designed to be consistent with the principles of avoid, mitigate and offset.	Refer section 2.2 of the amended EIS for further details of changes to the wind farm infrastructure and reasons for the changes.	No
34	OEH does not support the suggested generic offset ratios, particularly the 1:1 for HBTs.	A revised offset strategy has been prepared for the proposal which supersedes the 1:1 ratio proposed in the original BA (refer Appendix D).	No
35	OEH does not support the use of nest boxes as an offset strategy.	Noted. This has been superseded by the revised offset strategy included as Appendix D.	
36	Any loss of EEC or native vegetation that represents known or potential threatened species habitat must be offset using the appropriate entity-specific offset ratios in BioBanking or PVP tools. The proposed generic 1:1. 1:5 and 1:10 ratios may not achieve improve or maintain outcomes. In particular, the suggested 1:1 ratio for tree hollows is inadequate for hollow-dependent threatened fauna such as the Superb Parrot whose recommended offset ratio is 1:1.9.	A revised offset strategy has been prepared for the proposal which supersedes the ratios proposed in the original BA (refer Appendix D). The revised offset strategy assumes a worst case offset requirement for the proposal using the Framework for Biodiversity Assessment.	No
37	Vegetation condition must be mapped outside the impact zone, in potential offset areas, to ensure an appropriate offset is achieved.	The revised offset strategy (refer to Appendix D) assumes a worst case offset requirement for the proposal and uses tools provided by the OEH to demonstrate that adequate areas are available within the proposal site. It is a commitment of the strategy to assess and map vegetation condition according to the FBA to ensure an adequate offset is achieved for the proposal.	No

Item	Issue	NGH Response	Further work proposed
38	Further targeted surveys for Striped Legless Lizard outside the impact area are required to identify and quantify suitable offsets. Offsets for this species must contain habitat that is known to be used by the species. In the absence of suitable offsets for this species, the impact to the high constraint area at turbine 27 should not be approved.	Turbine 27 and associated infrastructure has been removed from the proposal. As documented in the revised offset strategy (refer to Appendix D), proposed offsets will include known habitat in the vicinity of what was previously turbine 27. As known habitat is proposed to be offset, further surveys are not considered to be required.	No
39	Some clusters of turbines (e.g. turbines 143 – 95) are very close to high constraint remnant woodland – distances between turbines and woodland edges seem very small and need to be stated in the report.	Refer to item 7.	No
	Adequacy of surveys		
40	Environmental Assessment (EA) must provide further information and clarification on the threatened flora surveys undertaken to date, including the timing of surveys and the species targeted.	Further information regarding threatened flora surveys undertaken to date is provided in Section 4.9.	No
41	All areas of woodland and grassland potentially impacted by the development must be surveyed for specified threatened flora species, including the Crimson Spider Orchid, in the appropriate season.	Not all areas of woodland and grassland potentially impacted by the development provide habitat for threatened flora species. Areas providing the most likely habitat for threatened flora species were targeted during the surveys (refer to Section 4.9). Comprehensive surveys for the Crimson Spider Orchid were undertaken as documented in Section 4.9 and Appendix C.2.	Yes – follow up surveys for the crimson Spider orchid will be conducted prior to construction to determine the presence or absence of the species within suitable habitat at the proposal site.

Item	Issue	NGH Response	Further work proposed
42	OEH considers that the information on threatened flora surveys provided in the EA and Biodiversity Assessment (BA) does not satisfy the DGEARs.	Information with respect to how the threatened flora surveys address the DGEARs is provide in Section 4.9.	No
43	Requested information from the additional survey work has not been provided to OEH after meetings with ngh about survey methodologies to meet DGEARs	This is addressed in points 40 through to 42 above	No

APPENDIX C ADDITIONAL STUDIES UNDERTAKEN

C.1 HABITAT ASSESSMENT FOR THE STRIPED LEGLESS LIZARD AND GOLDEN SUN MOTH

EPURON
POWER FOR PORTFOLIOS

RYE PARK WIND FARM
HABITAT ASSESSMENT

STRIPED LEGLESS LIZARD AND GOLDEN SUN MOTH

SEPTEMBER 2014

ngh environmental

Document Verification

Rye Park Wind Farm Habitat Assessment

Striped Legless Lizard and Golden Sun Moth

Project Number:	5439
Project File Name:	Rye Pk_SLL_GSM_Habitat_assessment_v1

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
V1	16/9/14	Deb Frazer	Brooke Marshall	Brooke Marshall

suite 1, 216 carp st (po box 470) bega nsw 2550 australia t 61 2 6492 8333

www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

po box 434
bathurst nsw 2795 australia
0488 820 748

unit 18, level 3, 21 mary st
surry hills nsw 2010 australia
t (02) 8202 8333

suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 australia
t (02) 6971 9696

unit 17, 27 yallourn st (po box 1037)
fyshwick act 2609 australia
t (02) 6280 5053

37 peron ave (po box 1037)
dunsborough wa 6281 australia
(08) 9759 1985

CONTENTS

1 BACKGROUND

1.1 SCOPE OF THIS REPORT

This report details the results of a habitat assessment for the Striped Legless Lizard (*Delma impar*) and Golden Sun Moth (*Synemon plana*), undertaken at the proposed Rye Park Wind Farm site in March 2014. Additional habitat assessment survey work was committed to by the proponent to address Office of Environment (OEH) and Department of Planning and Infrastructure (DPI) comments on the initial Biodiversity Assessment (BA) for Rye Park Wind Farm.

As part of the Biodiversity Assessment for the project (**ngh**environmental 2014), micro-habitat surveys of the wind farm site were prescribed for the Striped Legless Lizard (detailed in Table 8-3 of the BA). Further surveys were also committed to for the Golden Sun Moth in the pre-construction phase of the project (Table 8-3 of BA) however, habitat assessment was undertaken in March 2014 for this species as it occurs in similar grassland habitats as the Striped Legless Lizard.

The primary objectives of the assessment were to:

1) Determine the extent of potential Striped Legless Lizard and Golden Sun Moth habitat within the project boundary of the wind farm, with regard to habitat the species have been previously recorded within the wind farm;
2) Determine the impact footprint of the development on available habitat for these species; and
3) Determine the potential to offset the impact of the project on these species.

This report briefly summarises the results of previous targeted surveys for the Striped Legless Lizard and Golden Sun Moth and provides the methods and results of a broader habitat assessment for these species. It applies what is known of the habitat preferences of these species to the Rye Park site to quantify impacts and potential for offsets. It is intended to accompany the Submissions Report, prepared to respond to agency and public submissions to the publically exhibited environmental assessment for the Rye Park Wind Farm proposal.

1.2 PRIOR SURVEYS, BIODIVERSITY ASSESSMENT 2013-2014

Targeted surveys for the Striped Legless Lizard and Golden Sun Moth were undertaken during the biodiversity assessment phase of the project and are summarised below.

For full details of other surveys undertaken refer to *Rye Park Wind Farm Biodiversity Assessment Final V1.4* (**ngh**environmental 2014).

1.2.1 Striped Legless Lizard

An artificial shelter survey using concrete tiles was undertaken for targeted Striped Legless Lizard surveys during the biodiversity assessment. Five tile sites consisting of 50 tiles were installed on 11 July 2013 during winter and another five sites were installed on 10-11 October 2013. Tiles were checked for presence of reptiles during spring-summer 2013. One Striped Legless Lizard individual was detected; tile plot 10, near proposed turbine site RYP_27.

1.2.2 Golden Sun Moth

Meandering traverse surveys were undertaken for the Golden Sun Moth within potential habitat of Box Gum woodland, Box Gum derived grasslands and some areas of native pasture during the biodiversity assessment. A total of 10 search areas were surveyed across the project area between 18 and 27 November 2013. The Golden Sun Moth was observed at seven of the ten sites surveyed, with approximately 200 moths observed in total.

2 HABITAT ASSESSMENT SURVEYS - METHODS

Habitat assessment for the Striped Legless Lizard and Golden Sun Moth were undertaken at Rye Park Wind Farm during 12-15 March 2014. The survey timing was planned to coincide with the flowering season of grasses, especially native species.

The method employed was developed in consultation with Rod Pietsch (Senior Threatened Species Officer) from OEH prior to survey. Rod Pietsch provided further on-ground advice on the survey method during a site-visit with **ngh**environmental field staff on the 12th of March 2014.

2.1 SURVEY TECHNIQUES

- Transects and quadrats were used to assess grassland habitats within the project area, this included the understorey of Box Gum woodland, derived grassland, exotic and native pastures.
- Due to the large size of the wind farm the sampling design was prioritised to survey:
    - the ten existing Striped Legless Lizard tile sites;
    - the ten Golden Sun Moth search areas surveyed in November 2013;
    - grassland areas impacted by infrastructure; and
    - larger areas of continuous grassland habitat within the project area that could be used as potential offset sites.
- A rapid assessment using quadrat methodology was employed to supplement transect results. This method allowed information on dominant grassland species and habitat features to be collated rapidly both within the immediate development envelope and wider area of the wind farm. As the transect method was more time consuming this technique was prioritised within the impact area (i.e. within the impact footprint), while the quadrat technique permitted a greater area of the wind farm to be surveyed.
- Notes on the surrounding area and continuity of habitat within the locations of transects and quadrats were recorded.

Transects

- 50 m long transects were surveyed.
- At each transect the point intercept method was used to collect habitat composition and structure data.
- Points were sampled every 1m along the transect starting at the 1m point and ending at the 50m mark.
- The flora species or habitat structure present at each point was recorded on a data sheet supplied by OEH (see sample datasheet in Appendix A).

Quadrats

- 50 m x 50 m quadrats were surveyed.
- Notes were compiled on the general habitat of the area, habitat quality, grass and forb diversity and cover, ground cover structure, presence of rocks, habitat connectivity, and disturbance (see sample datasheet in Appendix A).
- Habitat quality was defined for the Striped Legless Lizard using four categories and included:

Excellent	Tussock forming native grasses dominant (exotic species may be present but in lower abundance). Tussock forming species relatively dense and continuous (≥ 50 % cover). Rock and ground timber present. Low - mod grazing pressure.

Good	Tussock forming native or exotic grasses dominant. Tussock forming species relatively dense and continuous (≥ 50% cover), rock and ground timber present or absent. Or if tussock forming species not continuous, rock and ground timber present. Low - mod grazing pressure.
Moderate	Tussock forming grasses present (native or exotic species). Tussock forming species moderately dense (≤ 50% cover). Rock and ground timber generally absent or in low abundance. Low - mod grazing pressure.
Low	No to little tussock forming species or rock or ground timber shelter available. Mod-high grazing pressure.

- Habitat quality was not defined for the Golden Sun Moth as it is known to occur in a variety of grasslands in varying condition. Wallaby Grass (*Rytidosperma* spp) is a key grass species used by the Golden Sun Moth and is an indicator of potential habitat even if present in low abundance. The abundance of Wallaby Grass was therefore used as an indicator of habitat quality for this species. Wallaby Grass abundance categories were developed and included:

Not present	0%
Low abundance	1% – 25%
Moderate abundance	26% – 50%
Good abundance	51% – 75%
Excellent abundance	76% – 100%

2.2 MAPPING

The habitat quality categories and Wallaby Grass abundance categories were used to map potential habitat within the project boundary for the Striped Legless Lizard and Golden Sun Moth, respectively. Notes on habitat connectivity and disturbance were recorded for the wider area where transects or habitat quadrats were completed to extrapolate data for mapping purposes.

Some areas of the wind farm could not be accessed and grassland condition was inferred from previous survey data collated during the biodiversity assessment phase of the project. Data on grass species, diversity and abundance previously recorded during these flora assessments were reviewed to map potential habitat in areas not surveyed this assessment. Potential habitat has been mapped as 'field based' or 'extrapolated' to highlight this.

2.3 SURVEY EFFORT SUMMARY

Table 2-1 details the survey effort for habitat assessment surveys. Appendix B details the locations of the surveyed transects and quadrats, location of the previous survey effort already undertaken (as discussed in Section 1.2), and locations of known records for the Striped Legless Lizard and Golden Sun Moth.

Table 2-1. Total survey effort for habitat assessment surveys.

Date	Method	Total Effort
12-15 March	50 m long transects	15
12-15 March	50 x 50 m habitat quadrat	27

3 HABITAT ASSESSMENT SURVEYS - RESULTS

3.1 GENERAL HABITAT CONDITION

3.1.1 Plant cover

Results from the habitat assessment show perennial native grass cover was higher compared to exotic plant cover, with Wallaby Grass (*Rytidosperma* spp) and Weeping Grass (*Microlaena stipoides*) the most dominant species detected in transect and quadrat surveys. Kangaroo Grass (*Themeda australis),* Spear Grass (*Austrostipa scabra falcata*) and Wattle Mat Rush (*Lomandra filiformis coriacea*) were present, but to a lesser extent. In 21 of the 27 quadrats assessed, native cover was at least higher than 50% and exotic cover was generally below 20%.

3.1.2 Strata structure

Tussock structure ranged between small tussock bases (<10cm diameter) and large tussock bases (>10cm diameter) and was recorded in all transects and quadrats assessed, except for Transects 1 and 7, and Quadrats 14 and 19 where tussocks were absent. Tussock structure was generally scattered across the landscape, but formed a continuous cover in some locations (within Quadrats 1, 3, 4, 7, 8, 13, 15, 18, and 24).

Leaf litter was moderately abundant in most locations and was recorded at 16 of the 17 transects. Surface rock and embedded rock were generally in low abundance or absent, except for Quadrats 3, 4, and 5 were rocks were reasonably abundant and consisted of scattered small and loose stones, small to medium embedded rocks and some boulder outcrops. Similarly, ground timber was generally absent but was recorded in low abundance (4% cover) at Transects 1, 2, 3, and 6.

Small areas of bare ground were recorded at 16 of the 17 transects and 25 of the 27 quadrats. The extent of bare ground ranged between 2% to 40% cover, but on average was less than 15% cover.

3.1.3 Disturbance

Sheep grazing is the primary land use within the area, with some cattle grazing observed in selected locations. Grazing pressure was moderate over most of the areas assessed (20 of the 27 quadrats). Some areas were identified as highly disturbed from grazing (5 of the 27 quadrats), while only two areas were identified as being subject to low grazing pressure (Quadrats 7 and 24).

3.2 STRIPED LEGLESS LIZARD

3.2.1 Habitat in area of known record

One individual of the Striped Legless Lizard was previously recorded nearby proposed turbine RYP_27 during summer 2013. Results from the transect and quadrat assessment completed at this location reveal a dominance of native grass cover (70% cover) compared to exotic cover (20% cover) and the presence of some bare ground (5% cover) and rock (5% cover) (see Appendix C, raw data). Wallaby Grass was the dominant species present, followed by Weeping Grass. Spear Grass was present but at low abundance (5% cover). The grasses were defined by small tussock bases that were generally continuous across the area, but subject to a moderate level of sheep grazing pressure. Moderate levels of leaf litter and rock cover are available at this

location; rock type is generally small to medium sized embedded rock. Habitat in the same condition is continuous through the landscape in this area and extends to nearby turbines (see Appendix B).

3.2.2 Habitat quality in project area

Habitat quality was generally moderate to good (recorded at 15 of the 27 quadrats) as tussock forming species were present, at least moderately dense, and grazing pressure was moderate. Six quadrats were recorded as excellent quality habitat as tussock forming native grasses were dominant and dense, while grazing pressure was generally lower. Another six quadrats were recorded as low quality habitat due to the low abundance of tussock forming species and presence of moderate to high grazing pressure.

3.3 GOLDEN SUN MOTH

3.3.1 Habitat in area of known records

The Golden Sun Moth was observed at seven of the ten sites surveyed in November 2013 and approximately 200 moths were observed in total. At the time of the November 2013 survey the habitat was recorded as variable and supported a mixture of native grasses and exotic grasses, but all sites supported Wallaby Grasses (even if in low abundance). The abundance of Wallaby Grasses varied, from a low abundance and patchy distribution to being more dominant with a tussocky structure (especially in the south of the project area). However, Golden Sun Moths were also observed to occupy areas not typical for the species; on rocky hillsides, elevated sites, areas where superphosphate has been regularly applied and in grassland areas derived from ecological communities other than Box Gum Woodland.

Results from the transect and quadrat assessments completed at these locations revealed similar findings; condition of habitat is variable. However, all areas where Golden Sun Moths were previously recorded support Wallaby Grass in varying abundance. In particular, the largest numbers of Golden Sun Moth were recorded in the area east of RYP_72 (~89 individuals) and the southern section of the site (~42 individuals) during November 2013 surveys. Quadrat and transect results show these areas supported higher native grass cover than exotic cover, with Wallaby Grass being the most dominant species recorded. Rock and bare ground were present in these areas, especially within Quadrat 3 (undertaken in the southern section of the project area) in which rock was recorded at 50% cover.

3.3.2 Wallaby Grass abundance in project area

Wallaby Grass was the most dominant grass present within transects and quadrats, but predominantly ranged between low to moderate abundance in regards to percentage of cover. Wallaby Grass was recorded in all transects except for one (Transect 7); it was also recorded within the top three dominant species in all quadrats, except for two (Quadrats 14 and 15), however it was recorded in Quadrat 14 but not as one of the dominant three species (i.e. it was recorded at <5% cover in Q14).

4 DISCUSSION

4.1 STRIPED LEGLESS LIZARD

4.1.1 Predictors of habitat

The Striped Legless Lizard is typically said to inhabit temperate lowland grasslands, secondary grasslands and occasionally open Box Gum Woodland. However, the species has also been recorded in degraded habitats such as sites dominated by introduced species (such as *Phalaris aquatica, Nasella trichotoma* and *Hypocharis radicata*) and sites with a history of grazing and pasture improvement (Robertson & Smith 2010). This species is mostly associated with grasslands supporting a dense cover of perennial tussock grasses, particularly spear grass (*Stipa bigeniculata*) and Kangaroo Grass (*Themeda triandra*) (Osborne *et al.* 1993, O'Shea 2005). The highest densities of the species in the ACT have been reported from sites with a Kangaroo Grass ground cover of more than 70 % (Osborne *et al*. 1993). It is also assumed that the species shelters mainly in grass tussocks and other thick ground cover (i.e. rocks); however in the ACT, most sites the species has been recorded has little or no rock cover and grass tussocks are assumed to be the primary refuge (Robertson & Smith 2010).

This assessment documented the grassland habitat values of the wind farm and it is apparent that native grasses are relatively common in the landscape, with Wallaby Grass and Weeping Grass the most dominant species. The more typical grass species known to support this species such as Spear Grass and Kangaroo Grass occur in lower abundance in the project area. This is true of the habitat within the area the Striped Legless Lizard was recorded at Rye Park in which Wallaby Grass was dominant and Spear Grass was recorded in very low abundance. In this area however, native grasses with tussock bases were continuous across the area, and small to medium sized embedded rock was present. Robertson and Smith (2010) suggest that the presence of a relatively dense and continuous structure, rather than the floristic composition of the grasslands may be more important in influencing the persistence of the Striped Legless Lizard in the landscape. Grazing pressure was moderate at the location of the record, but grass cover was well connected. Robertson and Smith (2010) further suggest the key to the survival of the Striped Legless Lizard in agricultural landscapes may be the availability of shelter (i.e. tussock bases, rocks) during disturbance events (such as ploughing or heavy grazing) from which they may be able to recolonise disturbed sites.

Based on the literature and the results above, the key attribute able to predict Striped Legless Lizard habitat at Rye Park Wind Farm was ground structure, rather than floristics. The presence of tussock forming grass species (preferably native) or another form of ground stratum, such as rocks, that was continuous was considered better quality habitat compared to an area of degraded habitat with no ground structure. The categories for mapping habitat quality were based on this principle.

Grazing pressure was generally moderate within the wind farm, with some exceptions of heavier or lower grazing pressure. The abundance of native versus exotic grass cover as well as the ground structure was related to grazing pressure; as expected lower grazing pressure equated to higher native grass cover and presence of larger tussock forming species. Many grassland areas of the wind farm currently supporting low or moderate quality habitat are likely to be considered excellent quality habitat if grazing pressure were reduced or removed; tussock forming native grasses are present in many of these lower quality areas and the reduction in grazing pressure would promote growth of these species.

4.1.2 Extent of impact

The extent and quality of Striped Legless lizard habitat available within the project area and the amount to be cleared is documented within Table 4-1 and mapped in Appendix B. A total of approximately 84 ha would be cleared by the proposal and at least 6,885 ha of habitat would remain within the project area; the total clearance of habitat equates to 1.2% of the total available habitat within the project boundaries.

If the low habitat quality category is excluded as potential habitat (assuming this provides less than optimum habitat), a total of approximately 5,246 ha is still available within the moderate to excellent habitat categories within the site boundaries. These results indicate a substantial amount of potential habitat will remain within the project area after development of Rye Park Wind Farm.

Table 4-1. Striped Legless Lizard habitat available within the project area and extent of impact.

Striped Legless Lizard habitat quality	Area within site boundary (ha)	Area permanently impacted (ha)	Area not impacted (ha)
Excellent	1,204.41	17.27	1,187.14
Good	1,323.49	17.87	1,305.62
Moderate	2,778.62	25.06	2,753.56
Low	1,662.49	23.68	1,638.81
Total	**6,969.01**	**83.88**	**6,885.13**

4.1.3 Offsetting potential and recommendations

Little is known about the movements of the Striped Legless Lizard, although some data is available from recapture studies. Recapture data from Victoria using tiles suggests a very small home range (within 10 m^2). Animals have been recorded moving at least 20 m in one day and up to 50 m over several weeks (Kutt Kukolic, cited in Robertson and Smith 2010) during their high activity period (November / December). Larger movements are suggested to probably relate to reproductive activity rather than normal home range movements in which the animal seems quite sedentary (Robertson and Smith 2010). These movement records indicate potential offset sites do not need to be large, rather the habitat needs to be suitable to ensure offsetting is viable.

Based on habitat quality mapping, it is possible that several areas of the wind farm support potential habitat for this species and could be considered offset sites if the species was demonstrated to occur there. Potential areas more suitable for offsetting may include:

- The area of the known record near RYP_27. This area is mapped as supporting excellent quality habitat nearby RYP_27and extends into the wider area.
    - The potential to remove turbine RYP_27 from this location should be explored to determine the feasibility of including this area as an offset given it is the only location the species is known.
- A large area of Derived Grassland and Native Pasture in the north-east of the project area (i.e. east of turbines RYP_17 through to RYP_138). This area is mapped as supporting moderate quality habitat and is not affected by infrastructure.
- An area of Native Pasture north of RYP_71 and east of the proposed overhead powerline. This area is mapped as supporting excellent quality habitat and is not affected by infrastructure.
- An area of Derived Grassland, Native Pasture and Box Gum Woodland in the southern end of the project area (i.e. south of RYP_131).

4.2 GOLDEN SUN MOTH

4.2.1 Predictors of habitat

The Golden Sun Moth is said to show a preference for natural temperate grasslands or derived grasslands (derived from Box Gum Woodland) that are dominated by a low and open cover of native Wallaby Grasses, Spear Grasses and the introduced Chilean needle grass (*Nassella neesiana*). Areas of bare or sparsely covered ground between grass tussocks (inter-tussock space) are thought to be important in helping males locate females and therefore high biomass renders habitat less suitable (Richter *et al.* 2013; DEWHA 2009).

While results from the November 2013 survey show the Golden Sun Moth was recorded in varying habitats, some of which were atypical, the species was always recorded in areas of Wallaby Grass. These results agree with the habitat descriptions from literature that Wallaby Grass is a key indicator of Golden Sun Moth habitat. Therefore, due to the widespread presence of Wallaby Grass across the project area it is assumed the Golden Sun Moth is likely to occupy areas beyond those where the species was recorded within during the November 2013 surveys.

Based on the above, the key attribute used to predict Golden Sun Moth habitat at Rye Park Wind Farm was the presence of Wallaby Grass. The categories developed for mapping habitat availability were based on abundance of this grass species.

As mentioned for the Striped Legless Lizard, grazing pressure was generally recorded as moderate overall within the wind farm, with some exceptions of heavier or lower grazing pressure. It is difficult to determine the impact of grazing on the Golden Sun Moth, but one assumes based on the results of the November 2013 survey that the species can persist in grazed environments as long as Wallaby Grass is present. Further, as inter-tussock spaces are thought to be an important habitat feature, grazing at lower levels may assist to maintain this ground structure and would not be considered a major threat to the persistence of the Golden Sun Moth in the landscape.

4.2.2 Extent of impact

The extent and quality of Golden Sun Moth habitat available within the project area and the amount to be cleared is documented within Table 4-2 and mapped in Appendix B. A total of approximately 76 ha would be cleared by the proposal and at least 5,964 ha of habitat would remain within the project area; the total clearance of habitat equates to 1.27 % of the total available habitat with the project boundaries.

If the low Wallaby Grass abundance category is excluded as potential habitat (assuming this provides less than optimum habitat), a total of approximately 3,782 ha remains available within the moderate to excellent abundance categories. These results indicate a substantial amount of potential habitat will remain within the project area after development of Rye Park Wind Farm.

Table 4-2. Golden Sun Moth habitat available within the project area and extent of impact.

Wallaby Grass abundance	Area within site boundary (ha)	Area permanently impacted (ha)	Area not impacted (ha)
Low (1%-25%)	2,206.24	23.95	2,182.29
Moderate (26%-50%)	1,905.89	24.43	1,881.46
Good (51%-75%)	1,609.25	18.65	1,590.60
Excellent (76%-100%)	319.78	9.34	310.43
Total	**6,041.16**	**76.37**	**5,964.78**

4.2.3 Offsetting potential and recommendations

The movements of the Golden Sun Moth are relatively contained to small areas. Only the male moth regularly flies, but is thought unlikely to travel beyond 100 m from suitable habitat (Clarke & O'Dwyer 2000). Therefore, the size of a potential offset site should be at least 100m where it supports suitable habitat.

Based on Wallaby Grass abundance mapping, there is potential to offset the impact of the proposal on this species in several places of the project area. Although, areas more suitable for offsetting may include:

- A large area of Derived Grassland and Native Pasture in the north-east of the project area (i.e. east of turbines RYP_17 through to RYP_138). This area is mapped as supporting a good abundance of Wallaby Grass and is not affected by infrastructure.
- An area of Native Pasture to the south and east of RYP_73. This area is mapped as supporting a good abundance of Wallaby Grass and is nearby the area the most Golden Sun Moth individuals were recorded in November 2013. Underground cabling is proposed for the area the Golden Sun Moths were reported.
    - The potential to remove the underground cabling in the area of the existing Golden Sun Moth records should be explored to determine the feasibility of including this area as an offset.
- An area of Derived Grassland, Native Pasture and Box Gum Woodland in the southern end of the project area (i.e. south of RYP_131 and nearby the construction compound). This area is mapped as supporting an excellent abundance of Wallaby Grass and is nearby an area of several Golden Sun Moth records.
    - The potential to relocate the construction compound and concrete batching plant should be explored to increase the potential area of offset in this location.
- An area of Box Gum Woodland west of RYP_99. This area is mapped as supporting a low abundance of Wallaby Grass, but is nearby an area of several Golden Sun Moth records.
    - The potential to micro-site/remove the access track in the area of the existing Golden Sun Moth records should be explored to determine the feasibility of including this area as an offset.

5 REFERENCES

Clarke, G.M. & C. O'Dwyer (2000). Genetic variability and population structure of the endangered golden sun moth, *Synemon plana*. *Biological Conservation*. 92:371-381.

DEWHA (2009) *Background Paper to EPBC Act Policy Statement 3.12 - Significant Impact Guidelines for the critically endangered Golden Sun Moth (Synemon plana)* [online], Department of Environment, Water, Heritage and the Arts. Available from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25234 [accessed 26 September 2012]

Kutt, A.S., Coulson, G. and Wainer, J. (1998). Diet of the Striped Legless Lizard Delma impar (Squamata: Pygopodidae) in a western (basalt) plains grassland, Victoria. Australian Zoologist 30(4): 412-18.

Osborne, W.S., Kukolic, K. & Williams, K.D. (1993). Conservation of reptiles in lowland native grasslands in the Southern Tablelands of New South Wales and the Australian Capital Territory. In Lunney, D. & Ayers,D., (eds) Herpetology in Australia: A diverse discipline, pp. 151-158. Transactions of the Royal Zoological Society of New South Wales.

O'Shea, M. (2005). Methods for assessment and techniques for management of Striped Legless Lizard *(Delma impar*) populations in South-eastern Australia. Thesis submitted at University of Victoria.

Richter, A., Osbourne, W., Hnatiuk, S. And Rowell, A. *Moths in fragments: insights into the biology and ecology of the Australian endangered golden sun moth* Synemon plana *(Lepidoptera: Castniidae) in natural temperate and exotic grassland remnants* in Journal of Insect Conservation Vol. 17, No. 4, August 2013.

Robertson, P., and Smith, W. (2010). Draft National Recovery Plan for the Striped Legless Lizard, *Delma impar*. Department of Sustainability and Environment, Melbourne.

APPENDIX A EXAMPLE DATA SHEETS

Transect Datasheet

Assessor/s	Project	Transect no.	Transect start waypoint	Transect end waypoint	Dominant weed species	Dominant exotic / perennial grass species

Strata Type		Point (m) Please note, columns should go up to 50m but only shown to 30m as example.																													Total	% of transect
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
Strata	Bare ground																																
	Cryptogam																																
	Embedded rock																																
	Loose surface rock																																
	Detached leaf litter																																
	Large tussock base (>10cm diameter)																																
	Small tussock base (<10cm diameter)																																
	Timber																																
	Leaf Litter																																
Exotic plants	Exotic perennial grass																																
	Exotic annual grass																																
	Clover (Trifolium spp.)																																
	Exotic forb																																
	Noxious weed																																
Perennial native grasses	Native forb																																
	Native shrub																																
	Sedge/rush																																
	Austrodanthonia spp. (wallaby grasses)																																
	Austrostipa spp. (spear grasses)																																

Strata Type	Point (m) Please note, columns should go up to 50m but only shown to 30m as example.																													Total	% of transect
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
Elymus scaber (native wheat grass)																																
Panicum spp. (blown grass)																																
Dichlachne spp. (plume grass)																																
Bothriochloa macra (red grass)																																
Themeda australis (kangaroo grass)																																
Microlena spp. (weeping grass)																																
Aristida ramosa (purple wire grass)																																
Joycea spp. (red anther wallaby grass)																																
Poa spp.																																
Unidentified perennial																																

Quadrat Datasheet

DATE	SURVEYORS		PHOTO ID
GPS ID	EASTING	NORTHING	DATUM
TILE SITE / GSM SITE ID	LANDHOLDER		

GENERAL DESCRIPTION: SITE CHARACTER/ GRASSLAND TYPE?

General habitat description	General habitat quality (circle)
	Low Mod Good

Grass / forb diversity (list native and exotic)

Grass / forb species in order of dominance	% cover	tussock forming (y/n?)			
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

GOUND COVER / STRUCTURE

cover native (%)	cover exotic (%)	bare ground (%)	rock (%)	tussock structure (dense & continuous, scattered, none?)

Rocks (circle relevant one)	Type of rock (circle)	% cover	Notes
Absent	Scattered small to medium, loose		
Low abundance	Embedded small to medium		
Moderate abundance	Exfoliation		
Abundant	Boulder, outcrops		

HABITAT CONNECTIVITY

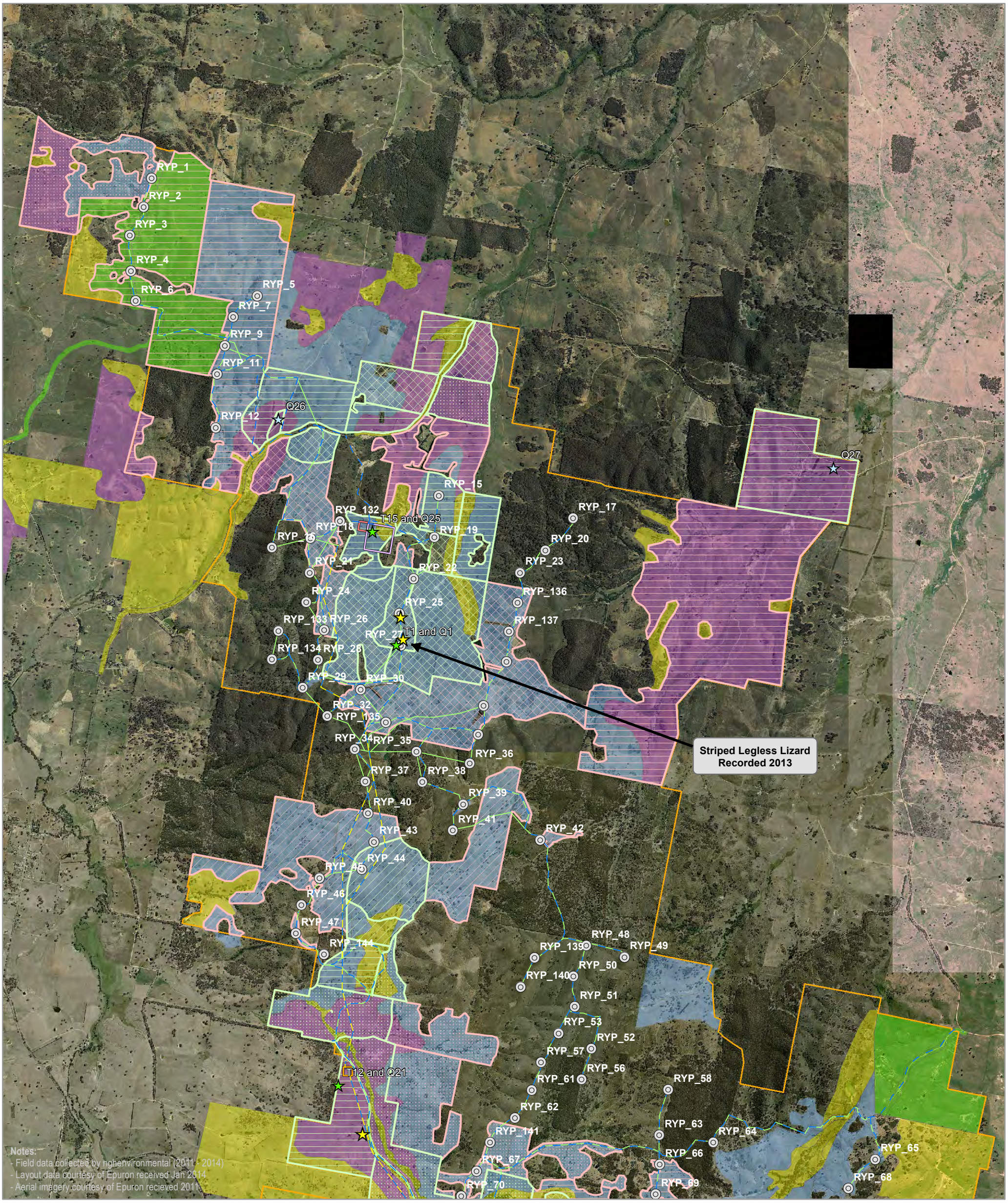
Connectivity to contiguous habitat: how far does habitat extend? Same condition?

DISTURBANCE HISTORY

Type			Disturbance extent (circle relevant one)
Grazing (low, mod, high?)			Undisturbed
Grazing type (sheep, cattle?)			Minor disturbance
Ploughed (yes / no?)			Mod disturbance
Improved pasture (yes / no?)			Very disturbed

ADDITIONAL COMMENTS (i.e. good SLL habitat with good tussock structure etc?)

APPENDIX B MAPS - SURVEY EFFORT AND RESULTS



STRIPED LEGLESS LIZARD SURVEY EFFORT AND RESULTS MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Substation
- Termination compound
- O&M building
- Construction compound
- Concrete batching plant

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Previous reptile survey effort

- Reptile Tile Plot
- Funnel Trap
- Reptile search

SLL habitat quality

- Excellent
- Good
- Moderate
- Low

Data source

- Field based
- Extrapolated

Vegetation type

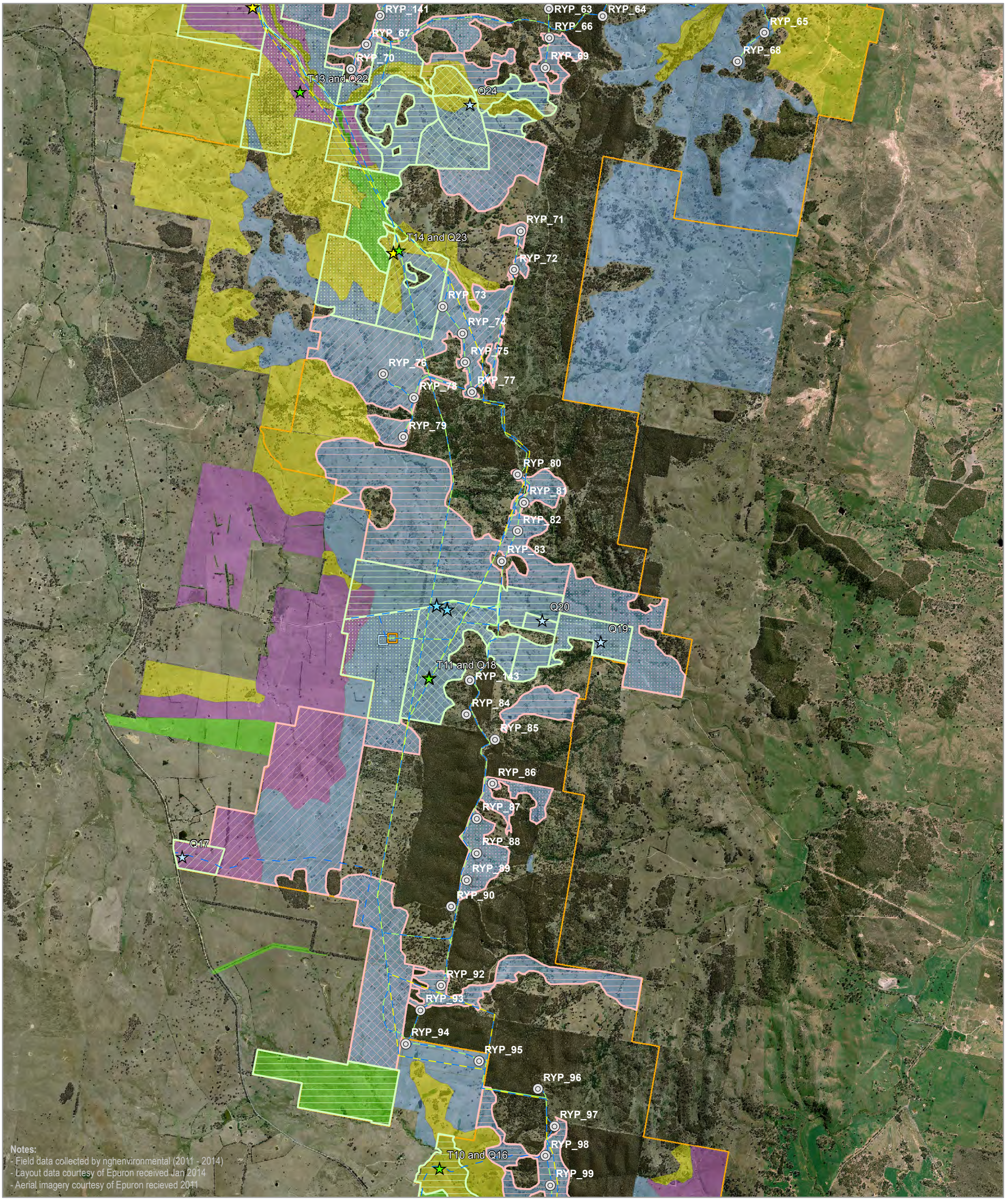
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - 11
Author: DM

ngh environmental

www.nghenvironmental.com.au



STRIPED LEGLESS LIZARD SURVEY EFFORT AND RESULTS MAP 2

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Substation
- Termination compound
- O&M building
- Construction compound
- Concrete batching plant

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Previous reptile survey effort

- Reptile Tile Plot
- Funnel Trap
- Reptile search

SLL habitat quality

- Excellent
- Good
- Moderate
- Low

Data source

- Field based
- Extrapolated

Vegetation type

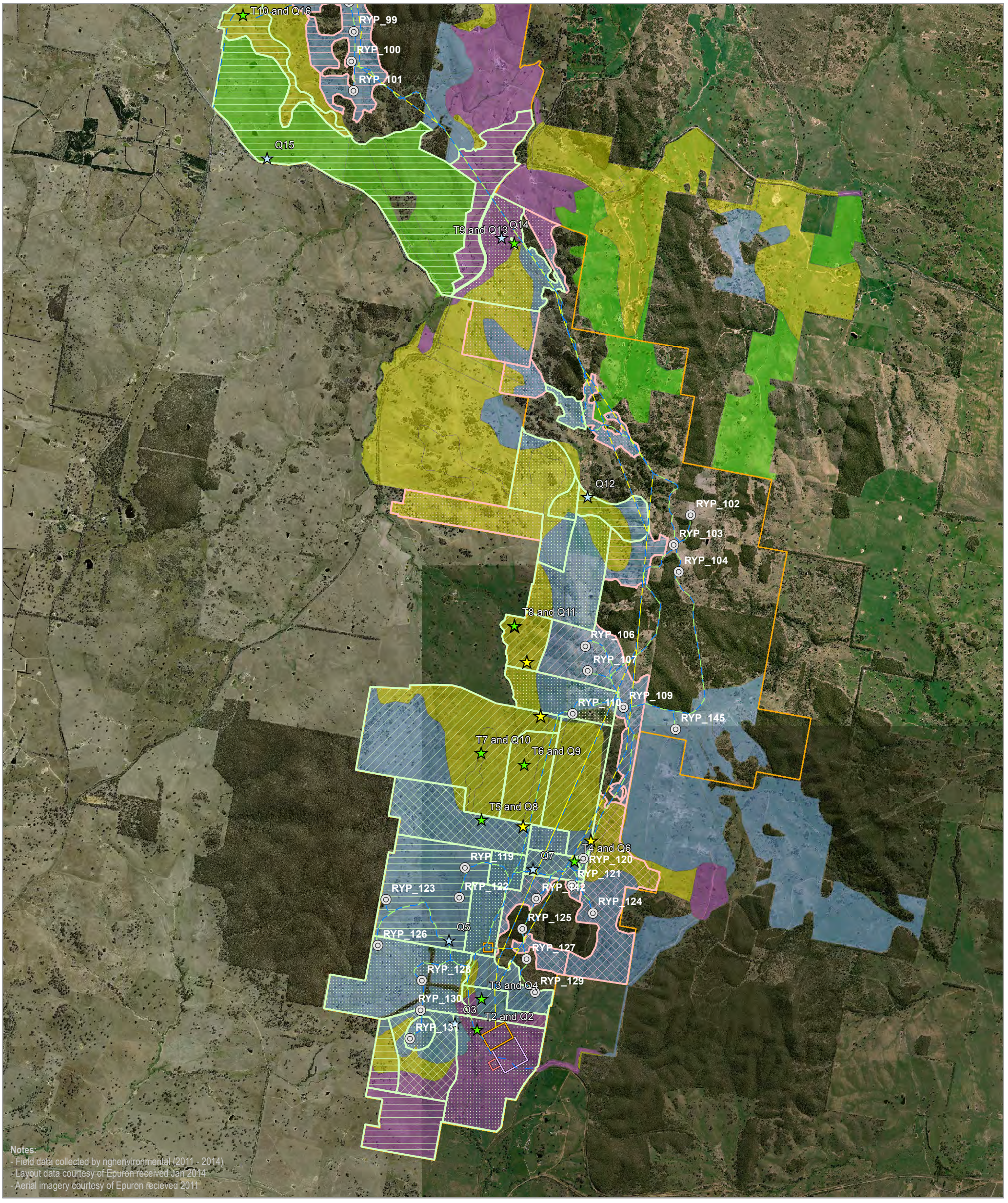
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - 11
Author: DM

ngh environmental

www.nghenvironmental.com.au



STRIPED LEGLESS LIZARD SURVEY EFFORT AND RESULTS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Substation
- Termination compound
- O&M building
- Construction compound
- Concrete batching plant

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Previous reptile survey effort

- Reptile Tile Plot
- Funnel Trap
- Reptile search

SLL habitat quality

- Excellent
- Good
- Moderate
- Low

Data source

- Field based
- Extrapolated

Vegetation type

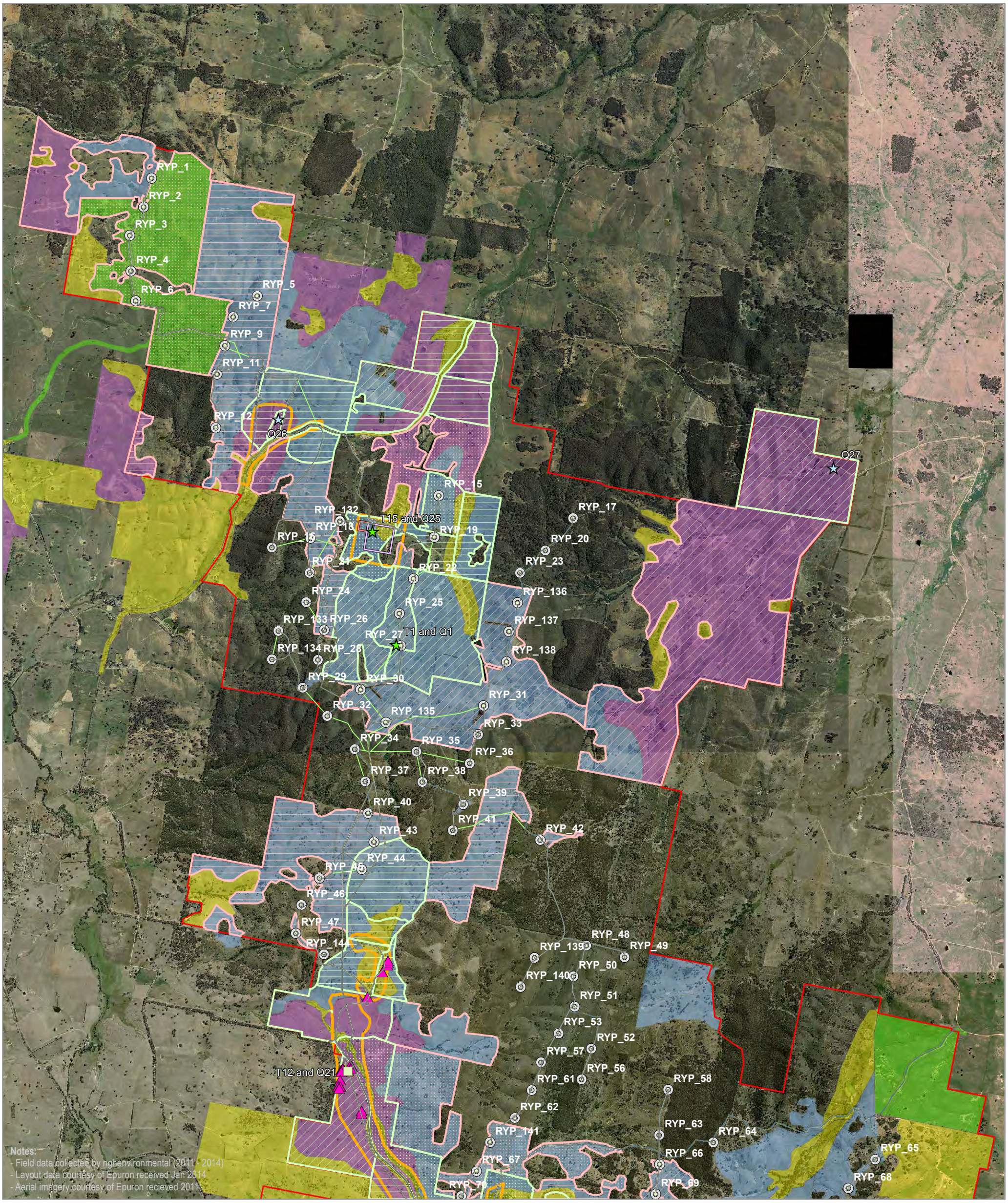
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - 11
Author: DM

ngh environmental

www.nghenvironmental.com.au



GOLDEN SUN MOTH SURVEY EFFORT AND RESULTS MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Substation
- Termination compound
- O&M building
- Construction compound
- Concrete batching plant

December 2013 survey effort

- Golden Sun Moth survey area

December 2013 survey results

- Golden Sun Moth records

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Wallaby Grass abundance

- 76%-100%
- 51%-75%
- 26%-50%
- 1%-25%
- Absent

Data source

- Field based
- Extrapolated

Vegetation type

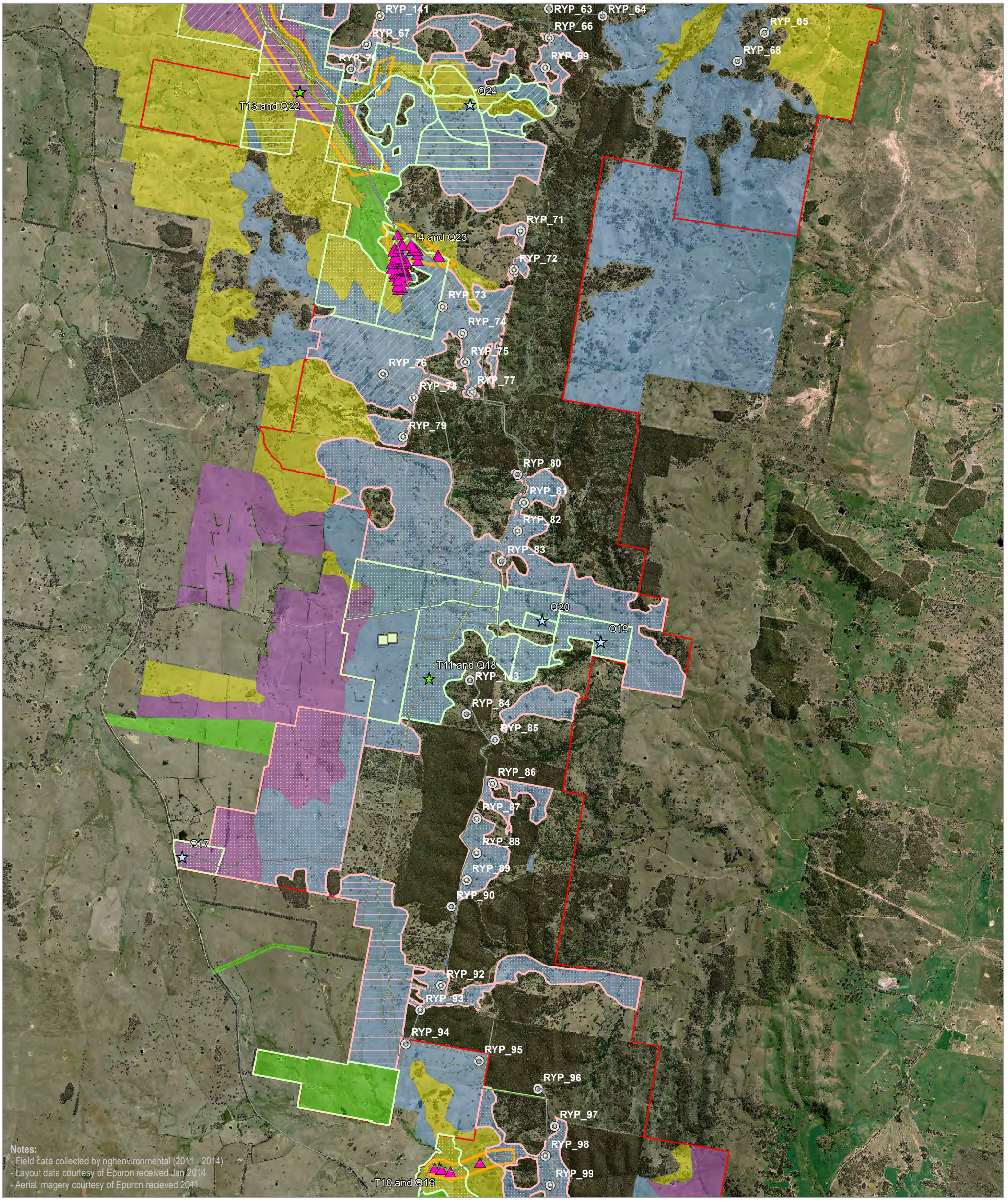
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - 10
Author: DM

ngh environmental

www.nghenvironmental.com.au



GOLDEN SUN MOTH SURVEY EFFORT AND RESULTS MAP 2

Rye Park Wind Farm Biodiversity Assessment

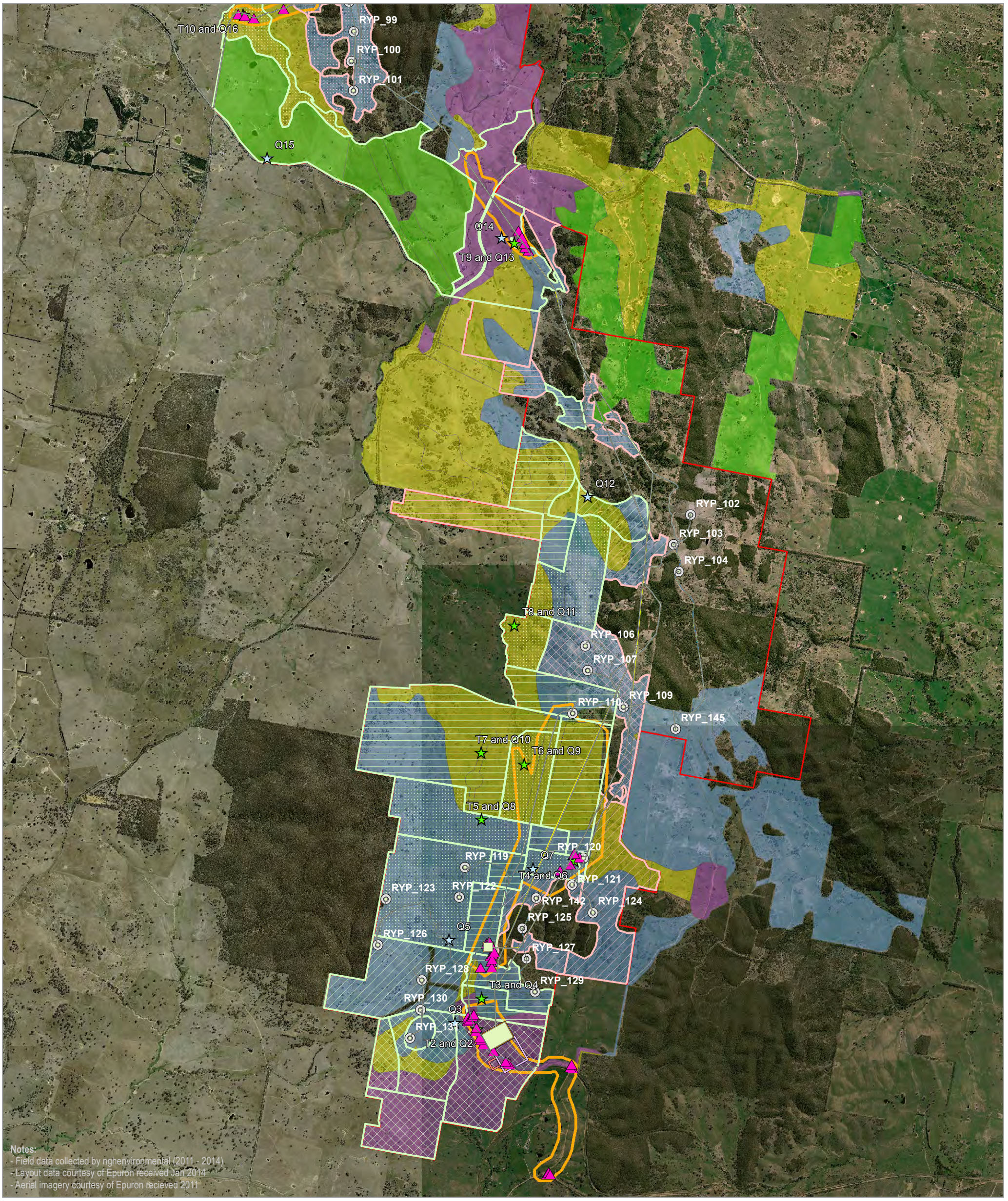
- Site perimeter
- **Infrastructure**
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Substation
- Termination compound
- O&M building
- Construction compound
- Concrete batching plant
- **December 2013 survey effort**
- Golden Sun Moth survey area
- **December 2013 survey results**
- Golden Sun Moth records
- **March 2014 survey effort**
- Transect start and habitat assessment
- Habitat assessment only
- **Wallaby Grass abundance**
- 76%-100%
- 51%-75%
- 26%-50%
- 1%-25%
- Absent
- **Data source**
- Field based
- Extrapolated
- **Vegetation type**
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - 10
Author: DM

ngh environmental

www.nghenvironmental.com.au



GOLDEN SUN MOTH SURVEY EFFORT AND RESULTS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- **Infrastructure**
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Substation
- Termination compound
- O&M building
- Construction compound
- Concrete batching plant
- **December 2013 survey effort**
- Golden Sun Moth survey area
- **December 2013 survey results**
- Golden Sun Moth records
- **March 2014 survey effort**
- Transect start and habitat assessment
- Habitat assessment only
- **Wallaby Grass abundance**
- 76%-100%
- 51%-75%
- 26%-50%
- 1%-25%
- Absent
- **Data source**
- Field based
- Extrapolated
- **Vegetation type**
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - 10
Author: DM

ngh environmental

www.nghenvironmental.com.au

APPENDIX C RAW DATA

Transect Raw Data

Please note, data is expressed as a percentage of cover for each transect.

Strata Type		Transect Number														
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15
Strata	Bare ground	6	4	16	18	6	4	4	14	20	6	2	14	14	14	0
	Cryptogam	0	0	0	2	2	0	30	4	0	0	0	0	0	0	0
	Embedded rock	0	0	14	2	2	0	6	8	4	2	4	0	0	0	0
	Loose surface rock	0	0	0	0	0	0	8	6	2	2	2	0	0	2	0
	Detached leaf litter	46	58	32	22	34	32	0	10	14	20	28	30	38	22	26
	Large tussock base (>10cm diameter)	0	2	2	2	14	6	0	2	12	10	6	6	4	6	12
	Small tussock base (<10cm diameter)	12	6	8	8	18	10	22	2	6	12	12	8	10	4	2
	Timber	4	4	4	0	0	4	0	0	0	0	0	0	0	0	0
	Leaf Litter	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0
Exotic plants	Exotic perennial grass	2	0	0	0	0	0	0	0	2	32	0	0	0	0	0
	Exotic annual grass	0	2	0	0	0	6	0	0	0	0	0	2	0	0	0
	Clover (Trifolium spp.)	6	2	4	0	0	14	0	0	12	20	4	16	8	14	0
	Exotic forb	16	2	2	0	0	0	0	0	0	4	4	0	0	0	2
	Noxious weed	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Perennial native grasses	Native forb	0	2	0	0	0	2	20	2	0	0	0	0	0	0	0
	Native shrub	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0
	Sedge/rush	4	4	4	0	8	4	2	12	2	0	20	6	0	18	14
	Austrodanthonia spp. (wallaby grasses)	36	24	24	18	14	8	0	6	32	12	16	22	24	14	2
	Austrostipa spp. (spear grasses)	0	6	6	22	0	0	0	2	6	0	2	2	8	0	0
	Elymus scaber (native wheat grass)	0	4	4	0	0	2	0	0	0	0	0	0	0	0	0
	Panicum spp. (blown grass)	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
	Dichelachne spp. (plume grass)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Bothriochloa macra (red grass)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Themeda australis (kangaroo grass)	0	0	0	0	40	18	0	0	0	0	0	12	0	0	0
	Microlaena spp. (weeping grass)	6	20	6	22	2	18	0	4	0	0	20	0	6	10	44
	Aristida ramosa (purple wire grass)	0	0	0	0	2	0	0	6	12	0	0	0	0	0	0
	Joycea spp. (red anther wallaby grass)	0	0	0	0	0	0	4	0	0	0	0	0	0	14	14
	Poa spp.	0	0	0	0	0	0	0	8	0	0	0	0	0	0	2
	Unidentified perennial	0	0	0	2	4	0	0	0	0	2	6	0	4	0	0

Quadrat Raw Data

Quadrat	Habitat quality	Top 3 dominant species recorded & percent cover						Percent cover				Tussock structure	Disturbance	Grazing type		Connectivity
		Dom 1	%	Dom 2	%	Dom 3	%	Native Cover %	Exotic Cover %	Bare Ground %	Rock %			1	2	
Q1	Excellent	Rytidosperma sp.	50	Microlaena stipoides	20	Rytidosperma carphoides	10	70	20	5	5	Continuous	Mod	Sheep		Yes
Q2	Low	Rytidosperma sp.	80	Microlaena stipoides	10	Elymus scaber	5	97	2	1	0	Scattered	High	Sheep	Cattle	Yes
Q3	Excellent	Rytidosperma setaceum	40	Aristida ramosa	30	Austrostipa scabra falcata	20	40	5	5	50	Continuous	Mod	Sheep		Irregular
Q4	Good	Rytidosperma setaceum	40	Austrostipa scabra falcata	30	Microlaena stipoides	5	50	5	5	40	Continuous	Mod	Sheep	Cattle	Yes
Q5	Moderate	Lomandra filiformis coriacea	30	Themeda australis	30	Rytidosperma sp.	10	75	0	0	25	Scattered	Mod	Sheep		Yes
Q6	Low	Microlaena stipoides	30	Austrostipa scabra falcata	30	Rytidosperma sp.	30	75	0	20	5	Scattered	High	Sheep		Restricted
Q7	Excellent	Themeda australis	50	Poa sieberiana var sieberiana	30	Rytidosperma sp.	10	95	5	0	0	Continuous	Low	Sheep		Restricted
Q8	Excellent	Themeda australis	70	Rytidosperma sp.	10	Aristida ramosa	10	89	1	5	1	Continuous	Mod	Sheep	Cattle	Yes
Q9	Good	Themeda australis	40	Microlaena stipoides	40	Rytidosperma sp.	10	80	16	4	0	Scattered	Mod	Sheep	Cattle	Yes
Q10	Good	Rytidosperma sp.	40	Trifolium sp	20	Rytidosperma carphoides	15	58	22	10	10	Scattered	High	Sheep	Cattle	Yes
Q11	Good	Poa sieberiana var sieberiana	20	Aristida ramosa	20	Rytidosperma sp.	10	60	0	15	15	Scattered	Mod	Sheep	Cattle	Confined to Paddock
Q12	Moderate	Rytidosperma sp.	60	Lomandra filiformis coriacea	10	Microlaena stipoides	10	5	5	10	0	Scattered	Mod	Sheep		Yes
Q13	Low	Rytidosperma sp.	60	Aristida ramosa	20	Trifolium sp	10	75	10	5	10	Continuous	Mod	Cattle		Surrounded by exotic pasture
Q14	Low	Trifolium sp	70	Cynodon dactylon	20	Avena sp.	5	5	85	5	5	None	Mod	Cattle		Surrounded by exotic pasture
Q15	Moderate	Dactylis glomerata	70	Phalaris aquatica	10	Trifolium sp	10	1	89	10	0	Continuous	Mod	Sheep	Cattle	Yes
Q16	Moderate	Dactylis glomerata	70	Trifolium sp	20	Rytidosperma sp.	5	20	70	5	5	Scattered	Mod	Sheep		Yes
Q17	Good	Phalaris aquatica	60	Trifolium sp	20	Rytidosperma sp.	10	15	70	5	10	Scattered	Mod	Sheep	Cattle	Yes
Q18	Excellent	Lomandra filiformis coriacea	30	Microlaena stipoides	30	Rytidosperma sp.	20	90	5	0	5	Continuous	Mod	Sheep		Continuous over greater area

Quadrat	Habitat quality	Top 3 dominant species recorded & percent cover						Percent cover				Tussock structure	Disturbance	Grazing type		Connectivity
		Dom 1	%	Dom 2	%	Dom 3	%	Native Cover %	Exotic Cover %	Bare Ground %	Rock %			1	2	
Q19	Low	Austrostipa scabra falcata	25	Rytidosperma sp.	25	Microlaena stipoides	5	50	10	40	0	None	High	Sheep	Cattle	Surrounded by highly grazed area
Q20	Moderate	Microlaena stipoides	30	Rytidosperma pallidum	30	Austrostipa scabra falcata	10	50	44	5	1	Scattered	Mod	Sheep	Cattle	Continuous across adjacent paddocks
Q21	Moderate	Rytidosperma ? racemosum	40	Rytidosperma ? carphoides	20	Microlaena stipoides	10	60	20	15	5	Scattered	Mod	Sheep	Cattle	Mostly continuous
Q22	Low	Rytidosperma sp.	40	Austrostipa scabra falcata	20	Trifolium sp	20	70	10	15	5	Scattered	High	Sheep	Cattle	Surrounded by highly grazed area
Q23	Good	Rytidosperma pallidum	30	Lomandra filiformis coriacea	30	Rytidosperma sp.	20	75	5	15	5	Scattered	Mod	Sheep		Continuous south and east
Q24	Excellent	Themeda australis	25	Rytidosperma pallidum	25	Lomandra filiformis coriacea	10	93	0	2	2	Continuous	Low	Sheep		Yes
Q25	Moderate	Microlaena stipoides	60	Lomandra filiformis coriacea	10	Rytidosperma pallidum	10	95	2	3	0	Scattered	Mod	Sheep		Mostly continuous
Q26	Moderate	Microlaena stipoides	60	Rytidosperma pallidum	20	Rytidosperma sp.	10	80	10	5	5	Scattered	Mod	Sheep		Mostly continuous
Q27	Moderate	Rytidosperma sp.	70	Microlaena stipoides	50	Lomandra filiformis coriacea	5	95	0	1	5	Scattered	Mod	Sheep		Widespread

C.2 TARGETED SURVEYS FOR THE CRIMSON SPIDER ORCHID

bega
unit 1, 216 carp st
(po box 470)
bega nsw 2550
t 61 2 6492 8333

bathurst
room 15, 341 havanah st
po box 434
bathurst nsw 2795
t 0488 820 748

sydney
unit 18, level 3
21 mary st
surry hills nsw 2010
t 61 2 8202 8333

wagga wagga
suite 1, 39 fitzmaurice st
(po box 5464)
wagga wagga nsw 2650
t 61 2 6971 9696
f 61 2 6971 9693

canberra
unit 17, 27 yallourn st
(po box 62)
fyshwick act 2609
t 61 2 6280 5053
f 61 2 6280 9387

ngh@nghenvironmental.com.au
www.nghenvironmental.com.au

20 February 2015

Brian Hall
Senior Project Manager
Epuron
Level 11 75 Miller St
North Sydney NSW 2060
B.Hall@epuron.com.au

Dear Brian,

RE – Rye Park Wind Farm targeted surveys for the Crimson Spider Orchid (our ref. 5439)

As detailed in correspondence from the NSW Office of Environment and Heritage (OEH) on the 2 July 2014 regarding the adequacy of the Biodiversity Assessment for the Rye Park Wind Farm development (the proposal), a population of the threatened Crimson Spider Orchid (*Caladenia concolor*) was detected in the Bango Nature Reserve (which adjoins the proposal site) in 2013 after the Biodiversity Assessment for the proposal had been completed. Prior to this, the nearest records of the Crimson Spider Orchid were approximately 95 kilometres west of the site, habitat at the site was not typical of that which it had been found in previously and as such, it was considered unlikely that this species would occur and targeted surveys were not undertaken.

In light of the new discovery of the species in Bango Nature Reserve, it was considered necessary to assess the potential for the species to occur at the Rye Park Wind Farm site and be impacted by the proposal. Please find overleaf the methodology and results of habitat assessment and targeted surveys undertaken for both the Bango Nature Reserve and the Rye Park Wind Farm site for the Crimson Spider Orchid in October 2014.

If you have any questions or require further advice relating to the potential impacts of the proposal on the Crimson Spider Orchid please do not hesitate to contact me.

Yours sincerely,

Dave Maynard
Senior Ecologist

Ph 02 6492 8311

nghenvironmental

RYE PARK WIND FARM HABITAT ASSESSMENT AND TARGETED SURVEYS FOR THE CRIMSON SPIDER ORCHID

BACKGROUND

The Crimson Spider Orchid (*Caladenia concolor*) is a terrestrial orchid that is known to occur within regrowth woodland where the dominant trees are Blakely's Red Gum (*Eucalyptus blakelyi*), Red Stringybark (*E. macrorhyncha*), Red Box (*E. polyanthemos*) and White Box (*E. albens*) and there is a diverse understorey which includes a number of other orchid species. At the time of the biodiversity surveys for the Rye Park Wind farm proposal (2011 – 2013), the Crimson Spider Orchid (CSO) was known to occur in two locations in NSW; a population on private property at Bethungra (approximately 95km west of the proposal site) and a population in Nail Can Hill Crown Reserve near Albury (approximately 200km south-west of the proposal site). There are also historic records from near Gerogery (just north of Albury) and Tumbarumba from 1978 and 1899 respectively. Given the large distances of the known records from the site and the absence of known habitat, the CSO was not considered likely to occur at the proposal site and as such targeted surveys at suitable times were not conducted.

On 7 October 2013, a single individual of the Crimson Spider Orchid was found in Bango Nature Reserve (NR) by orchid expert Graeme Bradburn (Australian Native orchid Society). Given that Bango NR is immediately adjacent to the proposal site, it significantly increased the potential for this species to occur on the proposal site and be impacted by the proposal.

SURVEY APPROACH

A two staged approach was proposed to determine if the CSO had potential to be impacted by the proposal.

1. Assess the CSO habitat within Bango NR to determine if similar habitat occurs at the proposal site.
2. If suitable habitat is present at the proposal site, conduct targeted searches for the CSO in those areas where the Rye Park Wind Farm infrastructure is proposed.

SURVEY RESULTS

Habitat for the CSO was assessed in Bango NR on the 16 September 2014 by Senior Ecologist, Dave Maynard (NGH Environmental Pty Ltd) Graeme Bradburn and John Briggs (Head of the Flora & Vegetation Management Unit – Southern Region, NSW Government – Office of Environment and Heritage) to the location of the record. It was noted that this was earlier than the flowering of the individual last year. Dominant species in all strata were recorded and targeted searches for the CSO were undertaken. A habitat description is provided below.

Following evaluation of the habitat, areas of potential habitat at the proposal site were identified based on existing vegetation mapping and field survey data collected during the surveys for the biodiversity assessment. Targeted searches were conducted by Dave Maynard (**ngh**environmental) and Virgil Robinson (Epuron) in potential habitat areas from the 7 – 9 October 2014. The survey period was targeted to coincide with the recorded flowering time of the species in Bango NR in 2013. Surveys were undertaken on foot employing transects spaced approximately 10 metres apart. The transects were recorded using the track function on a handheld Garmin GPSmap 62s. The transect tracks are shown on the maps in Attachment A.

Within each area the habitat characteristics were recorded and photographs taken. A summary of the habitat in each area and the potential for the CSO to occur based on the similarity of the habitats to that within Bango NR is provided below.

CSO habitat within Bango NR

The vegetation at the location of the known record (refer Figure 1) is representative of Red Stringybark - Long-leaved Box - Joycea pallida grassy open forest in the upper Lachlan catchment, NSWSWS and South Eastern Highlands Bioregions (ID348, Benson 2006). The overstorey is typically dominated by Red Stringybark (*Eucalyptus macrorhyncha*) and Long-leaved Box (*E. goniocalyx*) with a distinct absence of Inland Scribbly Gum (*E. rossii*) which occurs in other areas of Bango NR. Shrubs are sparse with common species including Grey Guinea Flower (*Hibbertia obtusifolia*), Austral Indigo (*Indigofera australis*), Urn Heath (*Melichrus urceolatus*) and *Hovea montana*. Silver wattle (*Acacia dealbata*) occurs as scattered individuals. A forb rich grassy groundcover is present dominated by Robust Wallaby Grass (*Rytidosperma pallidum*) along with Wattle Mat-rush (*Lomandra filiformis* subsp. *coriacea*) and Snow Grass (*Poa sieberiana* var. *sieberiana*). Common forb species include Stinking Pennywort (*Hydrocotyle laxiflora*), Raspwort (*Gonocarpus tetragynus*), Purple Coral Pea (*Hardenbergia violacea*), Sundew (*Drosera* sp.) and Prickly Starwort (*Stellaria pungens*) along with a range of orchid species including Maroonhood (*Pterostylis pedunculata*), Nodding Greenhood (*P. nutans*), Sun Orchid (*Thelymitra* sp.), Pink Fingers (*Caladenia carnea*) and another *Caladenia* sp. that was not identifiable at the time of the survey.

The habitat within Bango NR is different from the other known populations most notably in the absence of Blakely's Red Gum (*Eucalyptus blakelyi*). A common habitat feature however, seems to be the presence of Red Stringybark. In discussion with John Briggs (OEH) it was decided that targeted searches should be conducted at the proposal site in all areas where Red stringybark is co-dominant and a reasonably diverse grassy groundcover is present. This included most of the areas of Inland Scribbly Gum – Red Stringybark open forest except for those almost entirely dominated by Inland Scribbly Gum or where the community occurred on dry ridge tops and groundcover was very sparse.

Figure 1 Habitat at the location of the 2013 record in Bango NR

Rye Park Wind Farm Site

The CSO was not detected during surveys at the proposal site. However, repeat surveys at Bango NR by OEH during October 2014 also failed to relocate the known record. This is probably because flowering by the CSO may not take place every year for reasons that are not fully understood, though each plant probably lives for a considerable number of years (OEH 2014). As such, lack of detection during a single flowering season does not necessarily mean that the species is absent. Table 1 below details the habitat at each of the areas surveyed and the potential for the CSO to occur. Areas where it is considered that there is at least at moderate potential that the CSO could occur are highlighted. Each survey transect is labelled with the area number on the maps in Attachment A. Images of each area surveyed are included as Attachment B.

Table 1 Habitat description and potential for the CSO to occur in areas surveyed

Area	Associated infrastructure	Habitat description	Potential for the CSO to occur?
1	Turbine RYP_123 (now removed)	Small area adjoining Bango NR dominated by Red Stringybark and Inland Scribbly Gum. Heavily grazed and understorey largely exotic. Some native forb species such as Stinking Pennywort, Yam Daisy (*Microseris lanceolata*) and Wattle Mat-rush persist amongst rocks. Higher quality habitat over the fence to the west in Bango NR where a diverse groundcover exists including other orchid species.	Unlikely. Area heavily grazed and lacking diverse understorey.
2	RYP_125 and transmission lines and tracks to the north	Area variably dominated by Red Stringybark and Long-leaved Box. Shrubs sparse and primarily Grey Guinea Flower, Urn Heath and Daphne Heath (*Brachyloma daphnoides*). Groundcover variably dominated by Robust Wallaby Grass, Snow Grass and *Poa meionectes*. A diverse range of forbs are present including orchids such as Pink Fingers, Musky Caladenia (*Caladenia gracilis*), Maroonhood, *Diuris chryseopsis* and Waxlip Orchid. Habitat similar to that of the known record in Bango NR.	High. Habitat typical of that where the record was found in Bango NR including other orchid species.
3	Transmission lines and tracks between RYP_109 and RYP120	Highly disturbed area due to past clearing and grazing. Overstorey predominately scattered Red Stringybark with occasional patches of Brittle Gum (*Eucalyptus mannifera*). Dense stands of Parramatta Wattle (*Acacia parramattensis*) present (refer Attachment B). Groundcover patchy. Extensive areas dominated by Weeping Grass (*Microlaena stipoides*). Robust Wallaby Grass and Snow Grass dominant in other areas. A reasonable diversity of fobs and shrubs present but at low densities. Only orchid observed was the Waxlip Orchid.	Unlikely given disturbance history and not typical habitat.
4	Transmission line south-west of RYP_109 (now removed)	Highly disturbed area due to past clearing and grazing. Scattered Red Stringybark with Silver wattle and *Xanthorrhoea glauca*. Scattered Robust Wallaby Grass with Weeping Grass dominating the intertussock spaces. Good diversity of native forbs but low diversity. Other orchids virtually absent except for one Waxlip Orchid.	Unlikely given disturbance history and not typical habitat.
5	Access track south of RYP_104	Red Stringybark and Inland Scribbly Gum forest. Scattered shrubs mostly Urn Heath and Daphne Heath. Groundcover dominated by Robust Wallaby Grass and Wattle Mat-rush with occasional *Poa sieberiana* var. *cyanophylla* with a good diversity of forb species. Other orchids present including Musky Caladenia, Spotted Doubletail (*Diuris maculata*) and Waxlip Orchid.	Moderate. Low levels of disturbance and several species consistent with known habitat present. Not entirely typical of known habitat.

Area	Associated infrastructure	Habitat description	Potential for the CSO to occur?
6	Access track and power line route north of RYP_109	Scattered Red Stringybark and Yellow Box (*Eucalyptus melliodora*) on lower slopes to north with a dense Parramatta Wattle mid-storey. Red Stringybark and Inland Scribbly Gum on upper slopes with a Robust Wallaby Grass dominated groundcover ranging from moderately dense to sparse. Red Stringybark becoming low in abundance on ridge tops in the south and west. Forb diversity and abundance generally low.	Low. Low forb diversity and abundance and only a few orchid individuals observed.
7	Turbine RYP_102 and access track to south	Red Stringybark and Inland Scribbly Gum over a very sparse understorey comprising Robust Wallaby Grass, *Poa meionectes* and Wattle Mat-rush. Occasional Long-leaved Box. Low forb diversity and abundance and no other orchids present. Appears to be on substrate similar to a shale lithology.	Unlikely. Understorey does not resemble typical habitat.
8	Power line route west of RYP_102	Distinctly different on the southern and northern sides of a property boundary. On the south, mostly young Red Stringybark regrowth over a generally sparse Robust Wallaby Grass dominated groundcover. Forb diversity low most likely due to past disturbance. On the northern side of the property boundary, More mature Red Stringybark present however the groundcover is heavily grazed with large areas dominated by Weeping Grass. Native forbs are generally absent. This area was not surveyed as habitat for the CSO was not considered to be present.	Unlikely due to past disturbance and current grazing pressures.
9	Power line route and access tracks east of RYP_101	Surveys were not undertaken in the south-eastern section of the target area as the vegetation here was dominated entirely by Inland Scribbly Gum. In the north-west where surveys were undertaken, the vegetation was dominated by Red Stringybark and Inland Scribbly Gum with a dense low shrub layer dominated by Early Wattle (*Acacia genistifolia*) with a Daphne Heath, Grey Guinea Flower and Myrtle Tea-tree (*Leptospermum myrtifolium*). Robust Wallaby Grass was the dominant grass species. Spotted Doubletail and Waxlip orchids were common across the area along with a range of other forb species however, many were not associated with the known habitat. There was extensive evidence of past timber harvesting.	Low. Habitat more shrubby than grassy. Associated forb and orchid species not typical.
10	Power line route and access track to the west of RYP_96 and then south to RYP_97	Overstorey of Red Stringybark and Inland Scribbly Gum. To the west of RYP_97 and north towards RYP_96 the understorey is comprised of reasonably dense Robust Wallaby Grass with a moderate diversity of native forbs and two species of orchid that occur in the known habitat. At RYP_96 and further west the understorey is generally a lot sparser and forb diversity and abundance lower.	Moderate to the west of RYP_96 and north towards RYP_97 as typical structure and several species consistent with known habitat present. Unlikely to occur west of RYP_96.

Area	Associated infrastructure	Habitat description	Potential for the CSO to occur?
11	Power line route and access track north of RYP_95 and RYP_94	Variably dominated by very young regenerating Inland Scribbly Gum or Red Stringybark (refer to images in Attachment B). Groundcover very sparse and low forb and orchid diversity. Targeted searches terminated to the north of RYP_95 due to unsuitable habitat and low probability of occurrence.	Unlikely. Understorey does not resemble typical habitat.
12	Power line and access track north from RYP_80	Southern end of area dominated by Brittle Gum with a Weeping Grass understorey. Further north a Red Stringybark, Inland Scribbly Gum and Long-leaved Box overstorey occurs with a generally sparse Robust Wallaby Grass understorey however, forb diversity is low and no other orchids were detected. The existing track in this area is dominated by Parramatta Wattle. In the far north of the area east of RYP_77 there are higher levels of disturbance with more Parramatta Wattle, scattered Robust Wallaby Grass and Weeping Grass dominating the inter-tussock spaces.	Unlikely in disturbed areas and low in forest areas due to poor diversity of the understorey and absence of other orchid species.
13	Power line and access track east of RYP_78 and RYP_79	Very north of this area contains forest dominated by Red Stringybark and Inland Scribbly Gum. Scattered shrubs including Grey Guinea Flower and Daphne Heath are present along with a grassy ground cover dominated by Robust Wallaby Grass, Snow Grass and Wattle mat-rush. Native forb diversity is generally low. One other orchid, Waxlip Orchid, was recorded in this area. The southern section is largely dominated by a Parramatta Wattle scrub with scattered Long-leaved Box and Brittle Gum. Red Stringybark is absent in this area.	Low. Low forb and orchid diversity in the forest area in the north which is surrounded by areas subject to high levels of disturbance. Unlikely to occur in the south of the area.
14	Access track to RYP_64 and RYP_66	Area surveyed in two parts; eastern and western sections. A more highly disturbed area in the centre was not surveyed. In the east the overstorey is generally Red Stringybark with Inland Scribbly Gum and isolated occurrences of Mugga ironbark (*Eucalyptus sideroxylon*). The midstorey is largely dominated by Sifton Bush (*Cassinia arcuata*) which is likely a result of past disturbance. The groundcover is dominated by Robust Wallaby Grass but forb diversity is generally low. Virtually no orchids were detected except for one Waxlip orchid and one Tiger Orchid (*Diuris sulphurea*). The western section Follows a previously cleared track route/fire break which is currently unused. An overstorey of mature Red Stringybark and Inland Scribbly Gum is present. The groundcover is dominated by Robust Wallaby Grass and Wattle Mat-rush. A low diversity of forbs and shrubs are generally sparsely distributed and a small number of Pink Finger and Waxlip Orchids were detected.	Unlikely in eastern section given levels of past disturbance and low forb and orchid abundance. Low potential of occurrence in the western section. Given low diversity and abundance of native forbs and orchids.

Area	Associated infrastructure	Habitat description	Potential for the CSO to occur?
15	Turbine RYP_144 and power line and track to east	Turbine RYP_144 and the associated access track occur within a highly disturbed sheep camping area. Overstorey is dominated by Inland Scribbly Gum with little to no Red Stringybark and the groundcover is almost entirely exotic. The western power line and access track cross an area dominated by inland Scribbly Gum with occasional Red Stringybark and Long-leaved Box with a Robust Wallaby Grass groundcover. The area is actively grazed. There is some degree of forb diversity but no orchid species are present.	Unlikely at RYP_144 and access tracks. Low potential for occurrence along the western power line and access routes given the dominance of Inland Scribbly gum, the area is actively grazed and no other orchid species were present.
16	Access track south of RYP_42	Inland Scribbly Gum forest with occasional Red Stringybark. A diversity of low shrubs are present including Sifton Bush, Myrtle Tea-tree, Urn Heath, Grey Guinea Flower and Daphne Heath. The groundcover is dominated by Robust Wallaby Grass with a diversity of forbs but in low abundance. Orchid species are generally absent except for some isolated patches of the Waxlip Orchid.	Low given low abundance of Red Stringybark, low forb abundance and general absence of other orchid species.
17	Turbine RYP_35 to RYP_38	Around RYP_35 the area has been previously cleared and there is dense Acacia regrowth. Snow Grass and Speargrass (*Poa* sp.) dominate the understorey along with patches of dense Bracken (*Pteridium esculentum*). Isolated Red Stringybark and Long-leaved Box occur at the turbine site and Sifton Bush dominates to the north. To the south of RYP_35, a continuous overstorey of Inland Scribbly Gum with occasional Red Stringybark occurs. Native shrubs and forbs typical of this vegetation type are present but in low abundance. Very few orchids were observed restricted to the occasional Waxlip Orchid. Sifton Bush becomes more prominent again at RYP_38 and groundcover very sparse.	Unlikely at turbine sites and low along access track in between given low forb abundance and low orchid diversity and abundance.
18	RYP_19 and tracks and power line to south	At RYP_19 and along the access track to the south-west, scattered Mugga Ironbark and Red Stringybark are present over an understorey dominated by Robust Wallaby Grass and Kangaroo Grass (*Themeda australis*). The sparse overstorey is most likely due to past clearing. A moderate forb diversity was present but species were not typical of known habitat and no orchids were detected. Exotic species were common. Within the denser forest Inland Scribbly Gum dominates with occasional Red Stringybark. The understorey is very sparse in this area with scattered Wallaby Grass and exotic Hairgrass (**Aira* sp.) and virtually no forbs. No orchids were detected.	Low. Not typical habitat. No other orchid species were found within this area.

Area	Associated infrastructure	Habitat description	Potential for the CSO to occur?
19	Turbine RYP_17 to RYP_23	Forested areas dominated by Inland Scribbly Gum and Red Stringybark over a very sparse groundcover dominated by robust Wallaby Grass. Forb diversity and abundance is naturally very low in these areas and no orchids were observed. An existing track is present and areas that were disturbed for its establishment have been densely colonised by Sifton Bush and other *Cassinia* species.	Unlikely. Understorey does not resemble typical habitat.

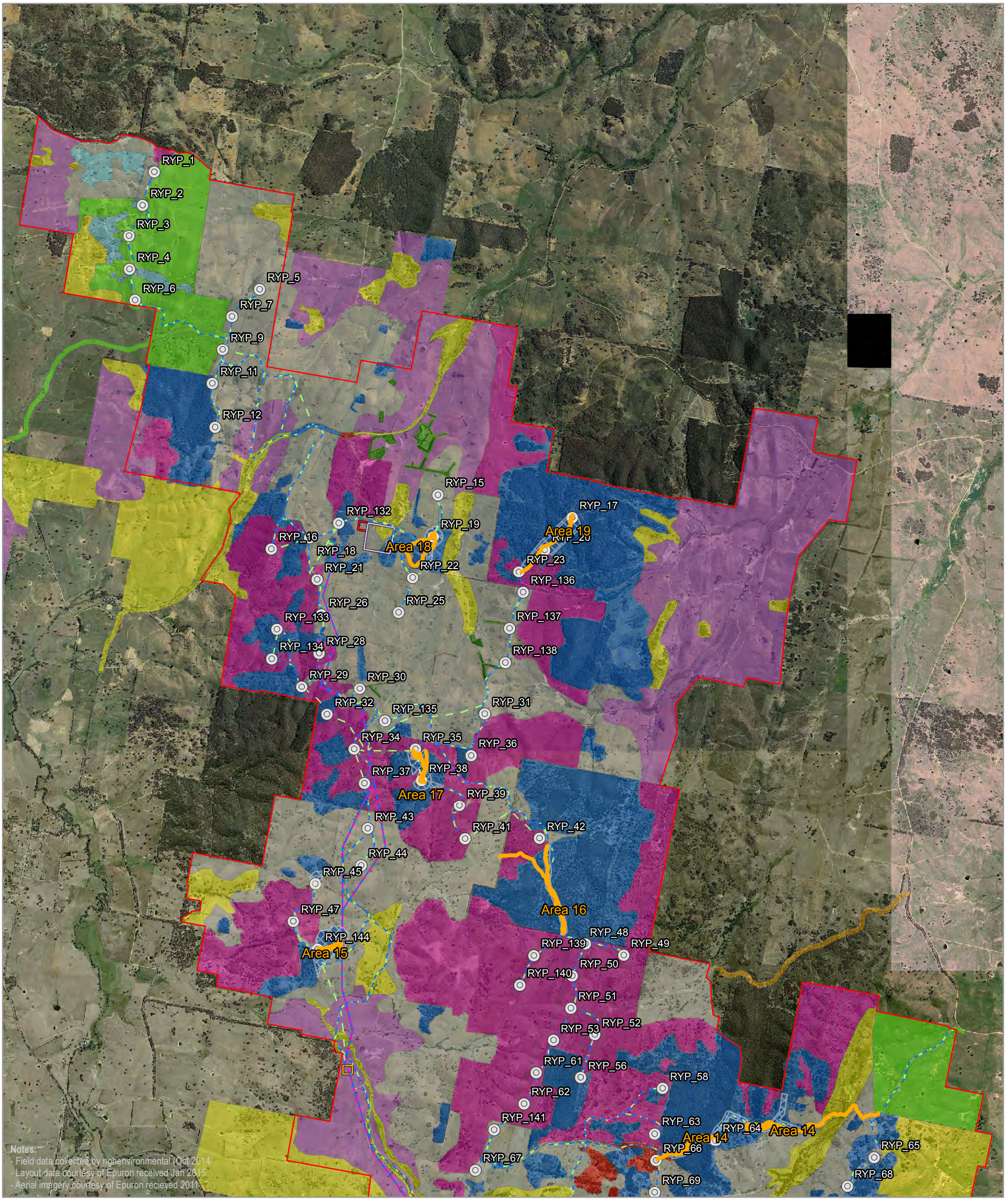
CONCLUSION

In conclusion, it is considered that CSO habitat across the majority of the Rye Park Wind Farm site is largely marginal. Although Red Stringybark is present in many areas, the understorey often lacks the density and diversity of that found at the known location within Bango NR particularly with regard to the presence of other orchid species. There are however, three areas within the proposal site where habitat is considered to be suitable and there is a moderate or higher potential for the CSO to occur; Areas 2, 5 and 10. Area 2 in particular exhibits habitat characteristics very similar to those found at the known location in Bango NR. The difficulty is however, the CSO may not flower every year and its lack of detection does not necessarily mean that it does not occur at the proposal site.

RECOMMENDATION

It is recommended that repeat surveys be conducted in late September – early October 2015 to again determine if the CSO is present in Areas 2, 5 and 10 prior to the commencement of construction of the Rye Park Wind Farm. The exact timing of surveys should be determined in consultation with OEH. The location of the known record would be surveyed also to confirm flowering (or lack of flowering) in the locality. It is also recommended that the results of these surveys would be provided to OEH since any confirmed discovery of the CSO may have implications about how the Rye Park Wind Farm is constructed and operated. The need for ongoing surveys each year should also be determined in consultation with OEH.

ATTACHMENT A: CSO SURVEY MAPS



CRIMSON SPIDER ORCHID TARGETED SURVEY LOCATIONS MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Targeted survey track record
- Target areas

Vegetation type

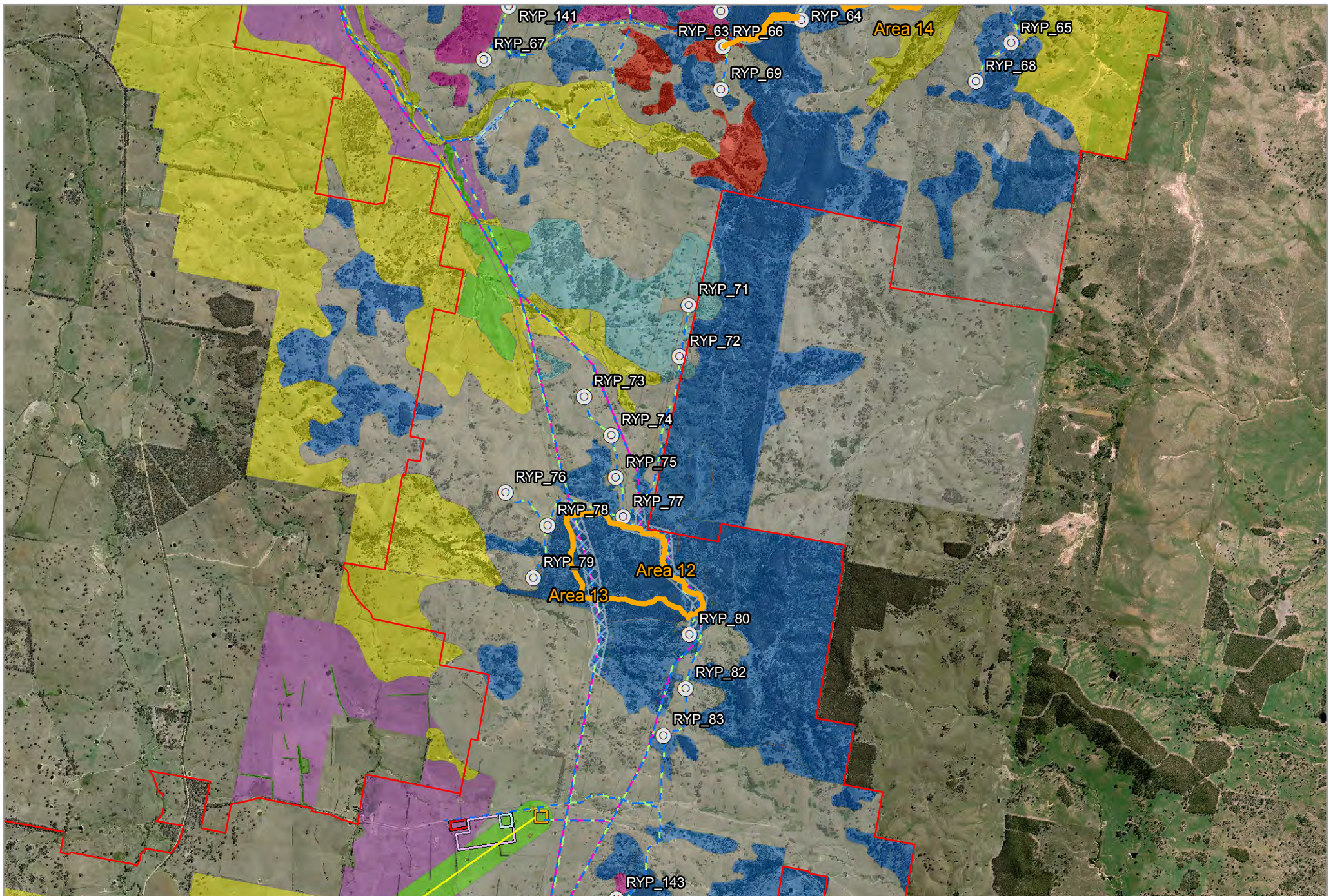
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Candlebark Woodland
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Red Box Woodland
- Scribbly Gum Forest
- Sedgeland - Rushland - Reedland
- Sifton Bush Shrubland
- Site perimeter
- Wind turbine
- Access track
- Underground cabling
- 132kV power line
- 330kV power line
- Substation
- 33kV termination compound
- O&M building
- Construction compound
- Concrete batch plant

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - CSO
Author: DM

ngh environmental

www.nghenvironmental.com.au



CRIMSON SPIDER ORCHID TARGETED SURVEY LOCATIONS MAP 2

Rye Park Wind Farm Biodiversity Assessment

- Targeted survey track record
- Target areas

Vegetation type

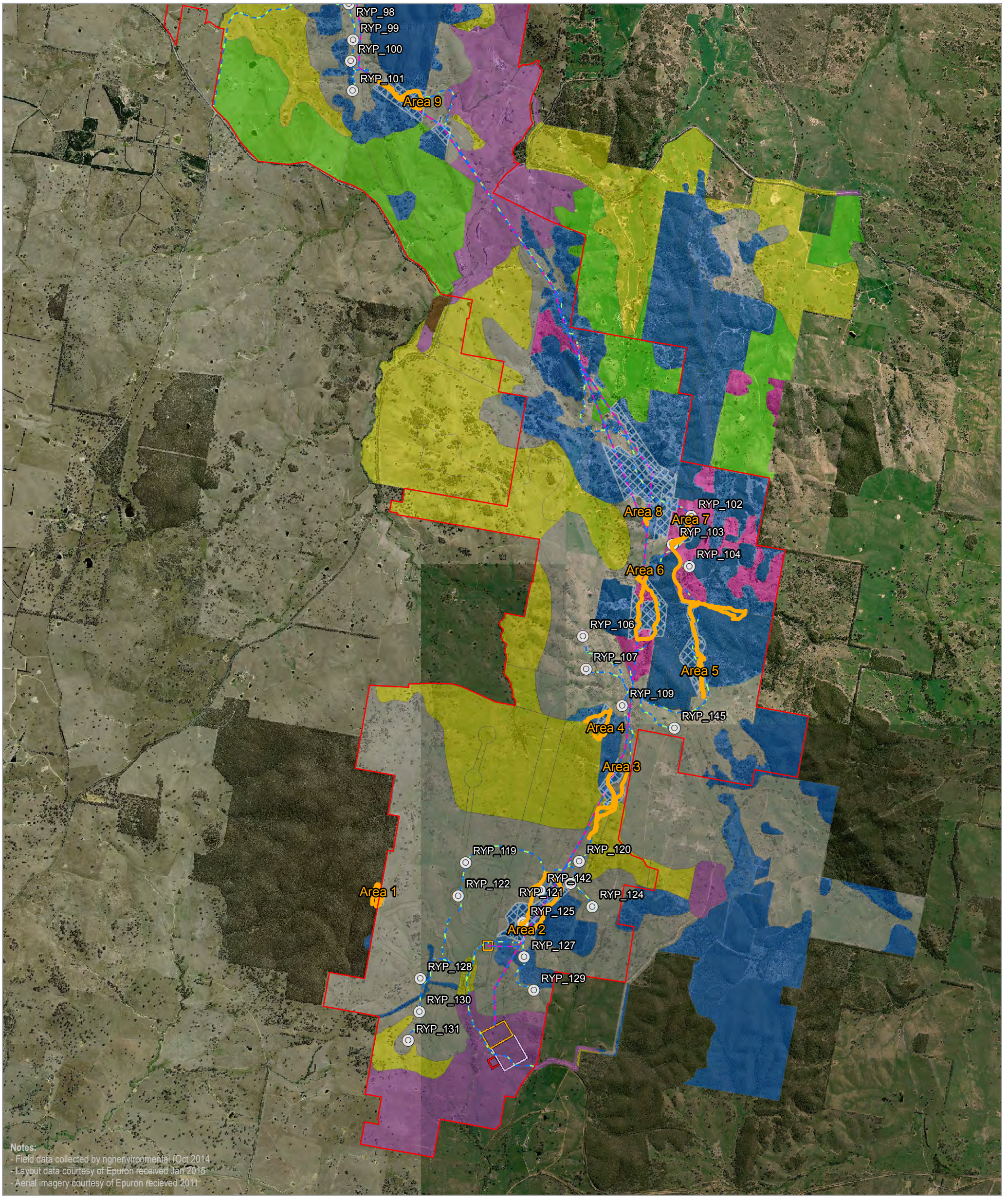
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Candlebark Woodland
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Red Box Woodland
- Scribbly Gum Forest
- Sedgeland - Rushland - Reedland
- Sifton Bush Shrubland
- Site perimeter
- Wind turbine
- Access track
- Underground cabling
- 132kV power line
- 330kV power line
- Substation
- 33kV termination compound
- O&M building
- Construction compound
- Concrete batch plant

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - CSO
Author: DM

ngh environmental

www.nghenvironmental.com.au



CRIMSON SPIDER ORCHID TARGETED SURVEY LOCATIONS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Targeted survey track record
- Target areas

Vegetation type

- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Candlebark Woodland
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Red Box Woodland
- Scribbly Gum Forest
- Sedgeland - Rushland - Reedland
- Sifton Bush Shrubland
- Site perimeter
- Wind turbine
- Access track
- Underground cabling
- 132kV power line
- 330kV power line
- Substation
- 33kV termination compound
- O&M building
- Construction compound
- Concrete batch plant

0 0.5 1 Kilometres

A3 @ 1:42000
Ref: 5439 - CSO
Author: DM

ngh environmental

www.nghenvironmental.com.au

ATTACHMENT B: IMAGES OF SURVEY AREAS

Area 1

Area 1 adjacent habitat in Bango NR

Area 2 north

Area 2 east

Area 2 south

Area 2 west

Area 3 south

Area 3 north

Area 3 dense Acacia stands

Area 4 east

Area 4 west

Area 5 north

Area 5 south

Area 6 lower slopes

Area 6 north

Area 6 south

Area 7 south

Area 7 north

Area 8 southern side of property boundary

Area 8 northern side of property boundary

Area 9 south-eastern section

Area 9 north-western section

Area 10 west of RYP_97

Area 10 at RYP_96

Area 11 typical habitat Inland Scribbly Gum dominant

Area 11 typical habitat red Stringybark dominant

Area 12 south

Area 12 central

Area 12 north

Area 13 north

Area 13 south

Area 14 eastern section

Area 14 western section

Area 15 at RYP_144

Area 15 west

Area 16 north

Area 16 south

Area 17 at RYP_35

Area 17 between RYP_35 and RYP_38

Area 17 at RYP_38

Area 18 at RYP_19

Area 18 denser forest area

Area 19 existing track

Area 19 suroounding forest vegetation

APPENDIX D REVISED OFFSET STRATEGY

EPURON

Biodiversity Offset Strategy

RYE PARK WIND FARM

MARCH 2016

ngh environmental

www.nghenvironmental.com.au

Document Verification

Project Title: Biodiversity Offset Strategy
RYE PARK WIND FARM

Project Number: 6043

Project File Name: Rye Park Offset Strategy Final v2.1.docx

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft v1.1	16/10/15	Brooke Marshall	Dave Maynard	Brooke Marshall
Draft v2	17/11/2015	Brooke Marshall	Dave Maynard	Brooke Marshall
Final v1	04/12/2015	Brooke Marshall		Brooke Marshall
Final v2	11/03/2016	Brooke Marshall	Dave Maynard	Brooke Marshall
Final v2.1	24/03/2016	Brooke Marshall	Dave Maynard	Brooke Marshall

NGH Environmental Pty Ltd (ACN: 124 444 622. ABN: 31 124 444 622) and NGH Environmental (Heritage) Pty Ltd (ACN: 603 938 549. ABN: 62 603 938 549) are part of the NGH Environmental Group of Companies.

www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

Sydney Region
18/21 mary st
surry hills nsw 2010 (t 02 8202 8333)

Canberra - NSW SE & ACT
unit 17/27 yallourn st (po box 62)
fyshwick act 2609 (t 02 6280 5053)

Wagga Wagga - Riverina and Western NSW
suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 (t 02 6971 9696)

Newcastle - Hunter and North Coast
153 tudor st
hamilton nsw 2303 (t 02 4969 4910)

Bega - ACT and South East NSW
suite 1, 216 carp st (po box 470)
bega nsw 2550 (t 02 6492 8333)

Bathurst - Central West and Orana
35 morrisset st (po box 434)
bathurst nsw 2795 (m 0448 820 748)

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 BACKGROUND

In January 2014, NGH Environmental submitted the Biodiversity Assessment (BA) of the potential impacts associated with the development of the Rye Park Wind Farm. The content of the assessment was informed by the DGRs which included a requirement for the proposal to offset impacts that cannot be sufficiently avoided or minimised.

A Biodiversity Offset Strategy was prepared for the project (Appendix F, NGH Environmental 2014) which identified appropriate offset ratios and measures to manage the offset area for preservation and improvement. Specifically, it was a commitment of the BA to:

- Develop an offset strategy and finalise prior to any construction impacts by an ecological professional, in accordance with Appendix F (of NGH Environmental 2014).
- Develop an offset plan prior to operation, demonstrating the suitability of the final offset site and providing detailed management actions specific to the site.
- Ensure the offset strategy complies with the Principles for the use of biodiversity offsets in NSW guidance document.
- The offset ratio will be determined with reference to: the conservation status of the vegetation, the condition of the vegetation, and the actual threatened species habitat value lost (i.e. known threatened species habitat, not potential habitat).
- Where vegetation is listed as an EEC, a ratio of 1:5 to 1:10 is proposed, depending on quality of habitat.
- Where non-threatened vegetation is cleared an offset ratio to be applied at 1:2.
- Where hollow-bearing trees are to be cleared and cannot be avoided an offset ratio to be applied at 1:1 and is supplementary to other areas offset.
- Include provisions for offsetting Commonwealth listed EEC to demonstrate compliance with the Commonwealth offset policy.

The proponents and authors have consulted closely with OEH and Department of Planning and Environment (DPE), and this has resulted in refinement of the previously submitted offset strategy. The main change to the strategy reflects a meeting with DPE (10 September 2015, DPE, Trustpower and NGH Environmental) that the NSW Framework for Biodiversity Assessment (FBA) and BioBanking Credit Calculator (BCC) should be used to calculate the offset requirement of the proposal and ultimately to demonstrate the adequacy of any offsets proposed.

1.2 PURPOSE OF THIS STRATEGY

The main objective of this revised Offset Strategy is to demonstrate that suitable and adequate offsets are available and achievable for the proposal using the FBA and BCC. This strategy includes:

Section 2 **Development site:**

- A preliminary assessment of the offset requirement for the proposal in terms of ecosystem and species credits, using the Major Projects option of the BCC and the rules under the FBA.
- The results of hollow bearing tree offset estimates (supplementary to the offsetting of native vegetation and threatened species habitat)

Section 3 **Staging:**

- Proportional offset requirement of the project, should it be separated into three stages:
  - Northern Precinct
  - Central Precinct
  - Southern Precinct

Section 4 **Candidate offset sites:**

- An estimate of the areas that would be required to meet the offset requirement, calculated in Section 2.
- Identification of candidate offset sites within the project boundary
- Evaluation of their availability and general adequacy to meet the offset requirements.

Section 5 **Additional matters including:**

- Time lines for implementation of an offset plan.
- Mechanisms to secure and manage the offset sites.
- Survey and assessment requirements

The draft strategy will be provided to DPE and OEH for their comment which will inform the final offset strategy for the proposal.

1.3 DATA SOURCES

Data for this assessment was sourced as follows:

• Vegetation type and condition of the development site:	Biodiversity Assessment of the Rye Park Wind Farm (NGH Environmental 2014)
• Impact area calculations:	Biodiversity Addendum of the Rye Park Wind Farm (NGH Environmental 2016), using 'worst case' or 'upper limit values' where multiple route options / layouts are proposed.
• Plot data (vegetation survey data required to be entered into the online BioBanking calculator):	OEH vegetation database benchmark data is used to derive plot data. Median values are entered, within the benchmark range, for parameters that have a benchmark in this database. No Biometric surveys have been undertaken for this assessment at this stage.
• Threatened species surveys, threatened species likely or unlikely to be impacted:	Biodiversity Assessment of the Rye Park Wind Farm (NGH Environmental 2014) and Biodiversity Addendum of the Rye Park Wind Farm (NGH Environmental 2016).
• Threatened species habitat impact areas:	Biodiversity Addendum of the Rye Park Wind Farm (NGH Environmental 2016), using follow up surveys, vegetation type and condition surrogates and in consultation with OEH with particular respect to known habitat of the Striped Legless Lizard.

• Hollow bearing tree impacts:	Biodiversity Addendum of the Rye Park Wind Farm (NGH Environmental 2016).
• BioBanking calculations:	Framework for Biodiversity Assessment: Major project, linear assessment. OEH BioBanking online calculator, accessed March 2016.
• Offset area estimate:	OEH credit converter tool, accessed March 2016.

2 PRELIMINARY CREDIT CALCULATIONS: DEVELOPMENT SITE

2.1 METHODS

Key aspects of this credit assessment methodology are detailed below. The assessment is considered preliminary, to ensure that offsets are feasible and achievable for the project.

The final offset requirement would be calculated using field collected plot data, would be based on the final impact areas of the construction process and would be validated by on-ground inspection of the completed construction footprint. This provides an incentive throughout the detailed design and construction phase, to minimise the impacts of the works and thereby reduce the offset requirement (refer to Section 6.1 and 6.2).

2.1.1 BioBanking credit calculations: FBA, linear development

The NSW Framework for Biodiversity Assessment (FBA) methodology has been used for this assessment (144/2015/2070D proposal version 3), via the online BioBanking calculator, selecting:

- Major Project and
- Development Site.

The offset rules as documented in the FBA have been applied in undertaking the assessment. Specifically offsets would not be considered to be required for:

- Vegetation zones that have a site value score of <17
- Vegetation that does not comprise either an Endangered Ecological Community (EEC) OR threatened species habitat

All native vegetation types (not only EECs) to be impacted are entered into the calculator to ensure that all threatened species with potential to occur are considered by the assessment.

The linear methodology (as detailed in Appendix 5 of the FBA and in notes provided by OEH) has been used to conduct the landscape assessment as the project conforms to the definition of a *linear shaped development* according to the FBA; *a development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length*.

2.1.2 Plot data and impact areas

A 'worst case' ecosystem offset requirement has been derived by using benchmark data held by the OEH for each native vegetation type that would be impacted. Using benchmark data assumes all vegetation to be impacted is of high quality; scores for native species diversity, native overstorey regeneration, fallen timber, hollow-bearing trees, weediness and other parameters reflect a vegetation community in good condition.

The impact areas calculated for the project within the Biodiversity Addendum are used in the assessment. These are the 'worst case' or 'upper limit' impact areas and as such will provide a 'worst case' or 'upper limit' offset requirement. This is to ensure that offsets for the project are *feasible*. *Actual* impact areas are expected to be less and therefore the offset requirement for the actual constructed footprint should also be less.

2.1.3 Offsetting high constraint CEEC

In previous correspondence, OEH had requested the proponent to comment on how high constraint Commonwealth listed Critically Endangered Ecological Communities (CEEC) would be offset, requiring a higher offset ratio.

For this preliminary assessment, all vegetation that meets the definition of the CEEC has been entered into the FBA assessment using median benchmark data which is reflective of it being high quality vegetation. It is proposed that the detailed offset plan would be developed using field collected plot data. Using this field collected data, the higher condition values of CEEC areas would be reflected in the site value scores and would more accurately determine the offset requirement for these areas.

It is expected that the outcome of this assessment would also satisfy Commonwealth offset requirements for the CEEC.

2.2 FBA ASSESSMENT

The BCC assessment was completed by accredited assessor Brooke Marshall, selecting 'Major Project' and using the rules under the FBA. Inputs were supplied by accredited assessor Dave Maynard (linear methodology mapping) and Epuron (impact areas). Key decision points in the application of the FBA for this project are documented below.

2.2.1 Application of the linear methodology

Landscape assessment

The following steps were completed in accordance with Appendix 5 of the FBA.

Assessing percent current extent of native vegetation cover

Using a GIS, a 550 m buffer was established from the outer edge of development.

- The total area of the buffer, including the development footprint, is 12,595 ha.
- The total area of native vegetation mapped within the buffer, including the development footprint, is 5,364 ha.
- Current native vegetation cover is therefore 43%.

Assessing percent future extent of native vegetation cover

Using the same buffer above, the impact area was considered.

- The total area of the buffer, including the development footprint, is 12,595 ha.
- The total area of native vegetation to be impacted within the buffer is 258.8[1] ha.
- Future native vegetation cover is therefore 41%.

[1] This is the total impact area of the infrastructure footprint (285ha) minus the area of exotic pasture mapped within that footprint (26.2ha).

Connectivity value

A connecting link is when native vegetation on the site adjoins native vegetation surrounding the site and the native vegetation:

- is in moderate to good condition, and
- has an patch size >1 ha, and
- is separated by a distance of <100 m (or <30 m for non-woody ecosystems), and
- is not separated by a large water body, dual carriageway, wider highway or similar hostile link.

With reference to Table 17 of the FBA (below), the development footprint affects the following link:

- A local area biodiversity link

Extract from the FBA Table 17: Connectivity value scores for linear shaped developments or development that has multiple fragmentation impacts

Category of connecting link	*Definition of connecting link*	*Score*
A local area biodiversity link	*Links areas of native vegetation in moderate to good condition that are ≥250 ha and <1000 ha in total, or areas greater than 1000 ha in total* *AND* *Width of vegetation in moderate to good condition that is connecting the area is >30 m and <100 m*	*2.5*

Generally, onsite link areas have been measured at less than 1000 ha, using GIS. Generally, habitat values within the project boundary area are considered to be determined by overstorey connectivity and maturity, therefore exotic areas, pasture and Sifton bush have not been considered in this score.

Patch size

For a development that is linear shaped or a multiple fragmentation development, the assessor must assess the patch size for each Mitchell landscape in which the development occurs. The results for this assessment are as follows:

Mitchell landscape 1:

Boorowa Volcanics

Largest patch size: >1000 ha

Table 18 of Appendix 5, score: 12.5

Mitchell landscape 2:

Dalton Hills

Largest patch size: >1000 ha

Table 18 of Appendix 5, score: 12.5

The final patch size score, found by averaging those scores, is 12.5.

Area to perimeter ratio

Two representative patches within the GIS produced buffer would be affected by the project (ID: A and B). Each patch is made up of one polygon. The area and perimeter ratio before development is shown below.

Table 2-1 Area to perimeter ratio

Patch	Area (m^2)	Perimeter (m)
A	7,130,000.00	2,213.00
B	5,100,000.00	24,295.00
Totals:	**12,230,000.00**	**26,508.00**
Area m^2 / Perimeter m	**461.37**	

The current area to perimeter ratio is 461.37.

Patch A is shown below.

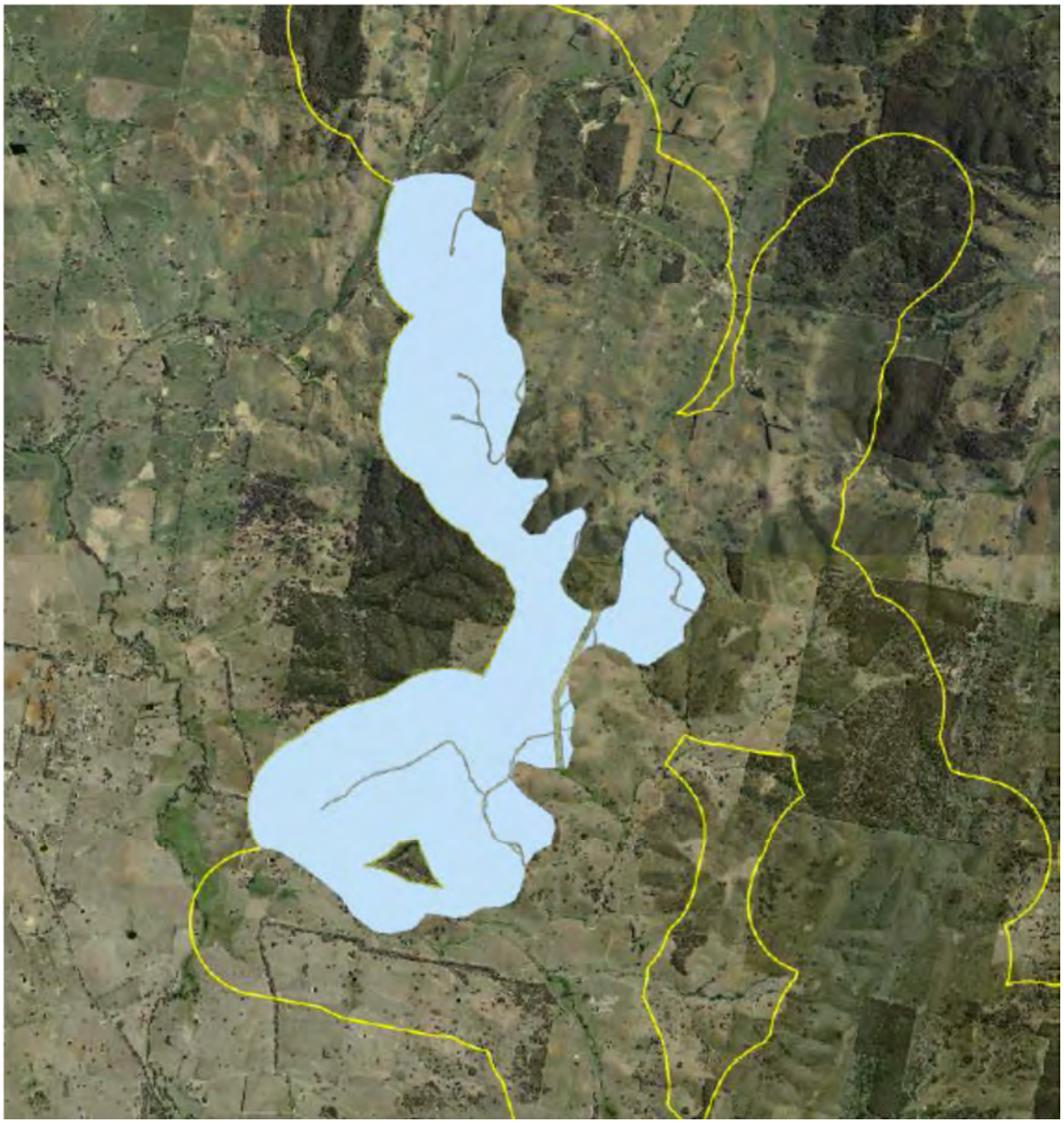


Figure 2-1 Representative patch within the GIS buffer

The effect of the development (the future score) is to increase the number of polygons (ID 1 - n) in some patches and to reduce their area. Taking into account the development, the future area and perimeter ratio of Patch A and B after development is shown below.

Table 2-2 Future patch size and perimeter

Patch A	Area (m^2)	Perimeter (m)
1	1745.56	242.09
2	25.10	29.31
3	274092.99	3231.81
4	19181.30	720.29
5	18082.59	557.51
6	8458.52	516.43
7	8834.63	567.55
8	24.67	87.41
9	113.24	50.59
10	485386.00	3341.76
11	67611.29	1255.38
12	1762.09	299.38
13	6917.00	450.94
14	6087429.80	25927.50
Patch B	**Area (m^2)**	**Perimeter (m)**
1	84864.10	1516.50
2	7.56	14.05
3	1108980.02	5889.56
4	47239.99	1372.84
5	26541.70	740.87
6	2045639.95	11002.50
7	36713.60	1216.73
8	872350.99	7427.55
9	97663.80	2375.46
10	4061.32	490.90
11	1266.01	256.40
12	529068.98	5785.14
Totals:	**11,834,062.80**	**75,366.44**
Area m2 / Perimeter m	**157.02**	

The future area to perimeter ratio after development is 157.02. As the current ratio is greater than the future ratio, the calculator returns a proportional change % and score of Zero $(0)^2$.

2.2.2 Vegetation zones

The native vegetation zones that would be impacted by the project as entered into the BCC (including their condition class, number of biometric plots required for them and their current site value score, as determined by the BCC), are provided below. Bold entries are the zones entered into the calculator. Non-bold entries have either been combined with a bold entry or excluded from the calculations, as explained below.

Table 2-3 Vegetation zones within the project

Zone ID	Vegetation zones	Biometric code and name	Condition class	Area (ha) within development footprint	Number of plots required (and undertaken)	Site value score (current)
1	Acacia scrub	This area has been derived from clearing of Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182). In this preliminary calculation, it has been combined with zone 8. This is considered precautionary, as benchmark plot data will likely be higher than field collected data for this zone.	Moderate to good	(1.3 – not entered as a separate zone, combined with zone 8).		
2	**Argyle Apple Forest**	Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands and South Western Slopes (LA102)	Moderate to good	0.4	1 (plot ID 1)	100
3	**Box-Gum Woodland**	Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (LA120)	Moderate to good	24.9	4 (plot ID 2)	100
4	**Brittle Gum Forest**	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands (LA124)	Moderate to good	2.8	2 (plot ID 3)	100
5	**Derived Grassland**	This area has been derived from clearing of Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (LA120). It is has been entered as a separate zone and benchmark data have been modified to reflect the lack of overstorey.	Moderate to good	25.3	4 (plot ID 4)	52
6	**Native pasture**	This area has been derived from clearing of Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182). It is has been entered as a separate zone of lower condition class and	Moderate to good	71.6	5 (plot ID 5)	53.12

[2] Confirmed with OEH Biobanking team member, Phil Wood, October 2015.

Zone ID	Vegetation zones	Biometric code and name	Condition class	Area (ha) within development footprint	Number of plots required (and undertaken)	Site value score (current)
		benchmark data have been modified to reflect the lack of overstorey.				
7	Planted native vegetation	This vegetation is native but is generally not from locally occurring species. It cannot be assigned to a biometric vegetation type with any accuracy and is not considered to be a driver of threatened species credits. This zone has been excluded from the assessment	Moderate to good	(0.2 – not entered; non-naturally occurring).		
8	**Scribbly Gum Forest**	Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)	Moderate to good	84.9 (Plus 1.3 ha from zone 1 = 86.2 entered for this zone in the calculator).	5 (plot ID 6)	100
9	**Sifton Bush Shrubland**	This area has been derived from clearing of Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182). It is has been entered as a separate zone of lower condition class and benchmark data have been modified to reflect the lack of overstorey and dense midstorey.	Moderate to good	29.6	4 (plot ID 7)	84.38

Notes:

- Exotic pasture and planted native vegetation have not been included in the assessment.
- As this assessment is preliminary, no additional threatened species polygons / management zones have been added. Management zones are equivalent to the vegetation zones; all site scores have been reduced to zero 'after development'.
- No vegetation zones had site value scores of <17.

2.2.3 Plot data used in the assessment

The following plot data have been derived from benchmark data on the OEH vegetation data base. The median range of the lower and upper benchmarks has been used unless otherwise justified. The number of plots required, as shown in Table 2-3, have been duplicated for each zone.

The management scores *with development* have been entered as zero for each parameter – that is, total removal of habitat would result from the development. Current site value scores are shown in Table 2-3. Future site value scores would all be zero.

Table 2-4 'Worst case' plot data, derived from OEH database benchmarks

Zone 2 Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands and South Western Slopes (LA102)

No change to median benchmark plot data.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
1	17	29	14.5	5.5	6	9.5	0	1	1	50	111111	1111111	1

Zone 3 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (LA120)

No change to median benchmark plot data.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
2	23	21.5	10.5	42.5	4	11.5	0	1	1	66	111111	1111111	1

Zone 4 Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands (LA124)

No change to median benchmark plot data.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
3	17	29	14.5	5.5	6	9.5	0	1	1	50	111111	1111111	1

Zone 5 Blakely's Red Gum - Yellow Box grassy woodland of the NSW South Western Slopes Bioregion (LA120)

Overstorey, midstorey and fallen log scores are zero, reflecting this is a grassland.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
4	23	0	0	42.5	4	11.5	0	1	1	0	111111	1111111	1

Zone 6 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)

Overstorey, midstorey and fallen log scores are zero, reflecting this is a grassland.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
5	19	0	0	3	1.55	2	0	1	1	0	111111	1111111	1

Zone 8 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)

No change to median benchmark plot data.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
6	19	35	5.5	3	1.55	2	0	1	1	45	111111	1111111	1

Zone 9 Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest of the NSW South Western Slopes Bioregion (LA182)

Overstorey and fallen log scores are zero. The upper midstorey score has been uses, reflecting this is a shrubland.

Plot name	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	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
7	19	0	8	3	1.55	2	0	1	1	0	111111	1111111	1

Benchmark data used to derive the 'worst case' plot data are provided in Table 2-5 for reference. In the cases where no benchmark is provided for a parameter, a precautionary treatment has been applied as follows:

- Exotic cover is scored as zero, assuming the vegetation is weed free.
- Regeneration is scored as 1, assuming all occurring trees are regenerating.
- For Vegetation types 120 and 124, 1 hollow-bearing tree has been entered as 0.8 was not accepted.

Note, as the data were not collected in the field, no Easting and Northing locations apply; '111111, 1111111' has been entered for each plot.

Table 2-5 Benchmark data (OEH Oct 2008).

Veg Type ID	Native plant species richness		Native over-storey cover		Native mid-storey cover		Native ground cover (grasses)		Native ground cover (shrubs)		Native ground cover (other)		Cover estimates - Source	Number of trees with hollows	Total length of fallen logs	Hollows & logs - Source
	Richness	Source	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper				
LA102	17	A	21	37	9	20	1	10	2	10	5	14	A	1	50	A
LA 120	23	E	8	35	1	20	15	70	3	5	3	20	P	0.8	66	E
LA 124	17	A	21	37	9	20	1	10	2	10	5	14	A	1	50	A
LA 182	19	P	30	40	3	8	1	5	0.1	3	1	3	E & P	1	45	A

2.2.4 Ecosystem credit species

The following habitat features have been entered for the development footprint, in the Geographic / habitat feature tab of the BCC.

Table 2-6 Geographic / habitat features (checked features occur for the development footprint).

Do any of the following features occur on the area to be assessed? Tick the box wherever the feature occurs, or is likely to occur in the area to be assessed. Leave blank if the feature does not occur.

Impact?	Common name	Scientific name	Feature
☑	Rosenbergs Goanna	Varanus rosenbergi	land within 250 m of termite mounds or rock outcrops
☑	Narrow Goodenia	Goodenia macbarronii	seasonally wet/boggy sites (including table drains)
☑	Yass Daisy	Ammobium craspedioides	land south of Cowra in Upper Slopes CMA subregion
☑	Golden Sun Moth	Synemon plana	land within 40 m of grassland or grassy woodland containing dense cover of wallaby grasses (Austrodanthonia spp.)
☑	Tarengo Leek Orchid	Prasophyllum petilum	land south and east of Boorowa in Upper Slopes CMA subregion
☑	Small Purple-pea	Swainsona recta	land containing a forb-rich grassy groundlayer
☐	Silky Swainson-pea	Swainsona sericea	land within the southern half of subregion in Murrumbateman CMA subregion
☑	Booroolong Frog	Litoria booroolongensis	land within 100 m of stream or creek banks
☐	Pink-tailed Legless Lizard	Aprasia parapulchella	land west of Dalton in Murrumbateman CMA subregion
☑	Small Scurf-pea	Cullen parvum	land within and to the east of Hay Plains in Murrumbidgee CMA subregion
☐	Crimson Spider Orchid	Caladenia concolor	land south and west of Young in Upper Slopes CMA subregion

The following species are all species predicted by the BCC to occur, based on the data entered for the landscape assessment and the geographic and habitat features in the assessment. These constitute all species which will generate ecosystem credits in the credit calculations.

Table 2-7 Species predicted to occur.

Predicted threatened species

Common name	Scientific name *	TS offset multiplier	On site *	
Barking Owl	Ninox connivens	3.0	Yes	Edit
Black-chinned Honeyeater (eastern subspecies)	Melithreptus gularis subsp. gularis	1.3	Yes	Edit
Brown Treecreeper (eastern subspecies)	Climacteris picumnus subsp. victoriae	2.0	Yes	Edit
Bush Stone-curlew	Burhinus grallarius	2.6	Yes	Edit
Diamond Firetail	Stagonopleura guttata	1.3	Yes	Edit
Flame Robin	Petroica phoenicea	1.3	Yes	Edit
Gang-gang Cockatoo	Callocephalon fimbriatum	2.0	Yes	Edit
Glossy Black-Cockatoo	Calyptorhynchus lathami	1.8	Yes	Edit
Grey-crowned Babbler (eastern subspecies)	Pomatostomus temporalis subsp. temporalis	1.3	Yes	Edit
Hooded Robin (south-eastern form)	Melanodryas cucullata subsp. cucullata	1.7	Yes	Edit
Little Eagle	Hieraaetus morphnoides	1.4	Yes	Edit
Little Lorikeet	Glossopsitta pusilla	1.8	Yes	Edit
New Holland Mouse	Pseudomys novaehollandiae	2.6	Yes	Edit
Painted Honeyeater	Grantiella picta	1.3	Yes	Edit
Powerful Owl	Ninox strenua	3.0	Yes	Edit
Scarlet Robin	Petroica boodang	1.3	Yes	Edit
Speckled Warbler	Chthonicola sagittata	2.6	Yes	Edit
Spotted-tailed Quoll	Dasyurus maculatus	2.6	Yes	Edit
Square-tailed Kite	Lophoictinia isura	1.4	Yes	Edit
Swift Parrot	Lathamus discolor	1.3	Yes	Edit
Turquoise Parrot	Neophema pulchella	1.8	Yes	Edit
Varied Sittella	Daphoenositta chrysoptera	1.3	Yes	Edit
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	2.2	Yes	Edit

2.2.5 Threatened species credit species

The following species were returned by the BCC as requiring survey. The table below states whether each species was detected during surveys and furthermore, if they are expected to be impacted by the proposal and therefore are required to be offset.

Species returned by the calculator

Golden Sun Moth

Only the Golden Sun Moth was returned by the calculator and considered likely to be adversely impacted by the development. Impact was determined as all 'excellent, good and moderate' quality modelled habitat (>25% wallaby grass), as recorded in the Biodiversity Addendum (NGH Environmental 2016). This equates to 66.94 ha of potential habitat.

It is noted that surveys for this species have not covered all proposed impact areas. Survey areas for this species across the broader site total 567 ha. To determine an estimate of the proportion of surveyed areas occupied by the species, survey (known) records were buffered by 200m to define known habitat. On this basis, approximately 315 ha of known habitat occurs within the site boundaries. This equates to approximately 55% of the area surveyed having known habitat. Therefore, offsetting 100% of modelled habitat is likely to be a large overestimate.

Additional species

It is noted that several wide ranging could be expected to occur onsite at some time. Careful consideration however, considering their range and the habitat values within the development footprint, deemed these species unlikely to be adversely impacted by the development.

Species not returned by the calculator, but considered to be impacted

It is noted that additional species not returned by the calculator are known to occur onsite:

Superb Parrot

This species was not returned by the calculator as requiring survey however, it is understood that offsets for this species are expected by OEH. As such, it has been added to Table 2-8 and will generate offsets. Impact areas have been determined as all moderate and good condition Box Gum Woodland (using the NGH Environmental condition classes in the Biodiversity Addendum, not biometric condition classes), which equates to 10.2 ha. This excludes grasslands derived from this community.

Striped Legless Lizard

This species was not returned by the calculator as requiring survey however, it is understood that offsets for this species are expected by OEH. As such, it has been added to Table 2-8 and will generate offsets. Impact areas include all 'excellent – good' quality habitat, as recorded in the Biodiversity Addendum. This equates to 39.04 ha. Impacts to known habitat were determined in consultation with OEH (Rod Pietsch – Senior Threatened Species Officer pers. comm. 13.10.2015) and constitute 10.5 ha of the mapped 18.67 ha which is contiguous with the single known record for the project site.

Woodland birds

Several threatened woodland birds were recorded onsite, in Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest. These include the ecosystem credit species: Painted Honeyeater, Diamond Fire Tail and Flame Robin. These species have been assumed by the assessment to occur and do not generate species credits. However, as areas of this non EEC vegetation are confirmed threatened species habitat, under the FBA rules, offsets are required. In our conclusion we have considered that all Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest may be required to be offset and considered the candidate offset sites accordingly.

Table 2-8 Threatened species requiring survey

Common name	Scientific name	Impact?	Id method	Loss	Unit	Survey date	TS offset multiplier	Comment
Booroolong Frog	*Litoria booroolongensis*	No	Survey	0.00	ha	2013	1.3	Surveys completed for this species. Not detected, no impact.
Brush-tailed Phascogale	*Phascogale tapoatafa*	No	Survey	0.00	ha	2013	2.0	Surveys completed for this species. Not detected, no impact.
Eastern Pygmy-possum	*Cercartetus nanus*	No	Survey	0.00	ha	2013	2.0	Surveys completed for this species. Not detected, no impact.
Superb Parrot	*Polytelis swainsonii*	Yes	Survey	10.2	ha	2014	1.8	Surveys completed for this species. Detected onsite and will be impacted.
Striped Legless Lizard	*Delma impar*	Yes	Survey	39.04	ha	2014	1	Surveys completed for this species. Detected onsite and will be impacted.
Golden Sun Moth	*Synemon plana*	Yes	Survey	66.94	ha	2014	7.7	Surveys completed for this species. Detected onsite and will be impacted.
Hoary Sunray	*Leucochrysum albicans subsp. tricolor*	No	Survey	0.00	indiv.	2013	0.6	Surveys completed for this species. Not detected, no impact.
Koala	*Phascolarctos cinereus*	No	Survey	0.00	ha	2013	2.6	Surveys completed for this species. Not detected, no impact.
Narrow Goodenia	*Goodenia macbarronii*	No	Survey	0.00	indiv.	2013	1.3	Surveys completed for this species. Not detected, no impact.
Regent Honeyeater	*Anthochaera phrygia*	No	Survey	0.00	ha	2013	7.7	Surveys completed for this species. Not detected, no impact.
Rosenberg's Goanna	*Varanus rosenbergi*	No	Survey	0.00	ha	2013	3.3	Surveys completed for this species. Not detected, no impact.
Small Purple-pea	*Swainsona recta*	No	Survey	0.00	indiv.	2013	2.6	Surveys completed for this species. Not detected, no impact.
Small Scurf-pea	*Cullen parvum*	No	Survey	0.00	indiv.	2013	7.7	Surveys completed for this species. Not detected, no impact.
Squirrel Glider	*Petaurus norfolcensis*	No	Survey	0.00	ha	2013	2.2	Surveys completed for this species. Not detected, no impact.
Tarengo Leek Orchid	*Prasophyllum petilum*	No	Survey	0.00	indiv.	2013	1.3	Surveys completed for this species. Not detected, no impact.
Yass Daisy	*Ammobium craspedioides*	No	Survey	0.00	indiv.	2013	2.1	Surveys completed for this species. Not detected, no impact.

2.3 RESULTS: OFFSET REQUIREMENT

The following ecosystem and threatened species credits have been returned by the assessment. The full offset profile generated by the BCC is provided in Appendix B.

Ecosystem credits

PC type code	Plant community type name	Management zone area (ha)	Loss in Landscape Value	Loss in site value score	EEC Offset Multiplier	Credits req. for TS	TS with highest credit req.	TS offset multiplier	Ecosystem credits required
LA102	Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion	0.4	15.00	100.00	3.0	32	Barking Owl	3.0	**32**
LA120	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	24.9	15.00	100.00	3.0	1961	Barking Owl	3.0	**1961**
LA124	Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	2.80	15.00	100.00	1.0	220	Barking Owl	3.0	**220**
LA120	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	25.3	15.00	52.00	3.0	1082	Barking Owl	3.0	**1082**
LA182	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	71.6	15.00	53.12	1.0	3121	Barking Owl	3.0	**3121**
LA182	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	84.90	15.00	100.00	1.0	6686	Barking Owl	3.0	**6686**
LA182	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	29.60	15.00	84.38	1.0	1984	Barking Owl	3.0	**1984**

Species credits

Scientific name	Common name	TS offset multiplier	Species credits required
Synemon plana	Golden Sun Moth	7.7	5154
Delma impar	Striped Legless Lizard	1.0	390
Polytelis swainsonii	Superb Parrot	1.8	184

It is noted that, as the development is being assessed under the FBA rules, red flags and offsets of non-EEC vegetation (where confirmed that his does not contain threatened species habitat) are not required. Under these provisions then, the offset requirement for the project is reduced to:

EECs:

- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, including derived grasslands
  3,043 credits

Threatened species:

- Golden Sun Moth 5154 credits
- Striped Legless Lizard 390 credits
- Superb Parrot 184 credits

Additional:

As stated earlier, we recommend that the Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest also be considered for offsetting; 84.9 ha would be impacted. This excludes the shrubby form (Sifton bush dominated) of this vegetation type.

- 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
  6,686 credits

Additionally, it is noted that a supplementary offset will be required for hollow bearing trees. Impacts to hollow bearing trees have been quantified in the Biodiversity Addendum.

OEH have indicated that a 1:1 offset (hollow bearing trees to be removed : hollow bearing trees verified to occur within the offset lands) is insufficient. A suitable offset ratio, higher than 1:1, will be determined in consultation with OEH. Extrapolation of field data for the offset candidate sites considered in Section 3 estimated 4384 hollow-bearing trees to be present in the combined offset area (refer to Table 4-3).

3 STAGING: PROPORTIONAL CREDIT REQUIREMENT

Three theoretical precincts have been defined to account for a staged development; Northern, Central and Southern (refer to mapping in Appendix C). If the project were developed in stages, there would be an argument to post pone the offsetting requirement of each stage until that stage was progressed to construction. For example, the construction of the Northern Precinct alone, represents approximately one third of the offset requirement. To understand the differing offset requirements of the Northern, Central and Southern Precinct, the proportional project impact on vegetation communities and species habitat was evaluated.

The evaluation is presented in Appendix C and summarised below.

3.1 NORTHERN PRECINCT

Construction of the Northern Precinct would impact the most Apple Argyle Forest (100%), Native pasture (52%) and Sifton Bush Shrubland (88%) and a high proportion of Box-Gum Woodland (woodland formation; 43%).

Dividing the credit requirement between precincts on the basis of the area that would be impacted at each precinct, the credit profile for this precinct is:

EECs:

- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, including derived grasslands
  1,070 credits

Threatened species:

- Golden Sun Moth 2,437.95 credits
- Striped Legless Lizard 183.13 credits
- Superb Parrot 12.63 credits

Additional

Assuming the Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest were also offset (excluding the shrub form / Sifton bush dominated areas):

- 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
  1,206.04 credits

3.2 CENTRAL PRECINCT

Construction of the Central Precinct would impact the most Brittle Gum Forest (91%) and Scribbly Gum Forest (53%) and a high proportion of Box-Gum Woodland (woodland formation; 48%).

Dividing the credit requirement between precincts on the basis of the area that would be impacted at each precinct, the credit profile for this precinct is:

EECs:

- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, including derived grasslands
  1,136.26 credits

Threatened species:

- Golden Sun Moth 680.67 credits
- Striped Legless Lizard 124.40 credits
- Superb Parrot 137.10 credits

Additional

Assuming the Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest were also offset (excluding the shrub form / Sifton bush dominated areas):

- 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
  3,564.78 credits

3.3 SOUTHERN PRECINCT

Construction of the Southern Precinct would impact the most Acacia scrub (83%) and Box-Gum Woodland derived grassland (60%).

Dividing the credit requirement between precincts on the basis of the area that would be impacted at each precinct, the credit profile for this precinct is:

EECs:

- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, including derived grasslands
  835.97 credits

Threatened species:

- Golden Sun Moth 2035.88 credits
- Striped Legless Lizard 82.47 credits
- Superb Parrot 34.27 credits

Additional

Assuming the Red Stringybark - Scribbly Gum - Red Box - Long-leaved Box shrub - tussock grass open forest were also offset (excluding the shrub form / Sifton bush dominated areas):

- 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
  2,017.18 credits

4 PRELIMINARY OFFSET EVALUATION

Based on the preliminary assessment of likely credit requirements in Section 2, seven candidate offset sites have been identified within the project site boundaries. This suite of sites may be expanded during the development of the final offset package for the site. The intention of this evaluation is to demonstrate that offsets are feasible and achievable for the project within the site boundaries.

4.1 CREDIT CONVERSION

The OEH 'credit converter' tool has been used to convert the credit requirements of the development into an estimate of the areas of each vegetation type and threatened species habitat needed to satisfy those credit requirements.

Table 4-1 Credit conversion: area estimated to achieve offset requirement

Entity requiring offsets	Credit requirement	Area of land required, as determined by the credit calculator
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	3,043 credits	327.2 hectares
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 (Sifton bush dominated areas excluded)	6,686 credits	718.9 hectares
Golden Sun Moth (known habitat, in native pasture and derived grasslands)	5,154 credits	1,116 hectares
Striped Legless Lizard (known habitat, in native pasture and derived grasslands)	390 credits	163 hectares
Superb Parrot (good to moderate[3] quality Blakely's Red Gum - Yellow Box grassy tall woodland, excluding derived grasslands)	184 credits	170 hectares

Note:

The requirements are not cumulative. That is, an area may concurrently satisfy the ecosystem and one or more threatened species requirements, subject to confirmation that the site provides suitable or known habitat, as the case may be.

[3] Using NGH Environmental condition classes, not biometric condition classes.

4.2 CANDIDATE OFFSET SITES

4.2.1 Evaluation

Seven candidate sites have been evaluated. An overview as well as a detailed breakdown of their attributes is provided below. The location of each site is mapped in Appendix A.

Table 4-2 Offset site overview

Site	Size (ha)	Vegetation	Threatened species	Landscape position / connectivity	Feasibility
1	578.3	Predominantly Blakely's Red Gum - Yellow Box grassy woodland and derived grassland.	Contains habitat for the Striped Legless Lizard and Golden Sun Moth	Provides a level of north-south connectivity for the north eastern area and appropriately minimises edge effects, consolidating existing remnant.	Lease agreements with involved landowners contain a provision that the land may be used as an offset for the project.
2	167.7	Predominantly Scribbly Gum forest.		Provides a level of north-south connectivity.	
3	348.2	Predominantly Blakely's Red Gum - Yellow Box grassy woodland and derived grassland.	Contains habitat for the Superb Parrot, Striped Legless Lizard and Golden Sun Moth	Provides a level of south- west connectivity.	
4	64.2	Predominantly Scribbly Gum forest.		Provides a level of east-west connectivity.	
5	94.8	Predominantly Scribbly Gum forest.		Provides a level of north-south connectivity.	
6	127.8	Predominantly Scribbly Gum forest.		Provides a level of east-west connectivity.	
7	38.7	Predominantly Scribbly Gum forest.		Provides a level of east-west connectivity.	
Total:	**1419.7**				

A detailed breakdown of the vegetation types and habitat for the threatened species requiring offsets, is provided in Table 4-3, set against the overall impact areas for each vegetation type and on relevant threatened species at the development site.

Table 4-3 Offset site detailed breakdown

	Permanent habitat loss within each class (ha)	Total of each type within the site boundary (ha)	Offset 1 (ha)	Offset 2 (ha)	Offset 3 (ha)	Offset 4 (ha)	Offset 5 (ha)	Offset 6 (ha)	Offset 7 (ha)	Total offsets (ha)	FBA offset requirement (using credit converter tool) (ha)
Vegetation types											
Acacia scrub	**1.3**	52.5			1.7					**1.7**	
Argyle Apple Forest	**0.4**	58.6								**0**	
Box-Gum Woodland (total)	**50.2**									**520.8**	**327.2**
Box-Gum Woodland (woodland)	**24.9**	1303.7	30.7	6.2	240					**276.9**	
Derived Grassland	**25.3**	1490.8	243.9							**243.9**	
Brittle Gum Forest	**2.8**	165.7								**0**	
Exotic pasture	**16.7**	1173								**0**	
Native pasture	**71.6**	3684	42.1	0.2	102.2			0.004	3.5	**148**	
Planted native vegetation	**0.2**	9.4								**0**	
Scribbly Gum Forest	**84.9**	3750.5	250.7	161.4	4.3	64.2	94.8	127.8	35.2	**738.3**	**718.9**
Sifton Bush Shrubland	**29.6**	2027.9	10.9							**10.9**	
Total	**257.7**	**13716.1**	**578.3**	**167.8**	**348.2**	**64.2**	**94.8**	**127.8**	**38.7**	**1419.7**	
Estimated number of trees assumed to be hollow bearing											
Total	**893**	**111284**	**0**	**1259**	**39**	**231**	**0**	**2032**	**823**	**4384**	
Striped Legless Lizard Habitat											
Total	**39.04**	**2411.2**	**42.1**	**3.5**	**348.1**	**0**	**0**	**0**	**3.5**	**397.2**	**163.0**
Golden Sun Moth Habitat											
Total	**66.94**	**3464.6**	**286**	**0.1**	**275.3**	**0**	**0**	**0**	**3.5**	**564.9**	**1116.0**
Superb Parrot Habitat											
Total	**10.2**	**1303.7**	**30.7**	**6.2**	**240**	**0**	**0**	**0**	**0**	**276.9**	**170.0**

FBA offset requirements

Considering the totals of all seven offset sites, in comparison to the areas estimated be required in Section 3.1, all entities required by be offset by the FBA can be fully offset within the seven sites as a whole, excluding the Golden Sun Moth.

As stated in Section 2.2.5, surveys to date (incomplete) for the Golden Sun Moth have detected it in approximately 55% of the areas surveyed considered suitable for it to occur. On this basis, offsetting 100% of modelled habitat is likely to be an overestimate. It is considered reasonable that a similar percentage may apply for remaining surveys to be undertaken. In this case:

- Impact areas for this species may be reduced by around 55%, totalling 36.8 ha of impact. Further, it is recognised that there is good ability to microsite infrastructure to avoid known habitat, once identified.
- Offset requirements would be reduced for this species by around 55% and would total approximately 613.8 ha.
- Additional areas of known habitat are likely to be identified in offset sites or nearby areas that could be included in the offset sites, during further surveys, to address the current shortfall of approximately 48.9 ha.

It is noted that not all threatened species habitat is confirmed. The figures above rely on vegetation type and condition to estimate habitat areas. Further surveys are required to confirm known habitat for the Golden Sun Moth.

Specifically for the Superb Parrot, vegetation condition at the offset sites is not available and the totals therefore include all conditions classes. This includes all Box-Gum Woodland 'woodland' vegetation but excludes 'derived grasslands' of this community. In this way the vegetation is assumed to be in moderate to good biometric condition, having sufficient overstorey to be within benchmark for this vegetation and is therefore considered habitat for the Superb Parrot.

Hollow bearing tree offsets

In addition to offsets required under the FBA, hollow bearing tree offsets are also expected by OEH for this project. Estimations of impact have determined 893 trees assumed to be hollow bearing may be impacted by the project. 4384 hollow-bearing trees are estimated to be present in the combined offset area. This results in an offset ratio of 1 : 4.6. The ratio should be discussed with OEH.

4.2.2 Consideration of staging

Considering the project may be developed in stages, an approximation of the proportion of offset area required for each precinct is provided, based on the percentage of the impact that occurs in each precinct (Box Gum Woodland and Box Gum Woodland derived grasslands are combined estimates):

Table 4-4 Offset area requirement by precinct

	Northern Precinct (ha)	Central Precinct (ha)	Southern Precinct (ha)
Box Gum Woodland (and derived grasslands)	104	107	112
Scribbly Gum Forest	128	377	213
Striped Legless Lizard Habitat	76	52	34
Golden Sun Moth Habitat	524	145	435
Superb Parrot Habitat	11	127	32

Note: areas are not cumulative. Refer to Section 4.1.

4.2.3 Final delineation of the offset package

Overlaps in credit requirements

As noted previously, the requirements are not cumulative. That is, an area may concurrently satisfy the ecosystem and one or more threatened species requirements, subject to confirmation that the site provides suitable or known habitat.

Overlaps have been identified in the requirements for the following entities:

- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion - derived grassland and Golden Sun Moth
- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion - derived grassland and Striped Legless Lizard
- Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion - woodland and Superb Parrot

The seven sites selected attempt to minimise overlaps as much as possible but there is a large surplus of Blakely's Red Gum - Yellow Box grassy tall woodland, due to the need to meet the larger Golden Sun Moth requirement, particularly.

Precautionary versus realistic outcomes

It is noted that while we have used a worst case scenario to estimate the offset requirements, the final offset areas will be based on post-construction validated impact areas. There are opportunities to reduce the impact areas in the final selection of track and transmission routes. There would be benefits of considering these route options in light of the key offset drivers: Golden Sun Moth and Superb Parrot habitat (higher offset ratios), as well as other impact area reductions that can be made.

Use of actual rather than benchmark plot data is likely to reduce the credit requirement somewhat as not all parameters of the vegetation to be impacted would be within benchmark. However, as habitat is in relatively good conditions, substantial reduction in the credit requirement based on actual plot data is not considered likely.

All Red Stringybark – Scribbly Gum – Red Box – Long-leaved Box shrub – tussock grass open forest has been considered threatened species habitat in this assessment, as ecosystem credit species known to be onsite were returned by the calculator for this vegetation. The requirement to offset this vegetation should be

discussed with OEH. It is a large component of the offset package and if a subset of the area was deemed unlikely to be habitat for these species, it would directly reduce the offset requirement.

It is noted that seven distinct offset sites complicate management actions and introduce additional 'edge effects' to vegetation managed at the offset sites. An ideal outcome would be to achieve the offset requirements in as few sites as possible, minimising the perimeter. This should be considered in formulating the final offset package.

4.3 COMMONWEALTH OFFSET REQUIREMENTS

Commonwealth offsets are not considered specifically in this assessment. It is noted that all vegetation communities and threatened species that could be impacted significantly and therefore required to be offset under the Commonwealth requirements are already included in the NSW assessment. It is further noted that the NSW offset requirements are usually more onerous than the Commonwealth requirements and therefore, as a preliminary assessment, Commonwealth offset requirements (if needed) are similarly expected to be able to be offset.

4.4 CONFIDENCE LEVEL OF MEETING THE OFFSET REQUIREMENT

Based on the investigations and assessment carried out on the project site, there is a high level of confidence that suitable offsets are available within the site boundaries or on land immediately adjacent to the site which is owned by involved landowners. Key factors contributing to this confidence include:

- Since 2013, a very broad survey coverage has been achieved. The surveyed land surrounding the impact areas provide similar habitat types and values as those that would be impacted. This is verified by on ground survey and site inspections. These areas are therefore well placed to provide a 'like for like' offset.
- A substantial amount of area is available from which to select the most suitable offset sites. While not all of the land within the project boundaries is available or suitable for offsets, by way of indication the area of land impacted by wind farm infrastructure is approximately 2.1% of the land included within the project boundaries.
- The project has been developed to reflect biodiversity constraints identified throughout the assessment process and therefore, the areas adjacent to the impact zones but within the project boundaries are more likely to contain better habitat values, more appropriate to an offset site that will be managed for biodiversity outcomes in perpetuity. For example, where possible better quality areas of a connected forest vegetation and threatened species habitat have been largely avoided by infrastructure. These areas are available for the offset area.

6 ADDITIONAL MATTERS

6.1 IMPLEMENTATION OF THE OFFSETS

The offsets must account for the final impact on biodiversity values, not the estimated impact prior to construction. It is therefore a relatively complicated process to identify and secure the land at key stages of the projects detailed planning and construction phase. Most major projects require offset strategies and preliminary planning and mapping prior to construction, with the final detail of the offset plan to reflect the field validated post construction impacts.

The following stages of implementing the Offset Package are proposed. The aim is to set out a clear path to identifying, securing and managing suitable offset lands prior to any construction impact. After construction, a verification process (Audit) would demonstrate the actual impact areas. This would dictate the final requirement for the offset lands. Monitoring and management of the offset would be are required.

Post approval, pending detailed design

1. Determine final credit requirement for areas predicted to be impacted, in consultation with OEH.
2. Select the final suite of offset sites including accurate calculation of credits able to be retired at each candidate site.
3. Management planning for each offset site including:
    a. Establishment of baseline data.
    b. Documentation of key biodiversity threats and opportunities.
    c. Refinement of management strategies specific to each offset site.

After construction

4. Verification of actual post construction impact area.
5. Finalisation of offset requirement and resulting offset site boundaries.
6. Formalisation of security mechanism over each offset site.
    a. Annual monitoring and management to ensure ongoing biodiversity improvement at the offset sites for the life of the project.

6.2 PROPOSED SURVEY METHODOLOGIES AND ASSESSMENT

Methodologies in completing the Offset Plan would be developed in consultation with OEH. Specifically, this includes:

- A commitment to using OEH endorsed survey methods and offset calculation tools.
- A commitment to offsetting hollow bearing trees, supplementary to the calculations presented in Section 2 (the BCC credit calculations). It is noted that under the BCC, offsets are not required specifically for hollow-bearing trees. Plot data takes into account hollow bearing tree impacts however, no specific requirement results from the assessment. However, ensuring a sufficient ratio of offset hollows to impacted hollows in consultation with OEH is an additional commitment of this project.

6.3 PROPOSED SECURITY AND MANAGEMENT OF THE OFFSET SITE

6.3.1 How offsets will be secured

Offsets would be governed by conservation mechanisms to ensure long-term protection and management of the site, including funding arrangements.

The proponent commits to securing a formal vehicle to manage the offset site in perpetuity. It is understood that a number of options may be available including:

- A Conservation Property Vegetation Plan (CPVP), attached to the land title.
- Establishment of a Biobanking site (s)
- Payment into an offset fund.

The proponent commits to working with the DPE and OEH to find a suitable security mechanism for the project.

6.3.2 How offsets will be managed

Management responsibility will be dependent on the security mechanism. Generally however, it is proposed that the wind farm owner (which may be different to the current proponent) would be responsible for the management of the offset sites, during the operational life of the wind farm. The wind farm owner finances the offset site landowner to undertake management actions (such as fencing and weed control) but would retain responsibility for the management of the site. This provides surety that the actions will be undertaken, as the requirement to offset would be a condition of the wind farm owner's operational consent and subject to auditing and reporting processes under that approval.

At the decommissioning stage, the ongoing management would be the responsibility of the landowner. It is expected that by this time the majority of the required management actions would have been undertaken and ongoing management tasks will largely coincide with routine agricultural activities. Land use restrictions will remain in place on the offset site in perpetuity so that any activities undertaken on the offset site must be compatible with the site's overall function: to improve biodiversity values.

During operation and post operation, management measures would be developed with reference to the Biobanking Management Plan template and with input from the LLS and OEH. Examples of likely measures are included below.

Example offset site management measures

Management measure	Objective	Justification	Action	Timing
Exclusion of stock	To prevent overgrazing and encourage regeneration of native vegetation and maintenance of tussocks in grasslands.	Grazing would be likely to degrade habitat.	• Install stock proof fencing around the perimeter of the Offset Site.	• At establishment of the Offset Site. • Ongoing repairs as required.
Weed control	To minimise the occurrence of weeds within the Offset Site particularly Weeds of National Significance (WoNS) and listed noxious weeds.	Weeds compete with native species and degrade habitats.	• Survey to identify target locations for weed control. • Weed control using appropriate methodologies considering target species and landscape context.	• At establishment of the Offset Site. • Ongoing as required.
Planting trees in pasture	To enhance connectivity in secondary grasslands.	Recruitment of trees and retention of mature trees is a threat to many species. Planting would provide greater connectivity and potential for hollows in the long term. In turn, it would also increase tree numbers through natural recruitment.	• Plant tube stock trees, appropriate to the vegetation type, in native pasture and derived grasslands • Placement to consider strategic connectivity.	• At establishment of the Offset Site.

Management measure	Objective	Justification	Action	Timing
Feral animal control	To minimise the risk of the Offset Site becoming a refuge for feral animals.	Feral animals can reduce native vegetation quality, compete with native fauna for resources and/or prey on native fauna.	• Monitor for presence of feral animals. • Conduct control appropriate to the feral animal species detected during monitoring. • Where possible, coordinate control efforts with adjacent landowners to maximise effects	• Consideration given to action on the basis of monitoring results.

7 CONCLUSION

Subject to final design and surveys, based on the investigations and assessment carried out on the project site, there is a high level of confidence that suitable offsets are available within the site boundaries.

Considering all seven offset sites together, all entities except for the Golden Sun Moth can be fully offset. Surveys for this species are not complete. Surveys to date indicate that:

- Impact areas for this species may be reduced by around 55%, pending the results of further surveys. Further, it is recognised that there is good ability to microsite infrastructure to avoid known habitat, once identified.
- Offset requirements would therefore also be reduced for this species by around 55%.
- Additional areas of known habitat are likely to be identified in offset sites or nearby areas that could be included in the offset sites, during further surveys, to address the current shortfall of approximately 48.9 ha.

An implementation plan has been provided to ensure that that actual impact areas are offset in accordance with OEH endorsed survey methods and tools.

It is understood that several management options may be considered for transitional major project offsets and the proponent commits to working with the DPE and OEH to find a suitable security mechanism for the project. Monitoring and management of offsets is required. Timing, mechanisms and example measures have also been included in this plan.

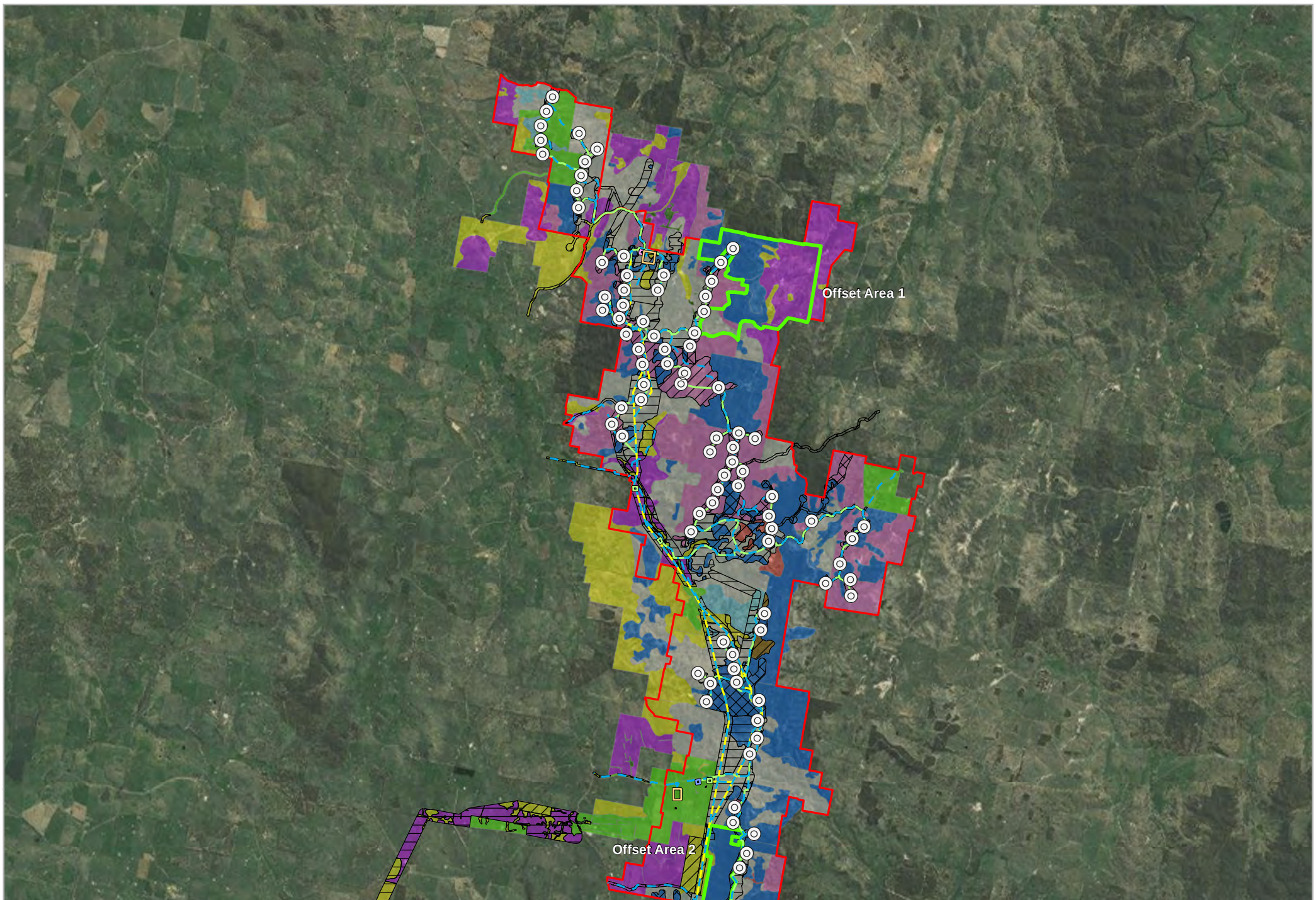
8 REFERENCES

NGH Environmental 2016. Biodiversity Addendum of the Rye Park Wind Farm. Report prepared for Epuron, March, 2016.

NGH Environmental 2014. Biodiversity Assessment of the Rye Park Wind Farm. Report prepared for Epuron, January, 2014.

Office of Environment and Heritage 2014. Framework for Biodiversity Assessment; NSW Biodiversity Offsets Policy for Major Projects, September 2014.

APPENDIX A CANDIDATE OFFSET SITES (7)



PROPOSED OFFSET AREAS INDEX MAP

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Proposed offset area

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Vegetation Type

- Acacia scrub
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

Vegetation Condition

- Good
- Moderate
- Poor

0 1 2 3
Kilometers

A3 @ 1:125,000
Date: 1/04/2016
Author: VR

EPURON
www.epuron.com.au

APPENDIX B OFFSET REQUIREMENT CREDIT PROFILE

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 24/03/2016 Time: 9:48:12AM Calculator version: v4.0

Major Project details

Proposal ID:	144/2015/2070D
Proposal name:	Rye Park Wind Farm Development
Proposal address:	Rye Park - Dalton Road Rye Park NSW 2586
Proponent name:	Epuron
Proponent address:	Level 11 75 Miller Street North Sydney NSW 2060
Proponent phone:	02 84567406
Assessor name:	Brooke Marshall
Assessor address:	1/216 Carp St Bega NSW 2250
Assessor phone:	64928333
Assessor accreditation:	0035

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion	0.40	32.00
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	50.20	3,043.00
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion	2.80	220.00
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	186.10	11,791.00
Total	239.50	15,086

Credit profiles

1. Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (LA120)

Number of ecosystem credits created	3,043
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion, (LA120) White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (LA219) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (LA145) Red Box - White Box +/- Red Stringybark hill woodland in the NSW South Western Slopes Bioregion, (LA252)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. 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, (LA182)

Number of ecosystem credits created	11,791
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
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, (LA182) Red Stringybark - White Box grassy open forest of the NSW South Western Slopes Bioregion, (LA183) Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest on hills in the upper slopes sub-region of the NSW South Western Slopes Bioregion, (LA247) Blakely's Red Gum - Red Stringybark - Long-leaved Box woodland on Wyangala Granite in the NSW South Western Slopes Bioregion, (LA231) Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments of the Wyangala Dam region, NSW South Western Slopes Bioregion, (LA268) Red Stringybark - red gum - Black Cypress Pine - Kunzea - tea tree shrubby open forest on granite ranges of the Boorowa - Wyangala region, NSW South Western Slopes Bioregion, (LA259) Mugga Ironbark - mixed box woodland on hills in the Cowra - Boorowa - Young region of the NSW South Western Slopes Bioregion, (LA248) Inland Scribbly Gum - Red Stringybark - box - Daviesia latifolia - snow grass open forest on sandy loam soils from acid volcanics in the Boorowa - Young region of the NSW South Western Slopes Bioregio, (LA241)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion, (LA102)

Number of ecosystem credits created	32
IBRA sub-region	Upper Slopes - Lachlan

Offset options - Plant Community types	Offset options - IBRA sub-regions
Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion, (LA102) Blakely's Red Gum - Red Stringybark open forest on slopes and hills of the western slopes, (LA117) Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion, (LA125) Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion, (LA234) Red Stringybark - Blakely's Red Gum hillslope open forest on meta-sediments in the Yass - Boorowa - Crookwell region of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion, (LA255)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion, (LA124)

Number of ecosystem credits created	220
IBRA sub-region	Upper Slopes - Lachlan

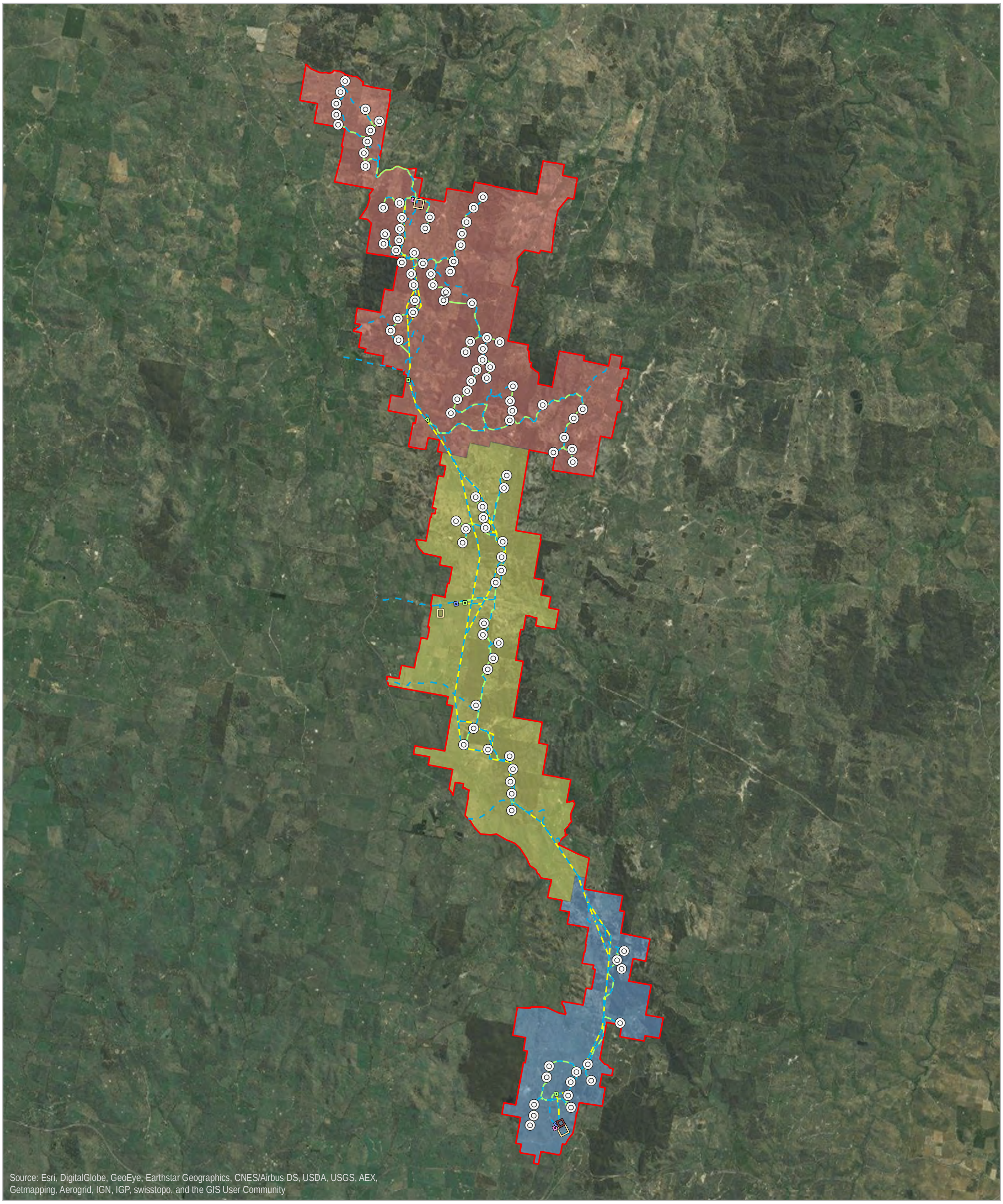
Offset options - Plant Community types	Offset options - IBRA sub-regions
Broad-leaved Peppermint - Brittle Gum - Red Stringybark dry open forest on the South Eastern Highlands Bioregion, (LA124) Apple Box - Broad-leaved Peppermint dry open forest of the South Eastern Highlands Bioregion, (LA101) Apple Box - Yellow Box - Argyle Apple dry open forest of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion, (LA102) Blakely's Red Gum - Red Stringybark open forest on slopes and hills of the western slopes, (LA117) Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion, (LA125) Mugga Ironbark - Red Stringybark - Long-leaved Box dry grass forest of the NSW South Western Slopes Bioregion, (LA167) Red Box - Tumbledown Gum - Red Stringybark - Long-leaved Box dry woodland, upper NSW South Western Slopes Bioregion, (LA251) Inland Scribbly Gum - Red Stringybark open forest on hills composed of silicous substrates in the mid-Murrumbidgee and upper Lachlan catchments mainly in the western South Eastern Highlands Bioregion, (LA242) Brittle Gum - Broad-leaved Peppermint - Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion, (LA234) Red Stringybark - Blakely's Red Gum hillslope open forest on meta-sediments in the Yass - Boorowa - Crookwell region of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion, (LA255)	Upper Slopes - Lachlan and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Striped Legless Lizard	Delma impar	39.04	390
Golden Sun Moth	Synemon plana	66.94	5,154
Superb Parrot	Polytelis swainsonii	10.20	184

APPENDIX C PRECINCT OFFSET REQUIREMENT ESTIMATES

C.1 PRECINCT BOUNDARIES; NORTHERN, CENTRAL AND SOUTHERN



PROPOSED OFFSET PRECINCTS

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Northern precinct
- Central precinct
- Southern precinct

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 1.5 3 4.5
Kilometers

A3 @ 1:125,000
Date: 9/03/2016
Author: VR

EPURON

www.epuron.com.au

C.2 VEGETATION IMPACTS BY PRECINCT

Project credit requirement	Vegetation types	Total all precincts (ha)
na	Acacia scrub	**1.3**
32.0	Argyle Apple Forest	**0.4**
1961.0	Box-Gum Woodland	**24.9**
1082.0	Derived Grassland	**25.3**
220.0	Brittle Gum Forest	**2.8**
na	Exotic pasture	**16.7**
3121.0	Native pasture	**71.6**
na	Planted native vegetation	**0.2**
6788.0	Scribbly Gum Forest	**84.9**
1803.0	Sifton Bush Shrubland	**29.6**
	Totals	**256.8**

		North Precinct						
Project credit requirement	**Vegetation types**	**G**	**M**	**P**	**U**	**Total (ha)**	**% in precinct**	**Proportional credit requirement**
na	Acacia scrub	0.0	0.0	0.0	0.0	0.0	0%	
32.0	Argyle Apple Forest	0.0	0.4	0.0	0.0	0.4	100%	32.00
1961.0	Box-Gum Woodland	0.0	0.7	9.9	0.0	10.7	43%	840.24
1082.0	Derived Grassland	0.0	0.6	4.8	0.0	5.4	21%	230.53
220.0	Brittle Gum Forest	0.0	0.0	0.2	0.0	0.2	9%	19.20
na	Exotic pasture	0.0	0.0	0.0	5.3	5.3	34%	
3121.0	Native pasture	1.8	8.9	26.2	0.1	36.9	52%	1609.10
na	Planted native vegetation	0.0	0.0	0.0	0.2	0.2	100%	
6788.0	Scribbly Gum Forest	5.1	4.8	5.2	0.0	15.1	18%	1206.04
1803.0	Sifton Bush Shrubland	12.7	13.1	0.0	0.4	26.2	88%	1594.54
	Totals	**19.5**	**28.5**	**46.4**	**6.0**	**100.4**		0.00

G = Good, M= Moderate, P=Poor, U= Unknown hectares of vegetation

		Central Precinct						
Project credit requirement	**Vegetation types**	**G**	**M**	**P**	**U**	**Total (ha)**	**% in precinct**	**Proportional credit requirement**
na	Acacia scrub	0.0	0.2	0.0	0.0	0.2	17%	
32.0	Argyle Apple Forest	0.0	0.0	0.0	0.0	0.0	0%	0.00
1961.0	Box-Gum Woodland	0.0	7.6	4.3	0.0	11.9	48%	937.01
1082.0	Derived Grassland	0.0	2.4	2.3	0.0	4.7	18%	199.25
220.0	Brittle Gum Forest	0.0	0.0	2.5	0.0	2.5	91%	200.80
na	Exotic pasture	0.0	0.0	0.0	10.3	10.3	65%	
3121.0	Native pasture	0.0	4.2	16.8	0.0	20.9	29%	912.52
na	Planted native vegetation	0.0	0.0	0.0	0.0	0.0	0%	
6788.0	Scribbly Gum Forest	26.2	9.3	8.7	0.3	44.6	53%	3564.78
1803.0	Sifton Bush Shrubland	0.1	0.2	0.0	0.0	0.3	1%	18.37
	Totals	**26.3**	**23.9**	**34.6**	**10.7**	**95.4**		0.00

		South Precinct						
Project credit requirement	**Vegetation types**	**G**	**M**	**P**	**U**	**Total (ha)**	**% in precinct**	**Proportional credit requirement**
na	Acacia scrub	1.1	0.0	0.0	0.0	1.1	83%	
32.0	Argyle Apple Forest	0.0	0.0	0.0	0.0	0.0	0%	0.00
1961.0	Box-Gum Woodland	1.9	0.0	0.4	0.0	2.3	9%	183.75
1082.0	Derived Grassland	0.0	0.0	15.3	0.0	15.3	60%	652.22
220.0	Brittle Gum Forest	0.0	0.0	0.0	0.0	0.0	0%	0.00
na	Exotic pasture	0.0	0.0	0.0	0.1	0.1	1%	
3121.0	Native pasture	0.0	5.9	7.9	0.0	13.7	19%	599.38
na	Planted native vegetation	0.0	0.0	0.0	0.0	0.0	0%	
6788.0	Scribbly Gum Forest	8.2	10.4	6.6	0.0	25.2	30%	2017.18
1803.0	Sifton Bush Shrubland	1.6	1.2	0.4	0.0	3.1	11%	190.08
	Totals	**12.8**	**17.5**	**30.5**	**0.1**	**60.9**		0.00

G = Good, M= Moderate, P=Poor, U= Unknown hectares of vegetation

C.3 THREATENED SPECIES IMPACTS BY PRECINCT

Striped Legless Lizard habitat quality	Area permanently impacted (ha) - Northern Precinct	Area permanently impacted (ha) - Central Precinct	Area permanently impacted (ha) - Southern Precinct	Total area permanently impacted (ha)	Area within site boundary (ha)	Area not impacted (ha)
Excellent	11.66	2.56	4.08	18.29	1,140.02	1,121.72
Good	6.67	9.90	4.17	20.74	1,271.23	1,250.49
Total	**18.33**	**12.45**	**8.25**	**39.04**	**2,411.25**	**2,372.21**
Proportion in each precinct	**47%**	**32%**	**21%**	**100%**		
Proportional credit requirement	**183.13**	**124.40**	**82.47**			
Total credit requirement for species	**390**					

Golden Sun Moth habitat (Wallaby Grass a	Area permanently impacted (ha) - Northern Precinct	Area permanently impacted (ha) - Central Precinct	Area permanently impacted (ha) - Southern Precinct	Total area permanently impacted (ha)	Area within site boundary (ha)	Area not impacted (ha)
Moderate (26%-50%)	20.21	1.35	4.69	26.24	1,613.54	1,587.29
Good (51%-75%)	11.46	7.49	4.26	23.21	1,570.26	1,547.05
Excellent (76%-100%)	0.00	0.00	17.48	17.48	280.84	263.35
Total	**31.66**	**8.84**	**26.44**	**66.94**	**3,464.64**	**3,397.70**
Proportion in each precinct	**47%**	**13%**	**39%**	**100%**		
Proportional credit requirement	**2437.95**	**680.67**	**2035.38**			
Total credit requirement for species	**5154**					

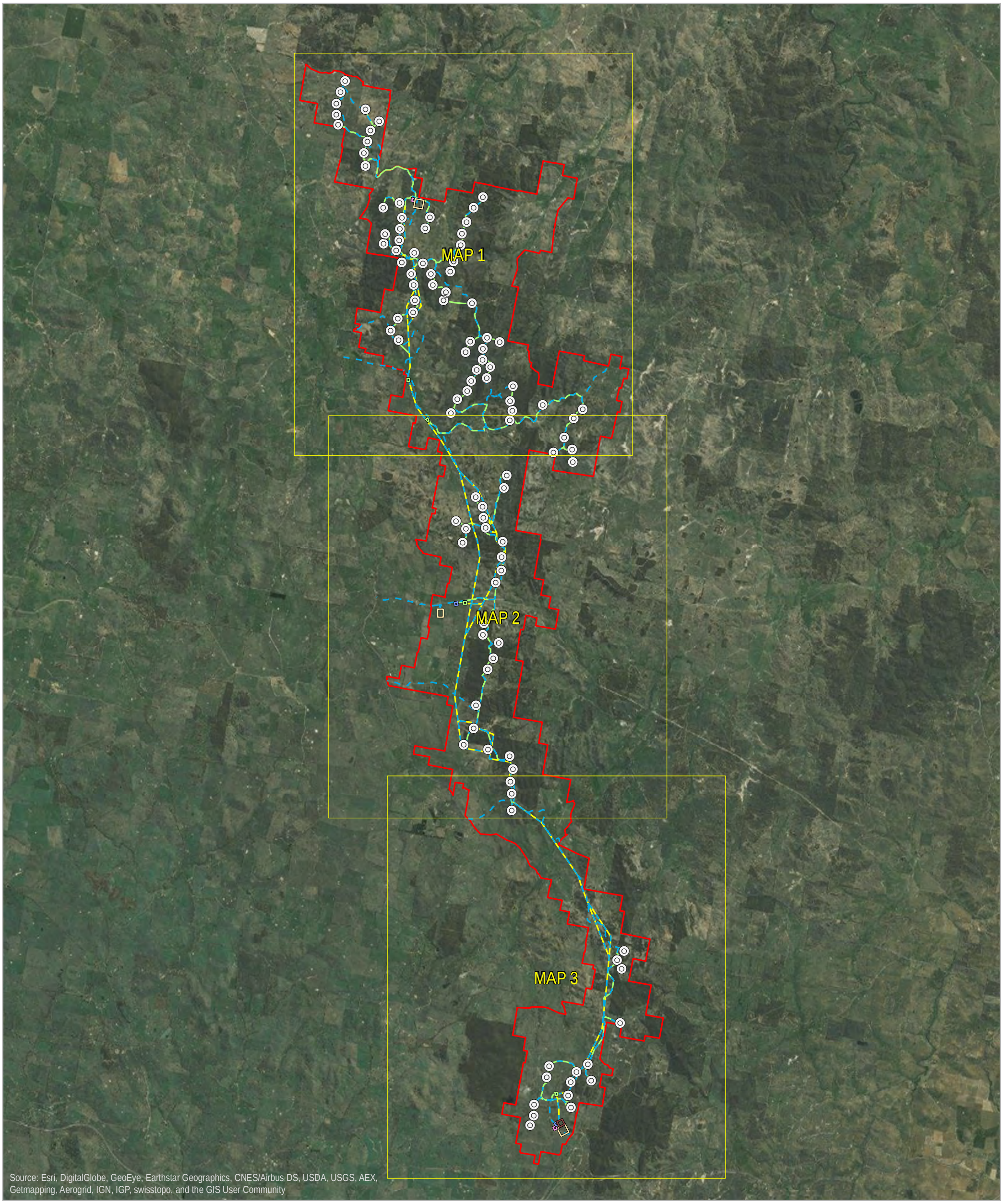
Superb Parrot habitat	Area permanently impacted (ha) - Northern Precinct	Area permanently impacted (ha) - Central Precinct	Area permanently impacted (ha) - Southern Precinct	Total area permanently impacted (ha)	Area within site boundary (ha)	
Box Gum Woodland moderate	0.70	7.60	0.00	8.30		
Box Gum Woodland good	0.00	0.00	1.90	1.90		
Total	**0.70**	**7.60**	**1.90**	**10.20**	**1,130.00**	
Proportion in each precinct	**7%**	**75%**	**19%**	**100%**		
Proportional credit requirement	**12.63**	**137.10**	**34.27**			
Total credit requirement for species	**184**					

APPENDIX E MAPS

Map within this Appendix are separated into the following components:

- E-1 Preferred project layout
- E-2 Comparison of the EA 2013 and preferred project layout
- E-3 Flora survey effort and results
- E-4 Box-Gum Woodland mapped according to OEH condition classes
- E-5 General fauna survey effort and results
- E-6 Superb Parrot survey effort and results
- E-7 Striped Legless Lizard and Golden Sun Moth habitat mapping with the preferred project layout
- E-8 Hollow-bearing tree survey effort and results
- E-9 Preferred project layout compared to the constraints identified in the original BA

E.1 PREFERRED PROJECT LAYOUT



PROPOSED INFRASTRUCTURE LAYOUT INDEX MAP

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

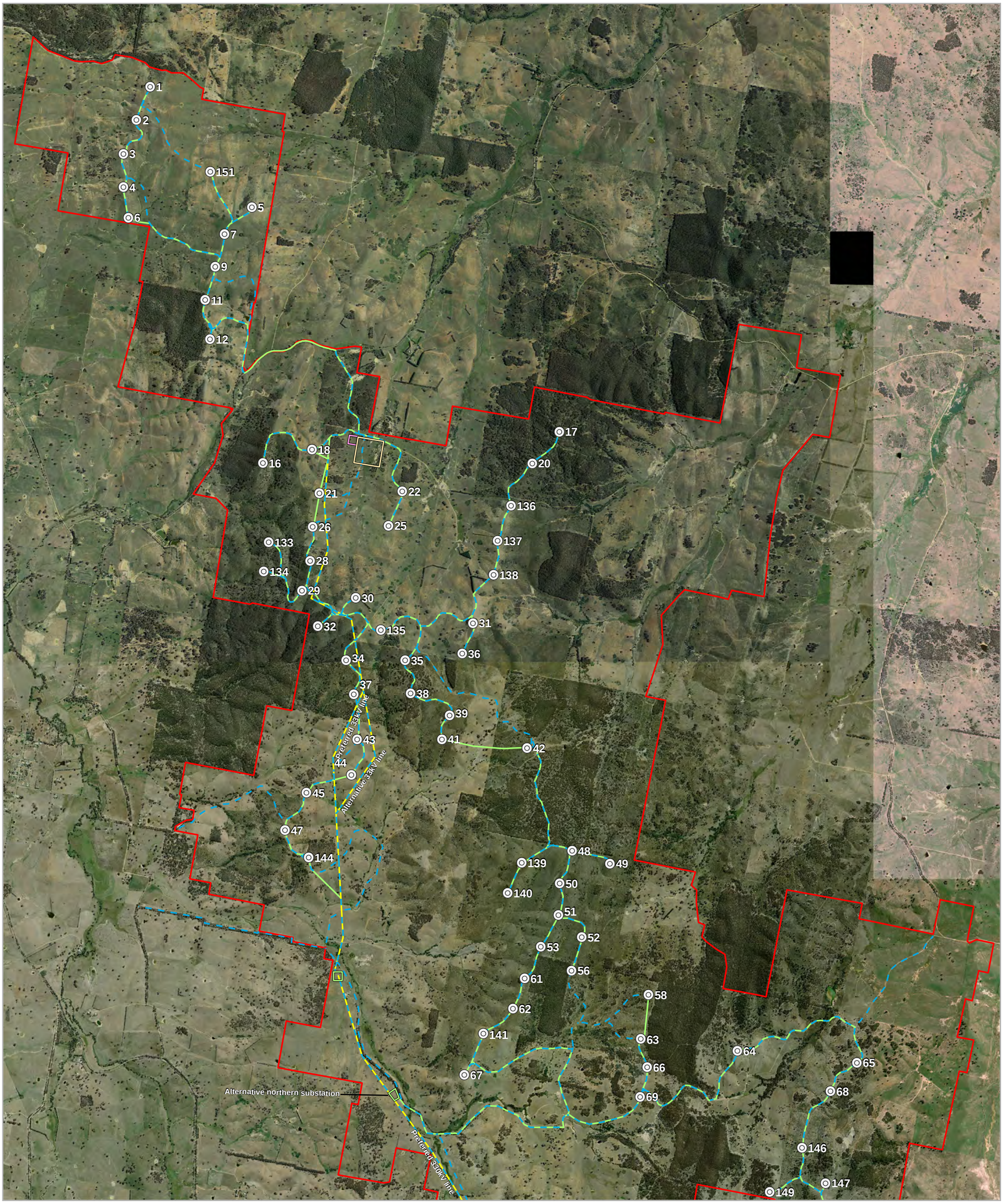
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 1.5 3 4.5
Kilometers

A3 @ 1:125,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au



PROPOSED INFRASTRUCTURE LAYOUT MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

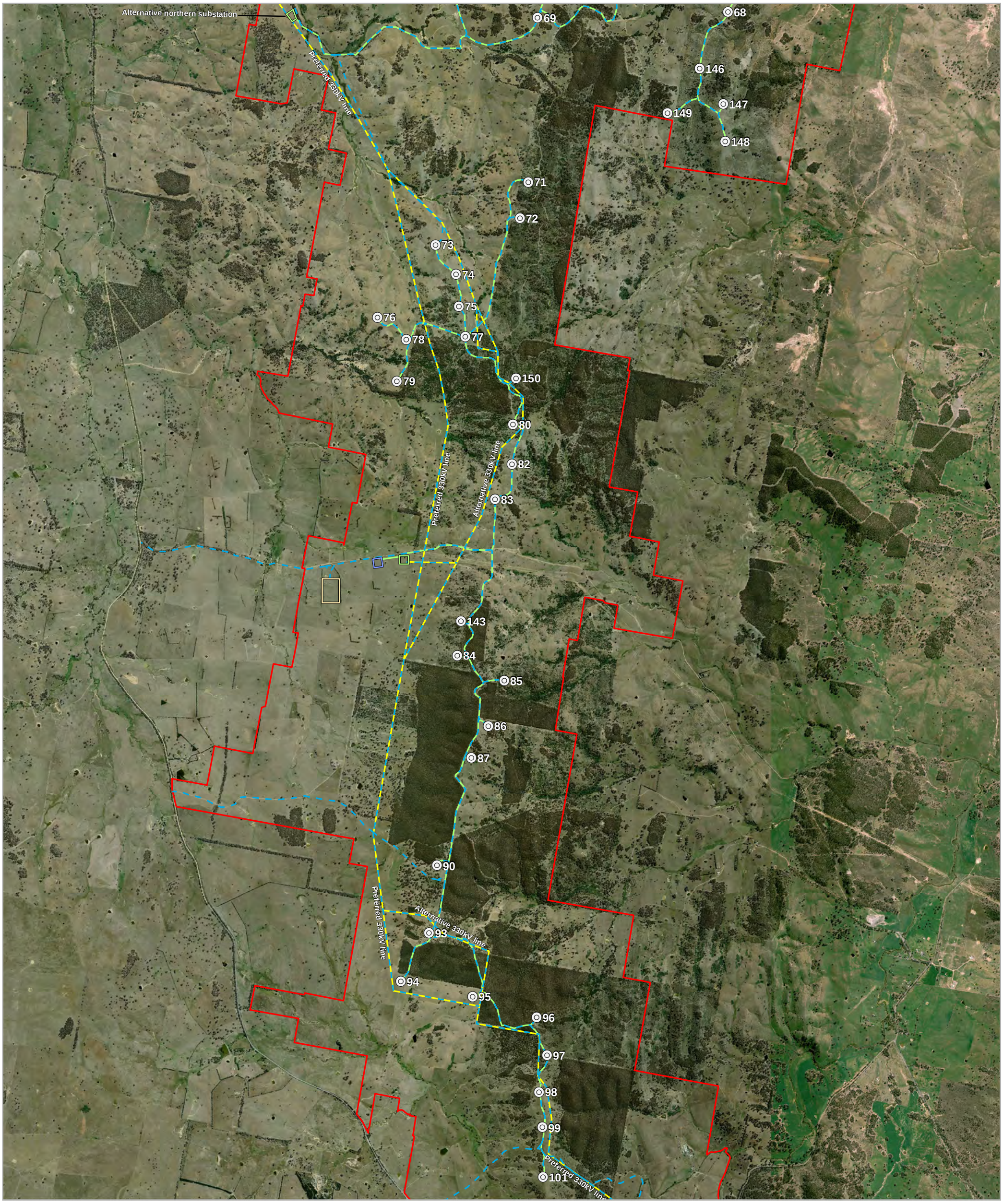
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au



PROPOSED INFRASTRUCTURE LAYOUT MAP 2

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

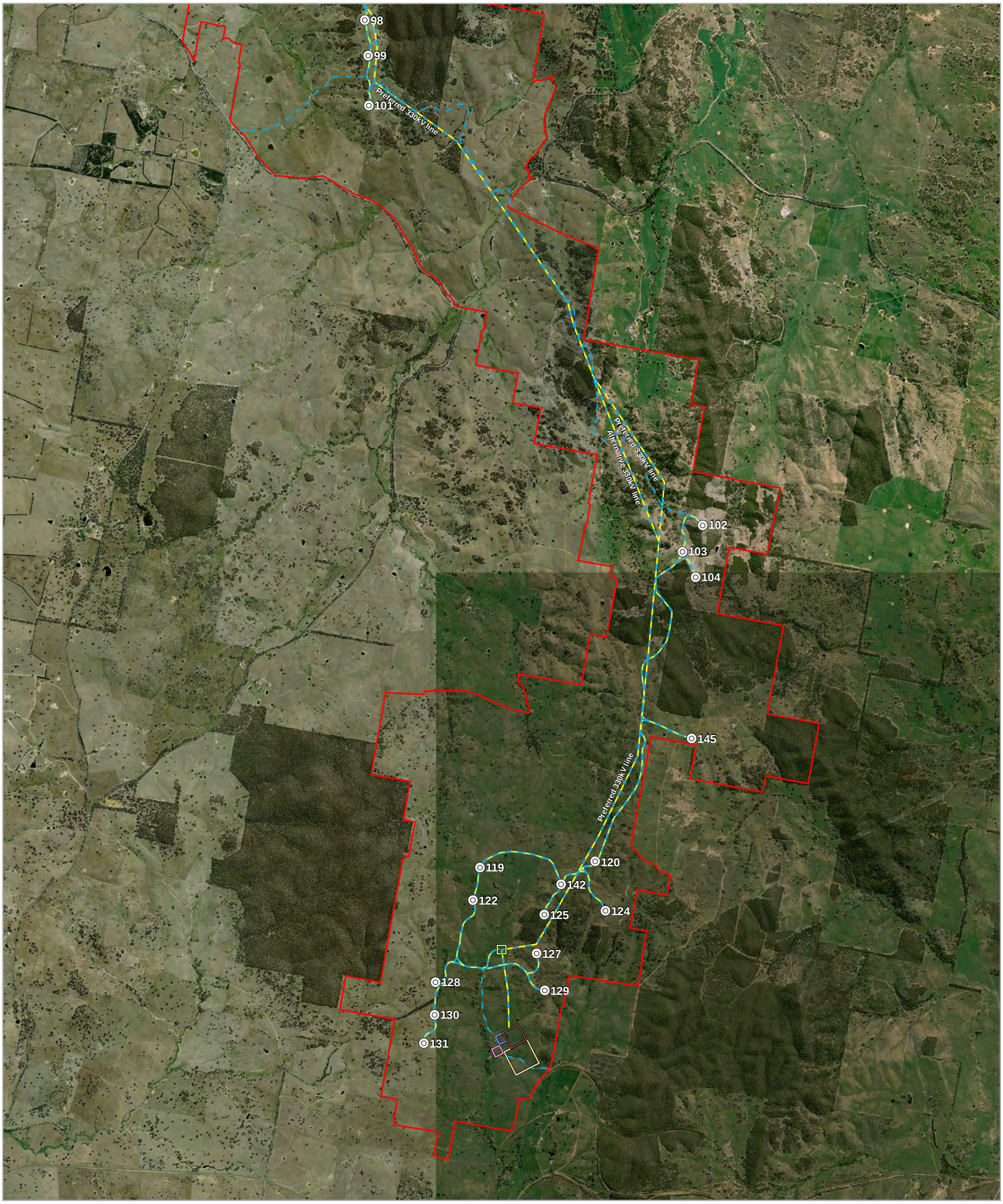
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au



PROPOSED INFRASTRUCTURE LAYOUT MAP 3

Rye Park Wind Farm Biodiversity Assessment

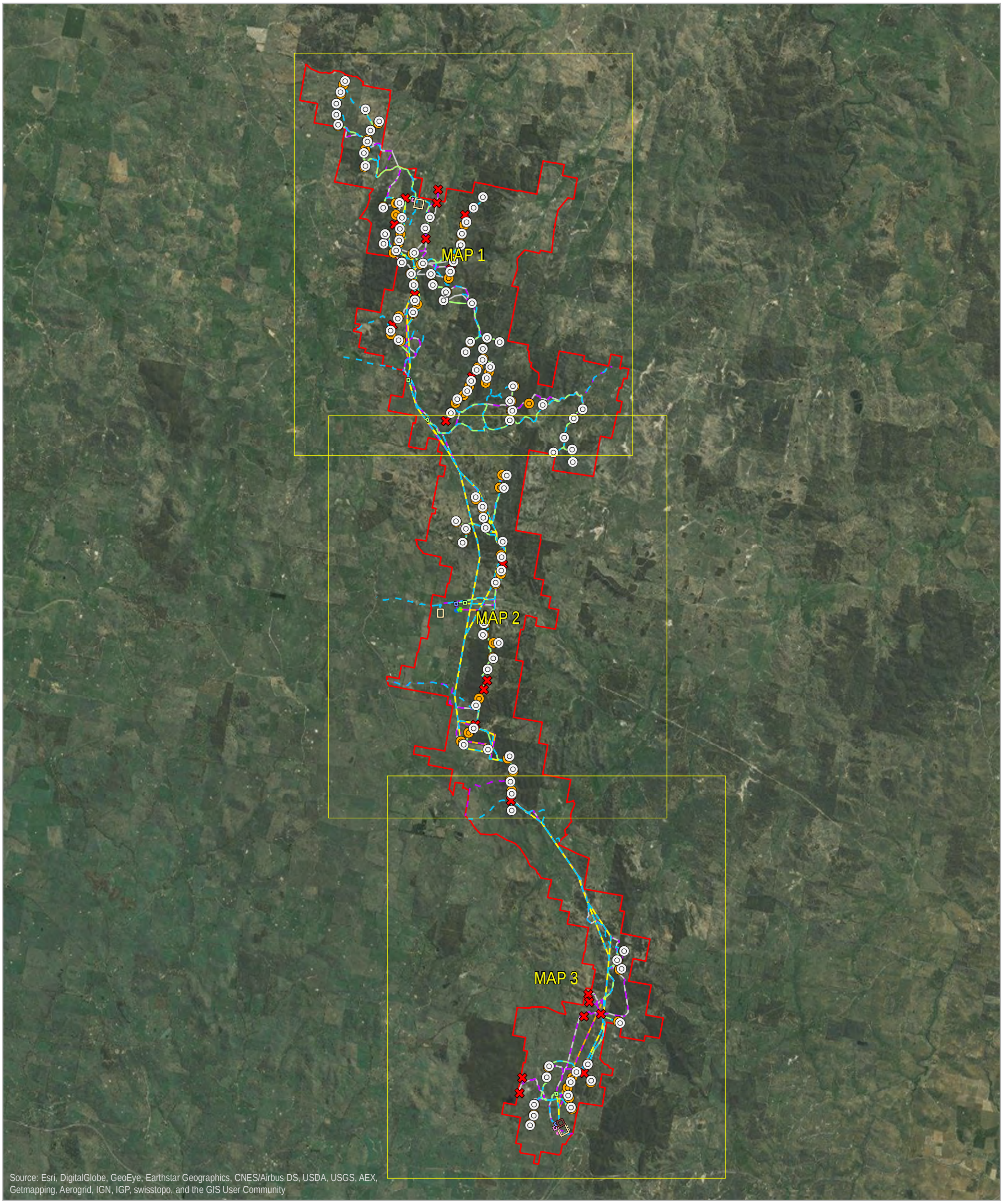
- Site perimeter
- Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

E.2 COMPARISON OF THE EA 2013 AND PREFERRED PROJECT LAYOUT



COMPARISON OF CURRENT & EA 2013 INFRASTRUCTURE INDEX MAP

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Current Layout
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

EA November '13 Layout
- Relocated turbine
- Removed turbine
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 1.5 3 4.5
Kilometers

A3 @ 1:125,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

COMPARISON OF CURRENT & EA 2013 INFRASTRUCTURE MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Current Layout

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

EA November '13 Layout

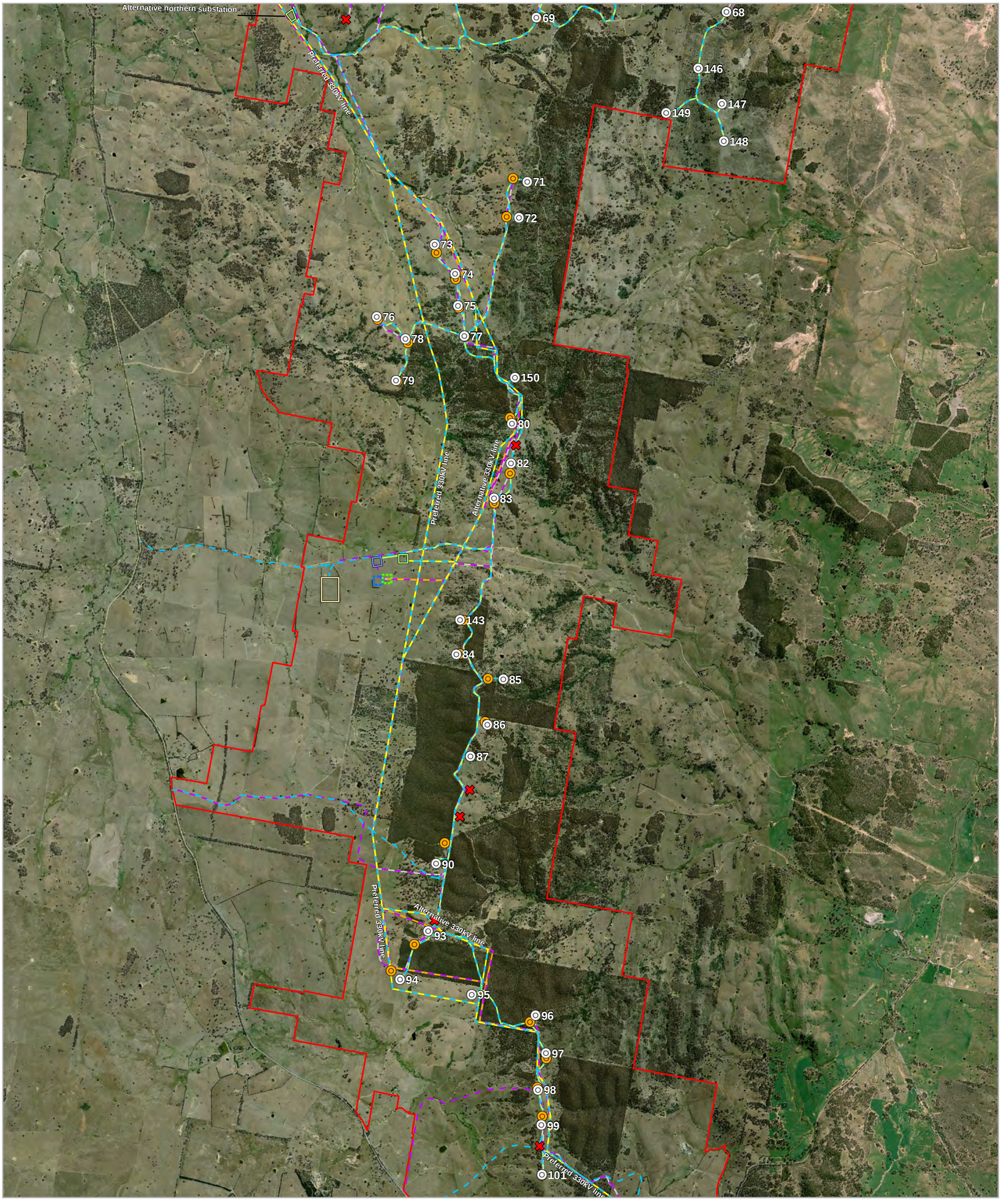
- Relocated turbine
- Removed turbine
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au



COMPARISON OF CURRENT & EA 2013 INFRASTRUCTURE MAP 2

Rye Park Wind Farm Biodiversity Assessment

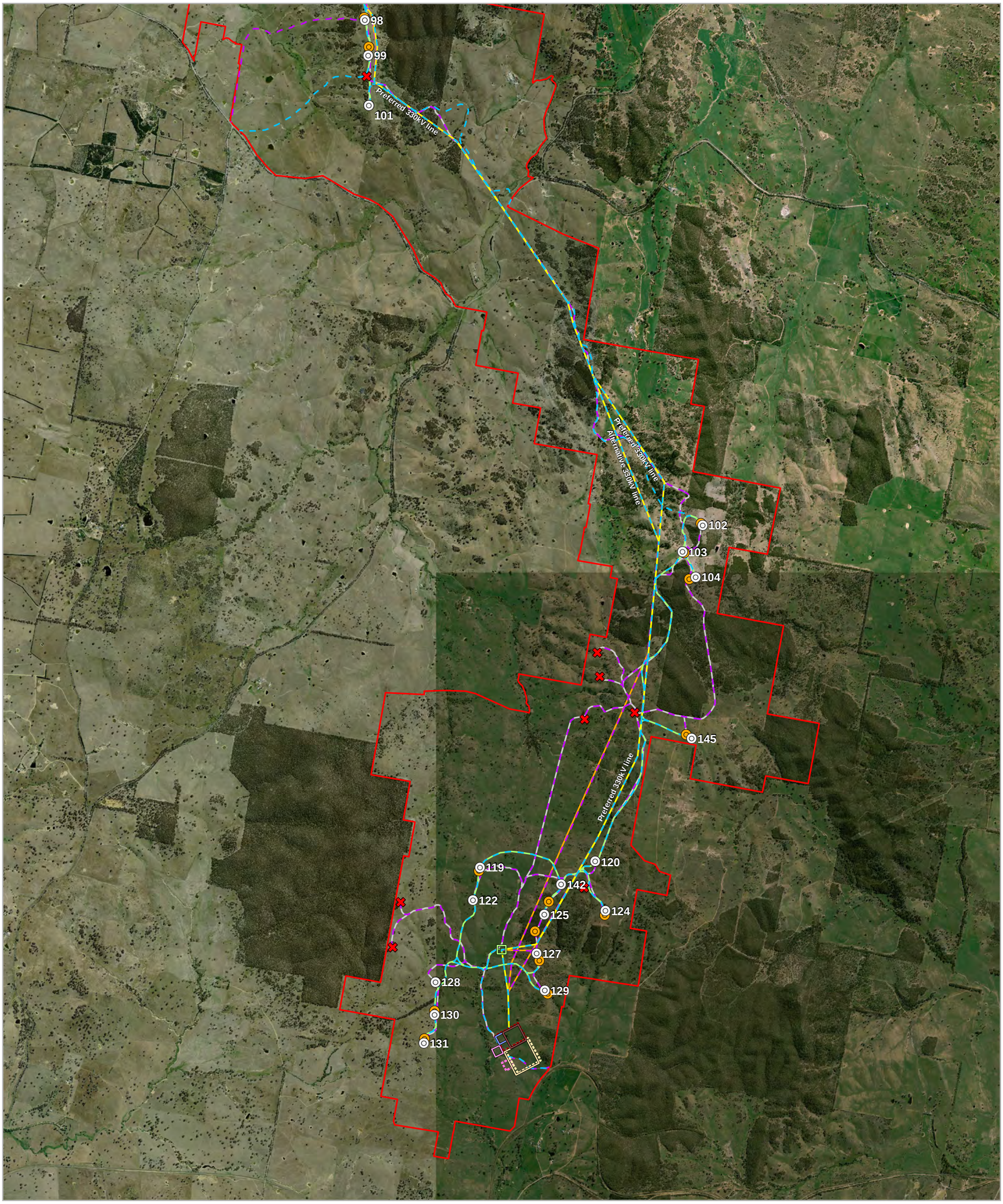
- Site perimeter
- Current Layout
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building
- EA November '13 Layout
  - Relocated turbine
  - Removed turbine
  - Access track
  - Underground cabling
  - Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au



COMPARISON OF CURRENT & EA 2013 INFRASTRUCTURE MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Current Layout
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building
- EA November '13 Layout
  - Relocated turbine
  - Removed turbine
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building

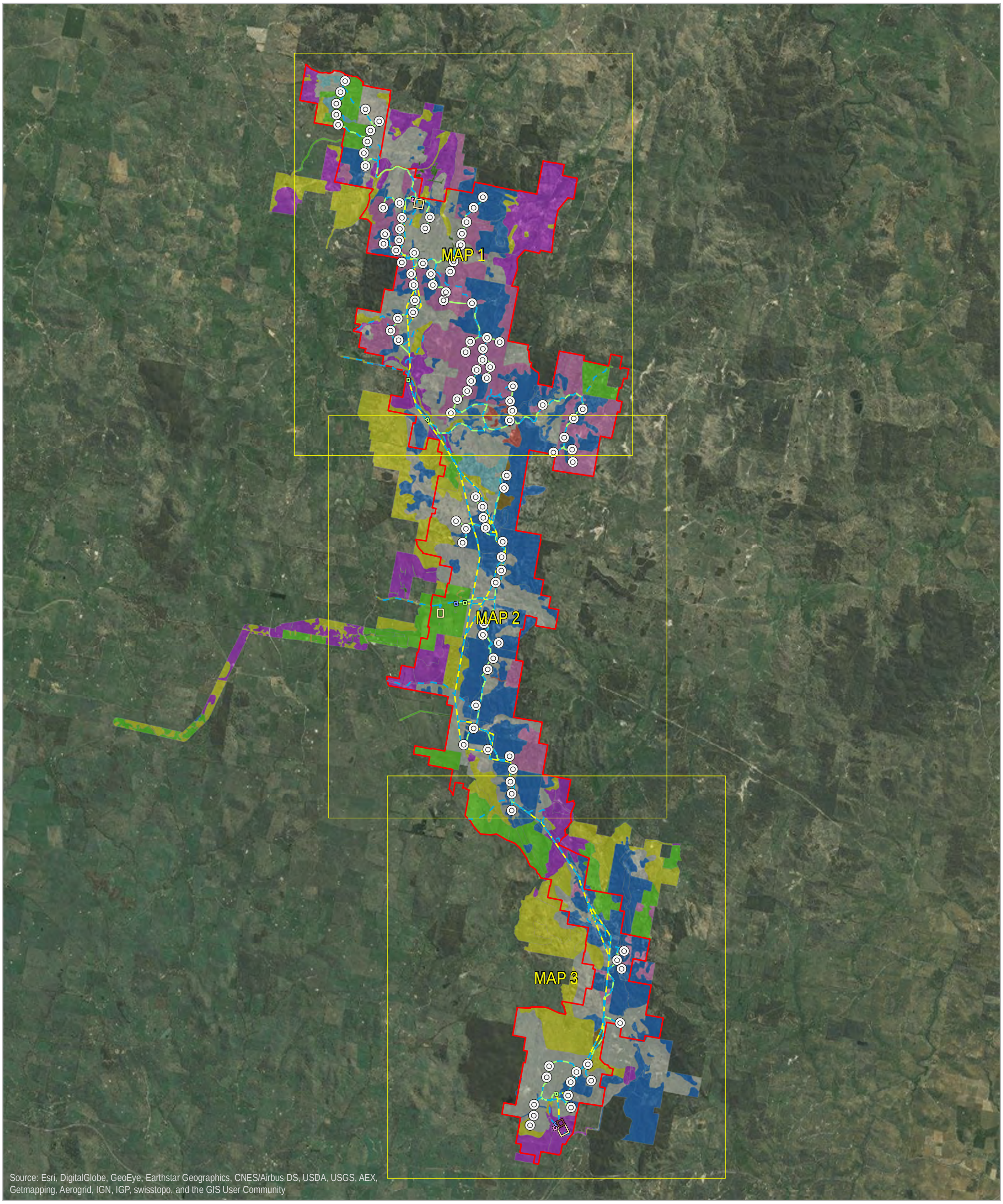
0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

E.3 FLORA SURVEY EFFORT AND RESULTS



GENERAL SURVEY EFFORT AND RESULTS INDEX MAP

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Vegetation Type

- Acacia scrub
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

0 1.5 3 4.5
Kilometers

A3 @ 1:125,000
Date: 9/03/2016
Author: VR

EPURON
www.epuron.com.au

FLORA SURVEY EFFORT AND RESULTS MAP 1

Rye Park Wind Farm Biodiversity Assessment

Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Flora survey effort
- Inspection point
- Flora quadrat / random meander

Targeted transect - spring 2014
- On foot

Targeted transect - spring 2013
- On foot
- Vehicle based

Vegetation Type
- Acacia scrub
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

Vegetation Condition
- Good
- Moderate
- Poor

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

FLORA SURVEY EFFORT AND RESULTS MAP 2

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building
- Flora survey effort
  - Inspection point
  - Flora quadrat / random meander
- Targeted transect - spring 2014
  - On foot
- Targeted transect - spring 2013
  - On foot
  - Vehicle based
- Vegetation Type
  - Acacia scrub
  - Argyle Apple Forest
  - Box-Gum Woodland
  - Brittle Gum Forest
  - Derived Grassland
  - Exotic pasture
  - Native pasture
  - Planted native vegetation
  - Scribbly Gum Forest
  - Sifton Bush Shrubland
- Vegetation Condition
  - Good
  - Moderate
  - Poor

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

FLORA SURVEY EFFORT AND RESULTS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building
- Flora survey effort
  - Inspection point
  - Flora quadrat / random meander
- Targeted transect - spring 2014
  - On foot
- Targeted transect - spring 2013
  - On foot
  - Vehicle based
- Vegetation Type
  - Acacia scrub
  - Argyle Apple Forest
  - Box-Gum Woodland
  - Brittle Gum Forest
  - Derived Grassland
  - Exotic pasture
  - Native pasture
  - Planted native vegetation
  - Scribbly Gum Forest
  - Sifton Bush Shrubland
- Vegetation Condition
  - Good
  - Moderate
  - Poor

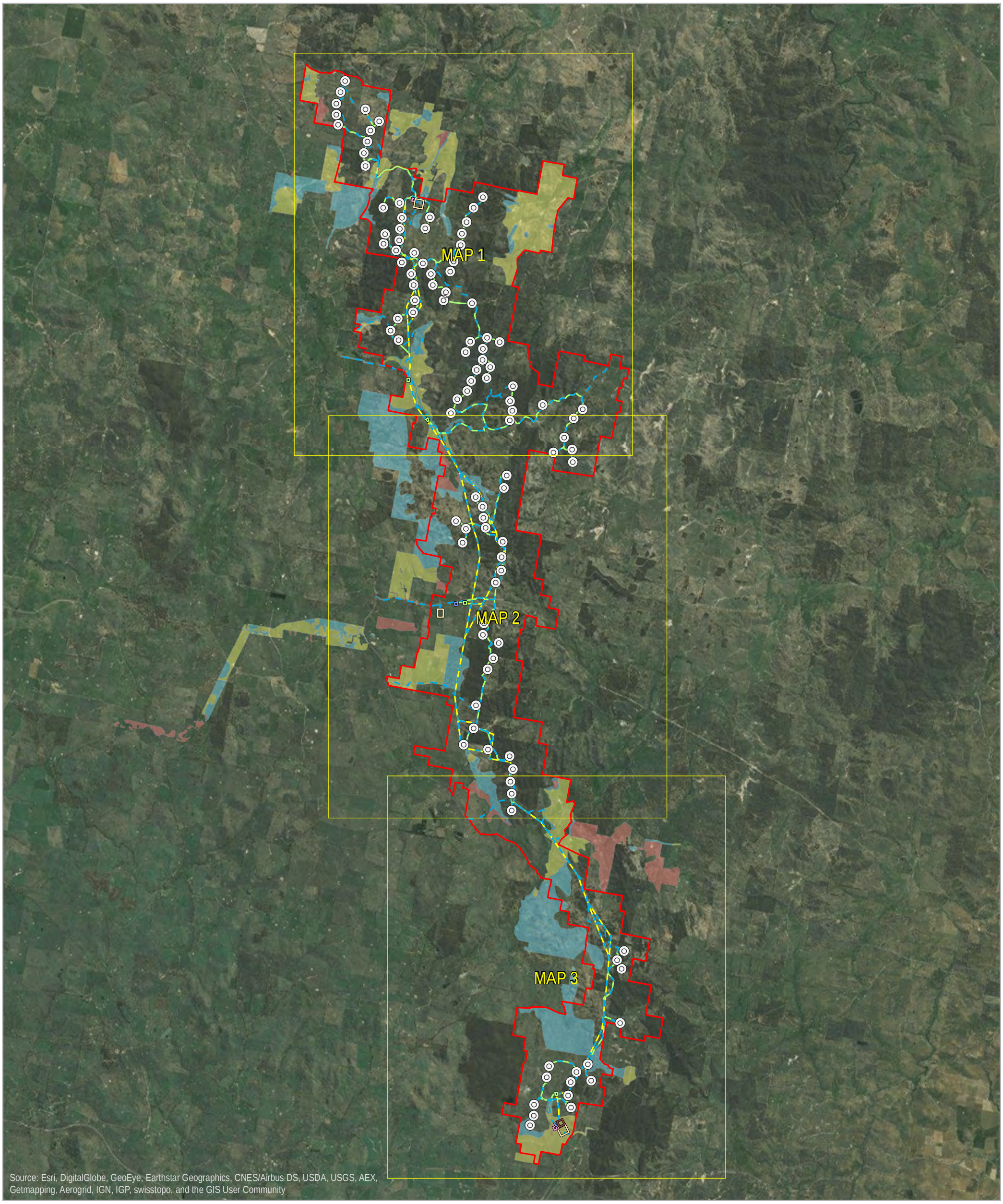
0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

E.4 BOX-GUM WOODLAND MAPPED ACCORDING TO OEH CONDITION CLASSES



BOX-GUM WOODLAND & DERIVED GRASSLAND WITH OEH CONDITION CLASS INDEX MAP

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Box-Gum Woodland

- Box-Gum Woodland with a native understorey and intact overstorey
- Box-Gum Woodland with an intact overstorey and non native in the groundcover

Derrived Grassland

- Box-Gum Woodland as a native ground cover without an overstorey

0 1.5 3 4.5
Kilometers

A3 @ 1:125,000
Date: 15/03/2016
Author: VR

EPURON
www.epuron.com.au

BOX-GUM WOODLAND & DERIVED GRASSLAND WITH OEH CONDITION CLASS MAP 1

Rye Park Wind Farm Biodiversity

- Site perimeter
- Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Box-Gum Woodland

- Box-Gum Woodland with a native understorey and intact overstorey
- Box-Gum Woodland with an intact overstorey and non native in the groundcover

Derrived Grassland

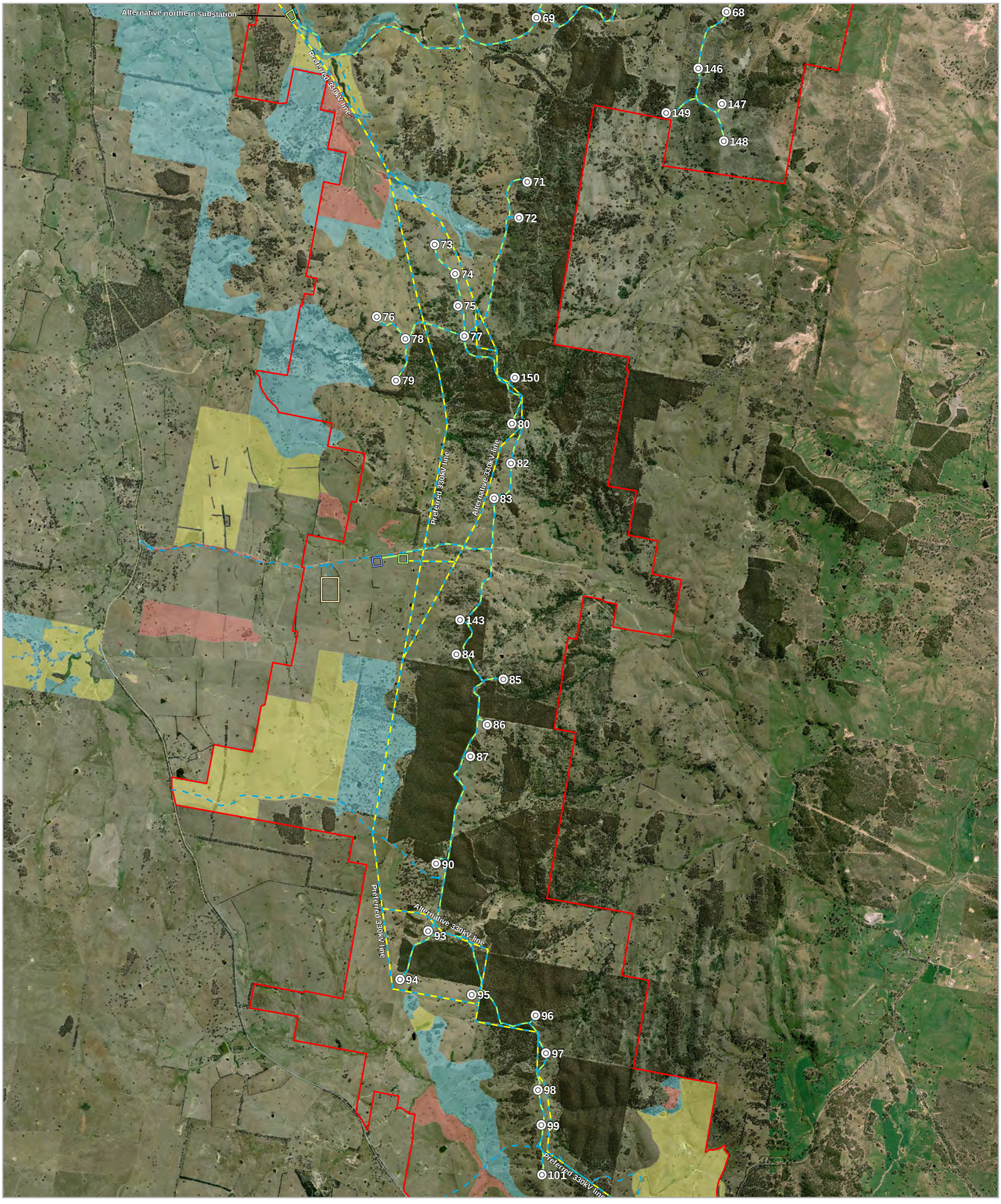
- Box-Gum Woodland as a native ground cover without an overstorey

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 15/03/2016
Author: VR

EPURON

www.epuron.com.au



BOX-GUM WOODLAND & DERIVED GRASSLAND WITH OEH CONDITION CLASS MAP 2

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Box-Gum Woodland

- Box-Gum Woodland with a native understorey and intact overstorey
- Box-Gum Woodland with an intact overstorey and non native in the groundcover

Derrived Grassland

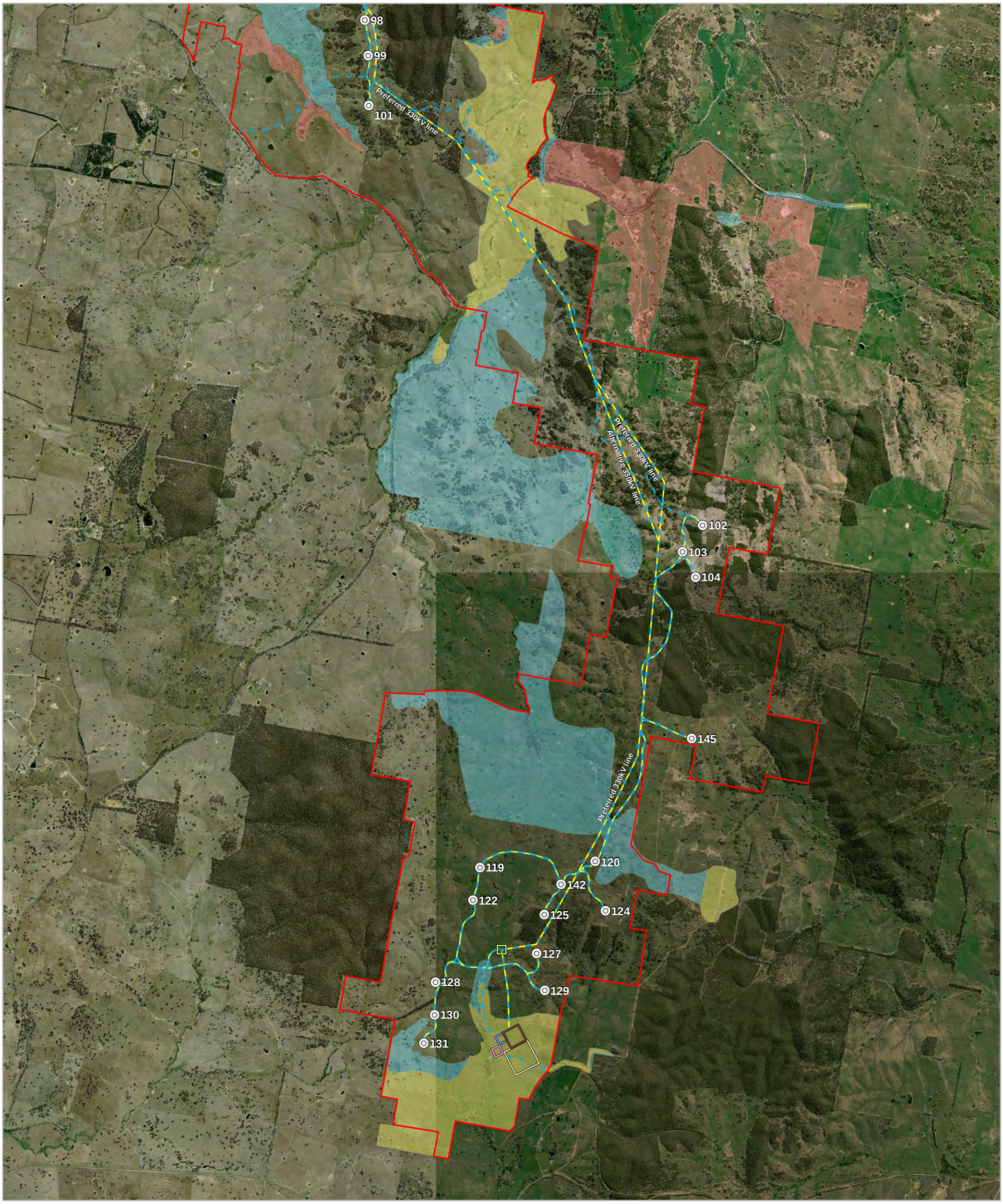
- Box-Gum Woodland as a native ground cover without an overstorey

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 15/03/2016
Author: VR

EPURON

www.epuron.com.au



BOX-GUM WOODLAND & DERIVED GRASSLAND WITH OEH CONDITION CLASS MAP 3

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Box-Gum Woodland

- Box-Gum Woodland with a native understorey and intact overstorey
- Box-Gum Woodland with an intact overstorey and non native in the groundcover

Derrived Grassland

- Box-Gum Woodland as a native ground cover without an overstorey

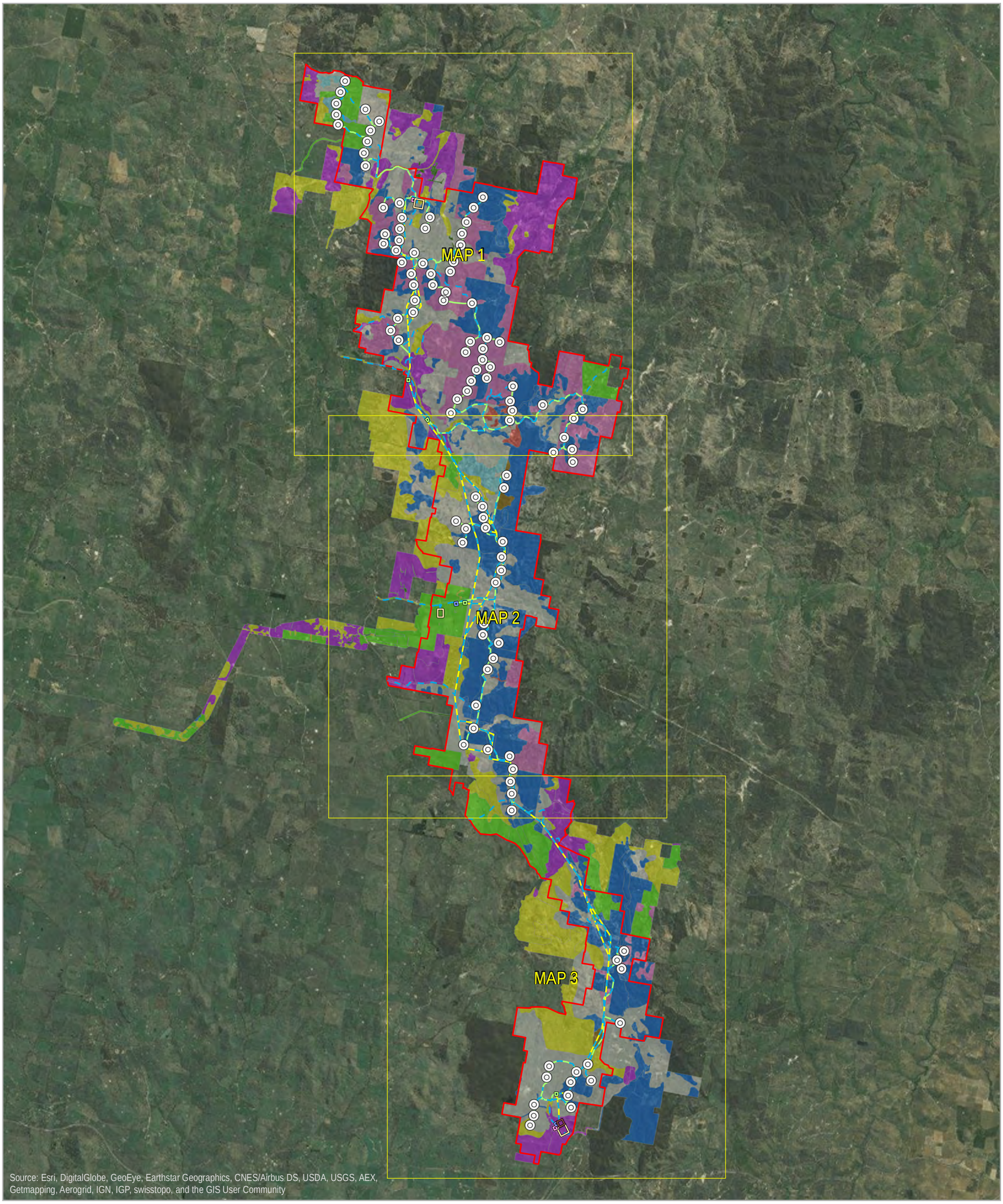
0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 15/03/2016
Author: VR

EPURON

www.epuron.com.au

E.5 GENERAL FAUNA SURVEY EFFORT AND RESULTS



GENERAL SURVEY EFFORT AND RESULTS INDEX MAP

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

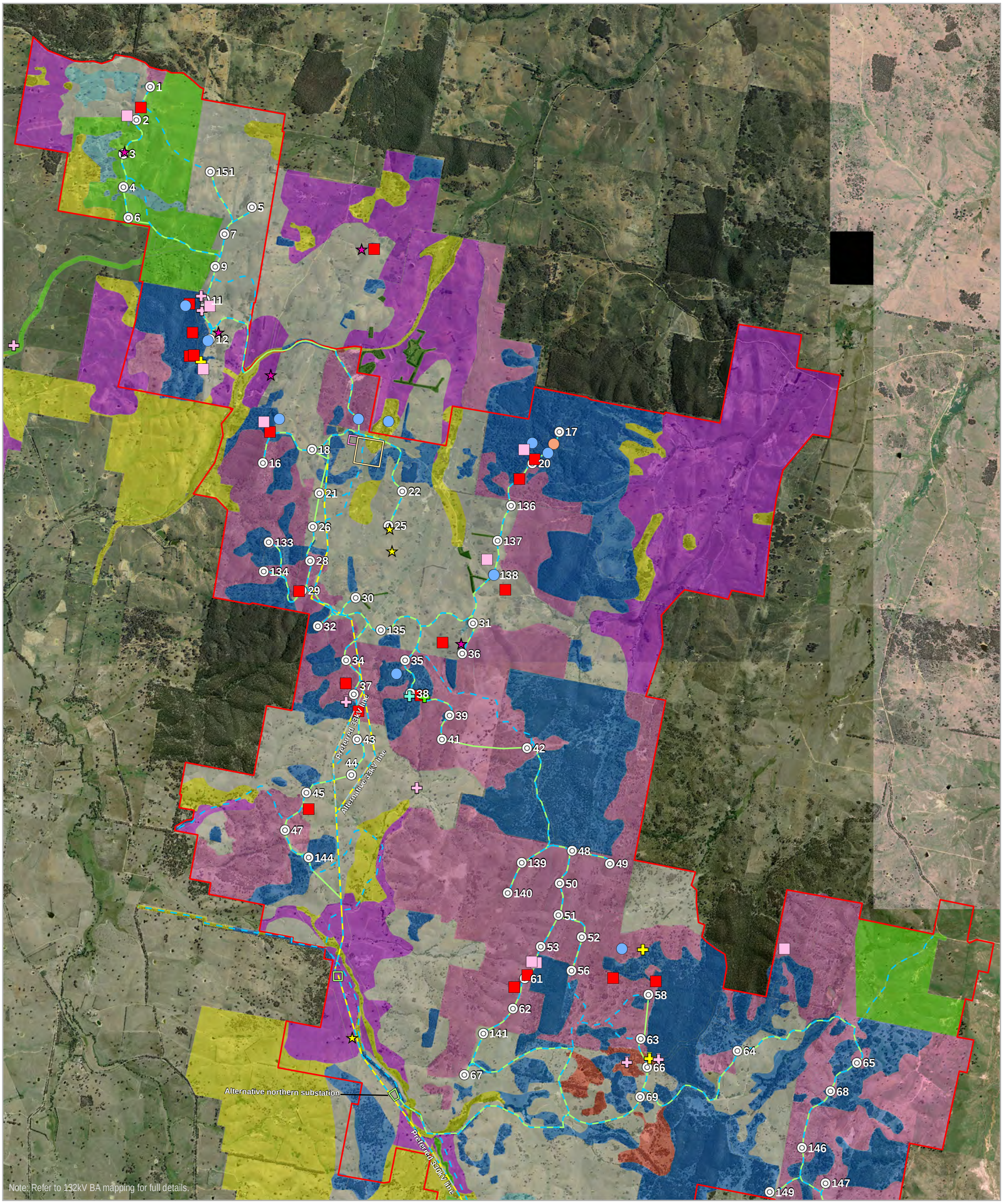
Vegetation Type

- Acacia scrub
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

0 1.5 3 4.5
Kilometers

A3 @ 1:125,000
Date: 9/03/2016
Author: VR

EPURON
www.epuron.com.au



FAUNA GENERAL SURVEY EFFORT MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Fauna survey effort

- Anabat
- Call playback / Spotlight
- Night work
- Spotlight
- Stag watch / listening
- Funnel trap
- Reptile search
- Reptile tile plot
- Tree-mounted trap 1
- Tree-mounted trap 2
- Bird survey
- Swift Parrot / Bird survey
- Habitat assessment
- Hollow quadrats
- Spotlight transect

Vegetation Type

- Acacia scrub
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

Alternative northern substation
Preferred 330kV line
Alternative 330kV line
Preferred 330kV line
Alternative 330kV line
Preferred 330kV line
Preferred 330kV line
68
69
146
147
148
149
71
72
73
74
75
76
77
78
79
80
82
83
143
84
85
86
87
90
93
94
95
96
97
98
99
101
150
Note: Refer to 132kV BA mapping for full details.

FAUNA GENERAL SURVEY EFFORT MAP 2

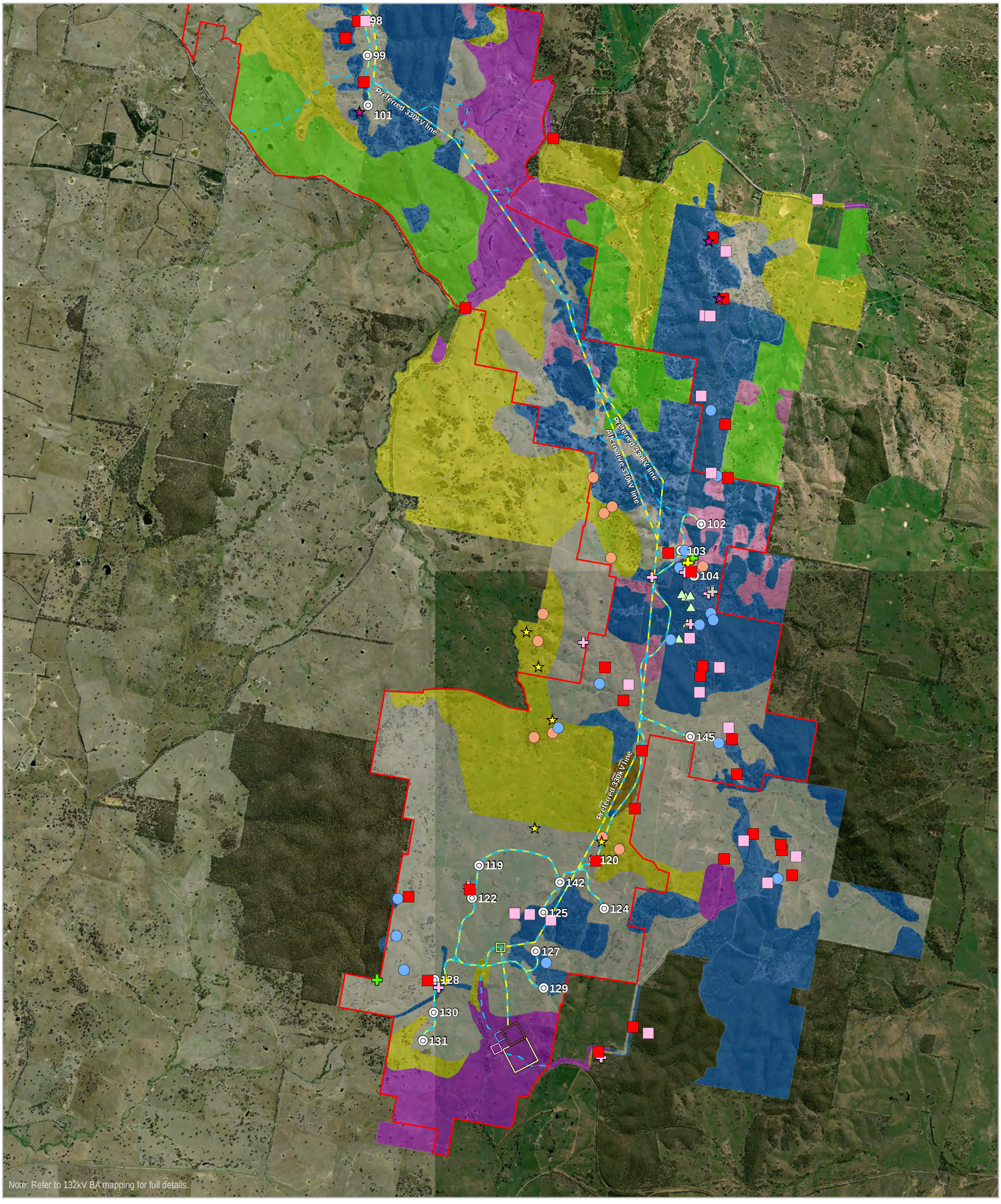
Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building
- Fauna survey effort
  - Anabat
  - Call playback / Spotlight
  - Night work
  - Spotlight
  - Stag watch / listening
  - Funnel trap
  - Reptile search
- Reptile tile plot
- Tree-mounted trap 1
- Tree-mounted trap 2
- Bird survey
- Swift Parrot / Bird survey
- Habitat assessment
- Hollow quadrats
- Spotlight transect
- Vegetation Type
  - Acacia scrub
  - Argyle Apple Forest
  - Box-Gum Woodland
  - Brittle Gum Forest
  - Derived Grassland
  - Exotic pasture
  - Native pasture
  - Planted native vegetation
  - Scribbly Gum Forest
  - Sifton Bush Shrubland

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au



FAUNA GENERAL SURVEY EFFORT MAP 3

Rye Park Wind Farm Biodiversity Assessment

Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

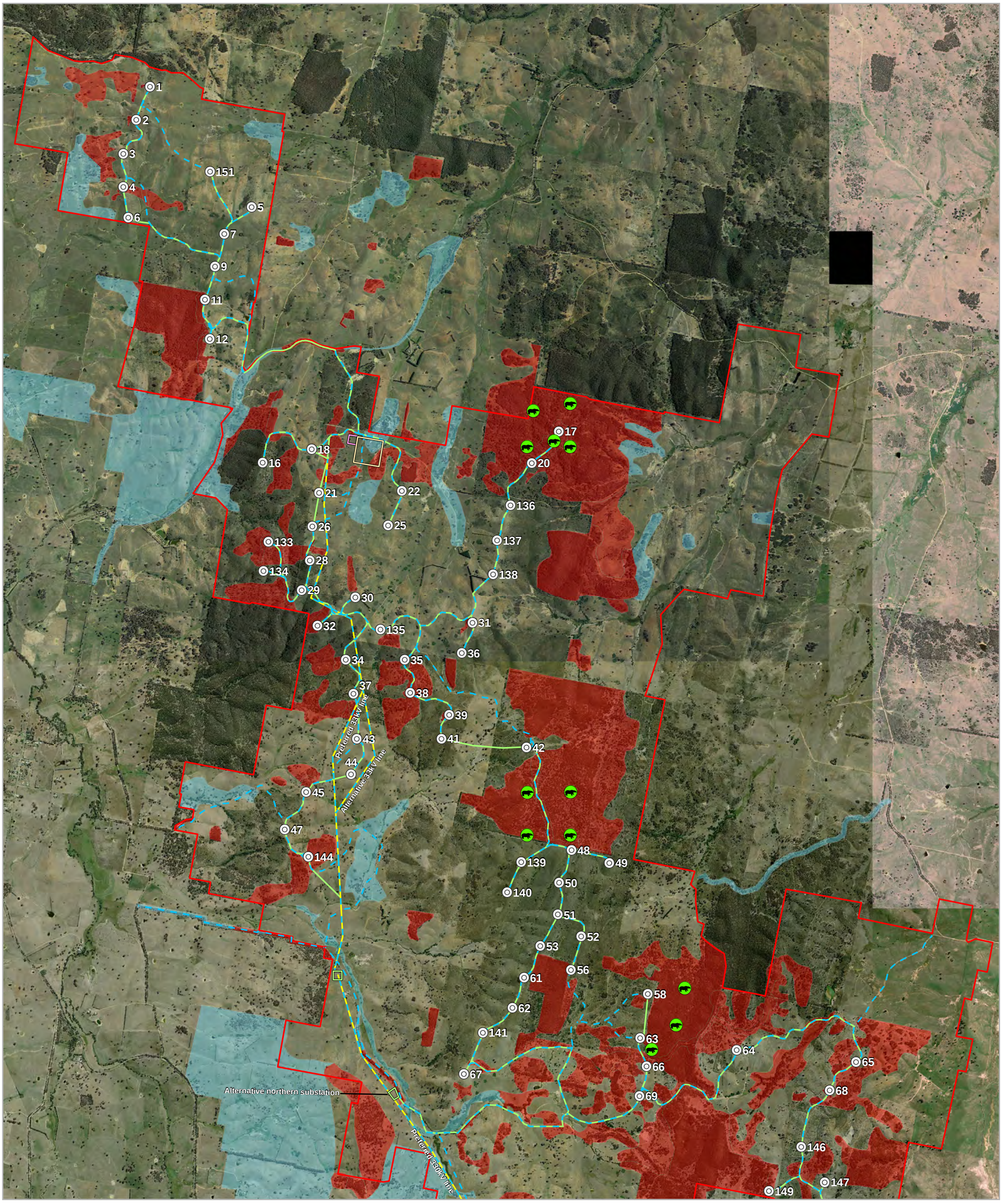
Fauna survey effort
- Anabat
- Call playback / Spotlight
- Night work
- Spotlight
- Stag watch / listening
- Funnel trap
- Reptile search
- Reptile tile plot
- Tree-mounted trap 1
- Tree-mounted trap 2
- Bird survey
- Swift Parrot / Bird survey
- Habitat assessment
- Hollow quadrats
- Spotlight transect

Vegetation Type
- Acacia scrub
- Argyle Apple Forest
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au



KOALA RANDOM GRID BASED SPOT ASSESSMENT TECHNIQUE SURVEY EFFORT MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building
- Koala habitat
  - Forest
  - Woodland
- Koala survey

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

KOALA RANDOM GRID BASED SPOT ASSESSMENT TECHNIQUE SURVEY EFFORT MAP 2

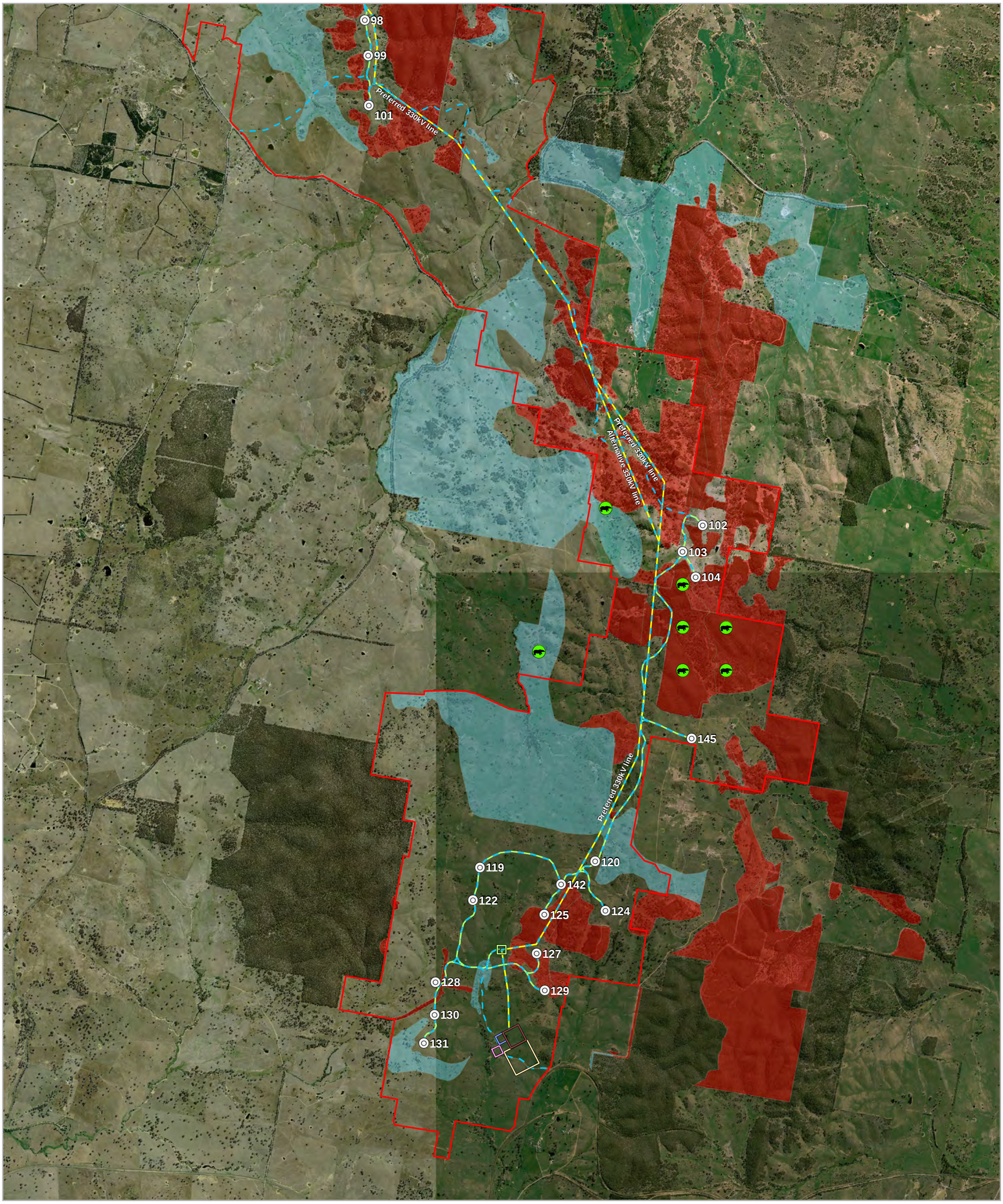
Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building
- Koala habitat
  - Forest
  - Woodland
- Koala survey

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au



KOALA RANDOM GRID BASED SPOT ASSESSMENT TECHNIQUE SURVEY EFFORT MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
  - Turbine location
  - Access track
  - Underground cabling
  - Overhead transmission line
  - Collection substation
  - Connection substation
  - Construction compound
  - Concrete batching plant
  - O&M building
- Koala habitat
  - Forest
  - Woodland
- Koala survey

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

FAUNA GENERAL SURVEY RESULTS MAP 1

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Threatened species

Nests

- Diamond Firetail nest
- Wedge-tailed Eagle nest
- Nankeen Kestrel nest
- Superb Parrot nest
- Potential Superb Parrot nest tree

Birds

- Brown Treecreeper
- Diamond Firetail
- Flame Robin
- Hooded Robin
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- White-fronted Chat
- Superb Parrot
- Painted Honeyeater
- Rainbow Bee-eater

Raptors

- Black-shouldered Kite
- Brown Falcon
- Brown Goshawk
- Nankeen Kestrel
- Wedge-tailed Eagle

Reptiles

- Striped Legless Lizard

Vegetation Type

- Acacia scrub
- Argyle Apple
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

FAUNA GENERAL SURVEY RESULTS MAP 2

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Threatened species

Nests
- Diamond Firetail nest
- Wedge-tailed Eagle nest
- Nankeen Kestrel nest
- Superb Parrot nest
- Potential Superb Parrot nest tree

Birds
- Brown Treecreeper
- Diamond Firetail
- Flame Robin
- Hooded Robin
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- White-fronted Chat
- Superb Parrot
- Painted Honeyeater
- Rainbow Bee-eater

Raptors
- Black-shouldered Kite
- Brown Falcon
- Brown Goshawk
- Nankeen Kestrel
- Wedge-tailed Eagle

Reptiles
- Striped Legless Lizard

Vegetation Type
- Acacia scrub
- Argyle Apple
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

FAUNA GENERAL SURVEY RESULTS MAP 3

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Threatened species

Nests
- Diamond Firetail nest
- Wedge-tailed Eagle nest
- Nankeen Kestrel nest
- Superb Parrot nest
- Potential Superb Parrot nest tree

Birds
- Brown Treecreeper
- Diamond Firetail
- Flame Robin
- Hooded Robin
- Scarlet Robin
- Speckled Warbler
- Varied Sittella
- White-fronted Chat
- Superb Parrot
- Painted Honeyeater
- Rainbow Bee-eater

Raptors
- Black-shouldered Kite
- Brown Falcon
- Brown Goshawk
- Nankeen Kestrel
- Wedge-tailed Eagle

Reptiles
- Striped Legless Lizard

Vegetation Type
- Acacia scrub
- Argyle Apple
- Box-Gum Woodland
- Brittle Gum Forest
- Derived Grassland
- Exotic pasture
- Native pasture
- Planted native vegetation
- Scribbly Gum Forest
- Sifton Bush Shrubland

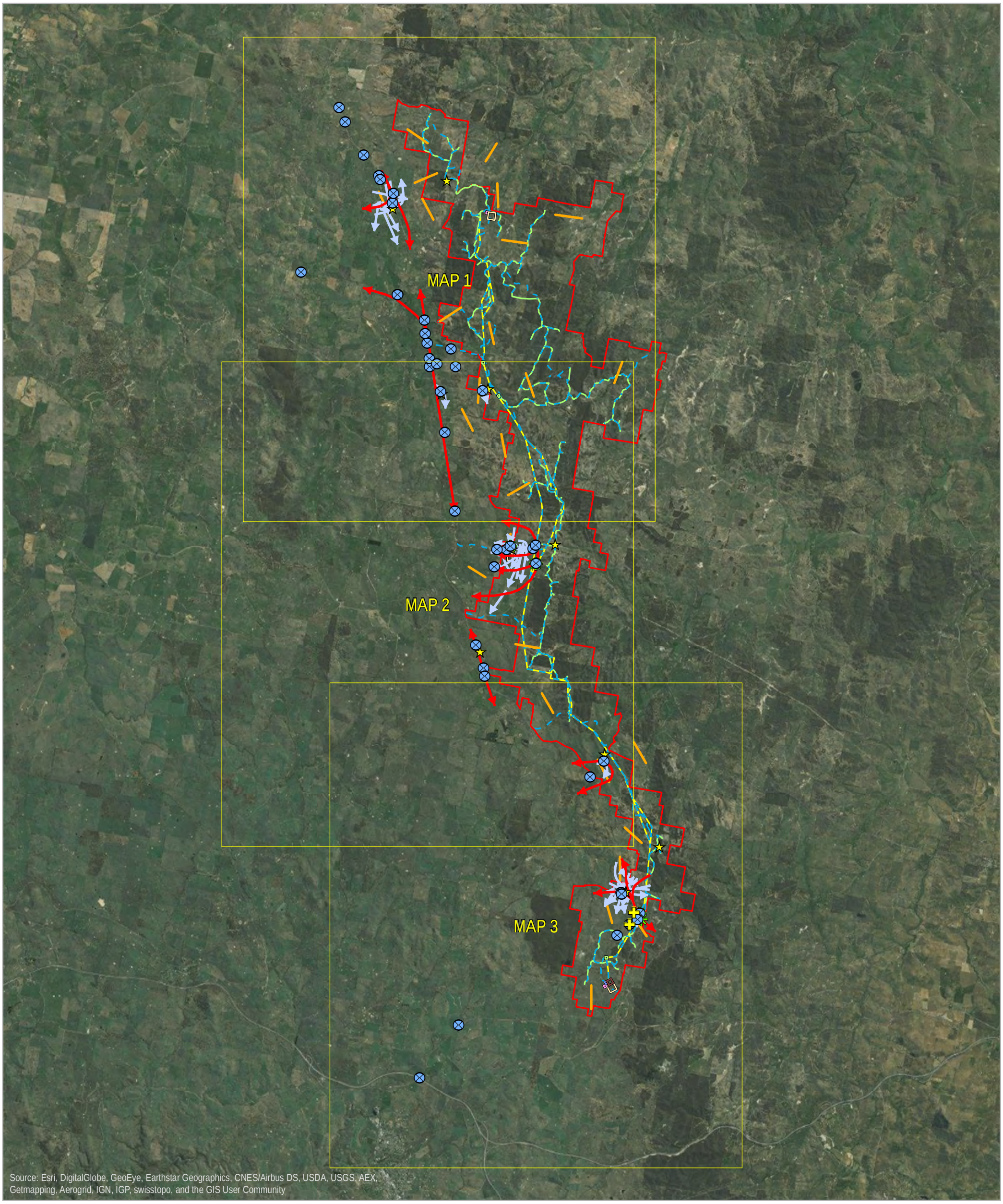
0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

E.6 SUPERB PARROT SURVEY EFFORT AND RESULTS



SUPERB PARROT SURVEY EFFORT AND RESULTS INDEX TO MAPS

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building
- Flight path viewing station
- Superb parrot transect
- Superb Parrot
- Superb Parrot nest
- Potential Superb Parrot nest tree
- Primary movement corridors
- Observed flight paths

0 1 2 3
Kilometers

A3 @ 1:150,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

SUPERB PARROT SURVEY EFFORT AND RESULTS MAP 1

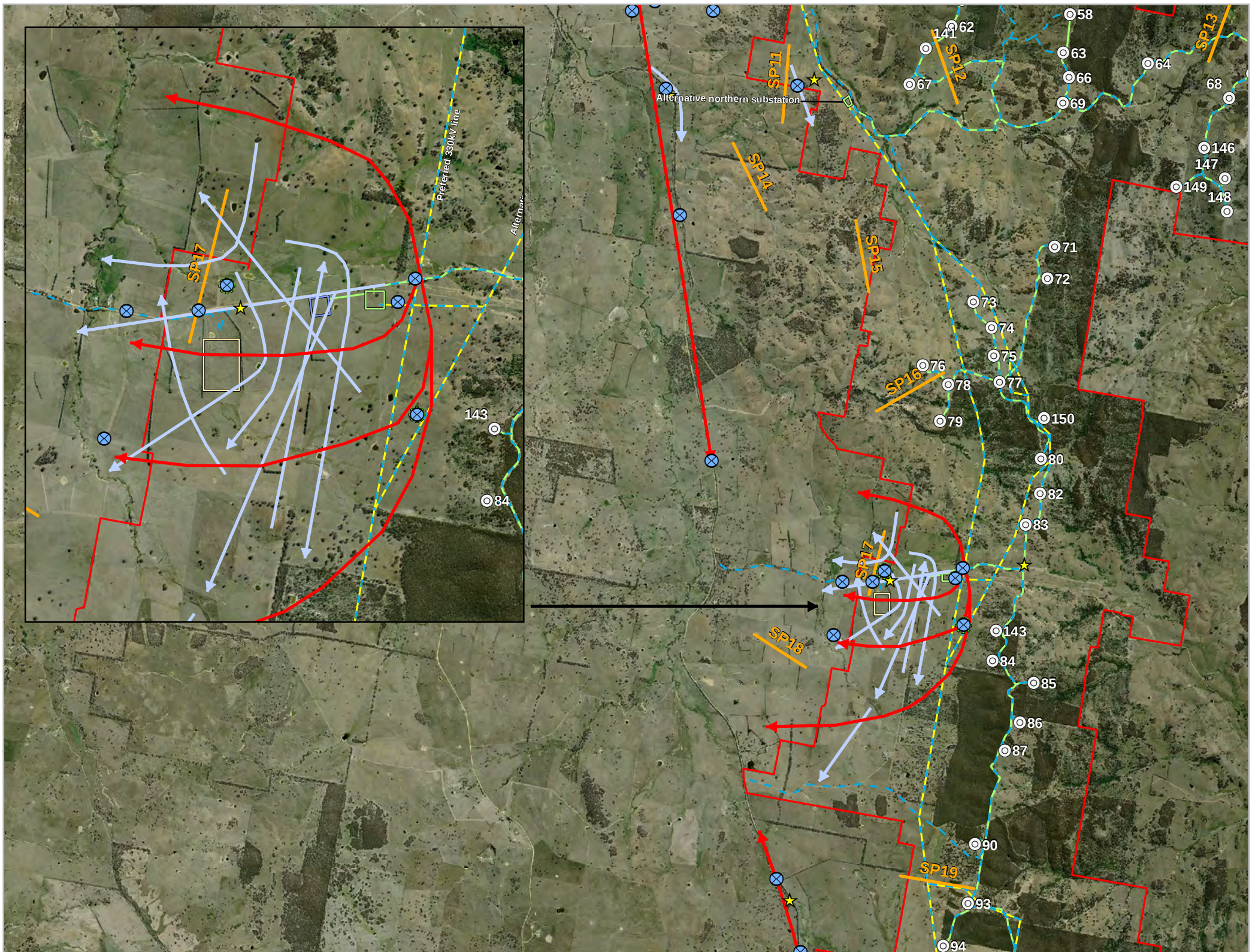
Rye Park Wind Farm Biodiversity

- Site perimeter
- Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building
- Flight path viewing station
- Superb parrot transect
- Superb Parrot
- Superb Parrot nest
- Potential Superb Parrot nest tree
- Primary movement corridors
- Observed flight paths

0 0.5 1 1.5
Kilometers

A3 @ 1:60,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au



SUPERB PARROT SURVEY EFFORT AND RESULTS MAP 2

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

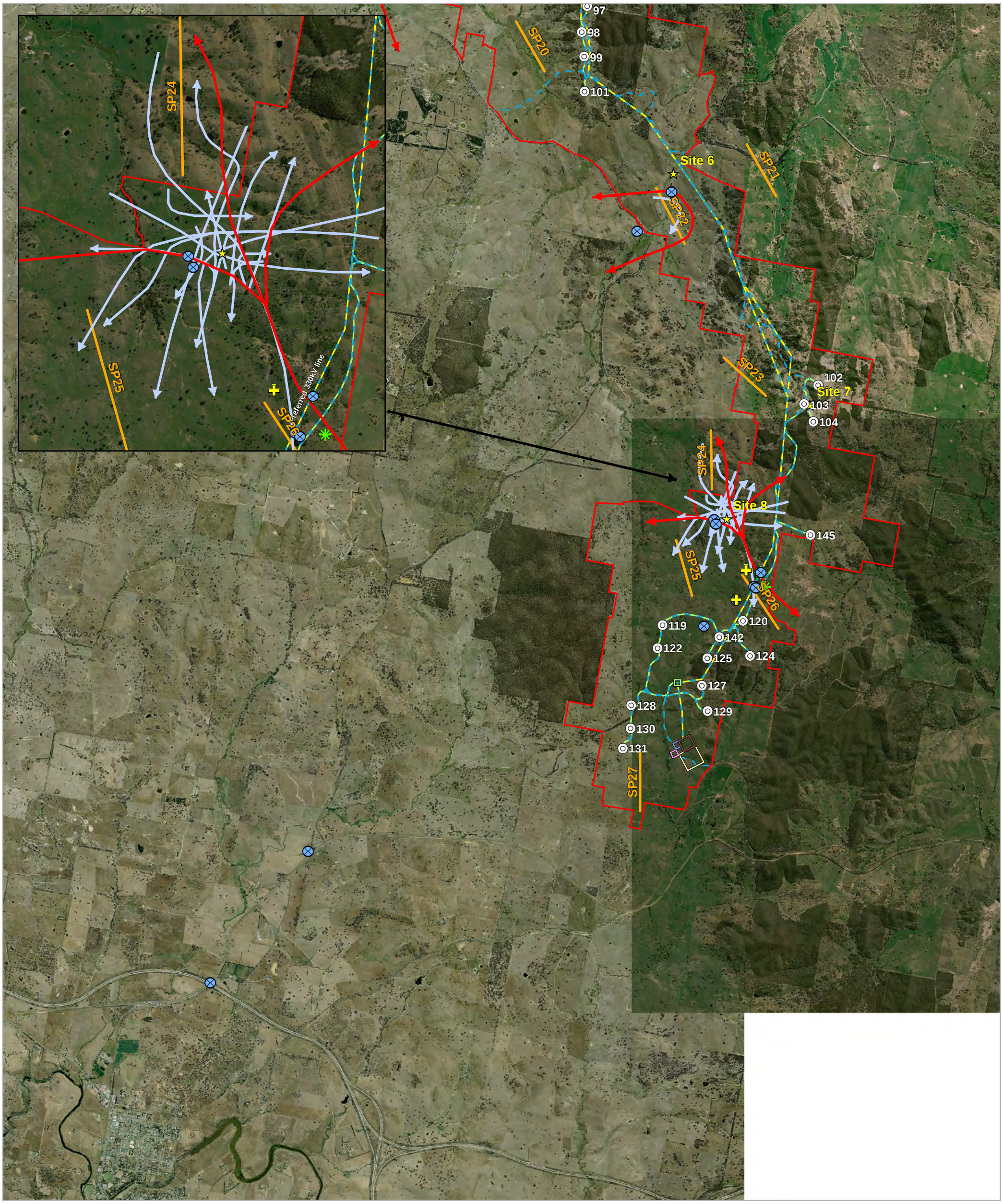
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building
- Flight path viewing station
- Superb parrot transect
- Superb Parrot
- Superb Parrot nest
- Potential Superb Parrot nest tree
- Primary movement corridors
- Observed flight paths

0 0.5 1 1.5
Kilometers

A3 @ 1:60,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au



SUPERB PARROT SURVEY EFFORT AND RESULTS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter
- Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building
- Flight path viewing station
- Superb parrot transect
- Superb Parrot
- Superb Parrot nest
- Potential Superb Parrot nest tree
- Primary movement corridors
- Observed flight paths

0 0.5 1 1.5
Kilometers

A3 @ 1:60,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

E.7 STRIPED LEGLESS LIZARD AND GOLDEN SUN MOTH HABITAT MAPPING WITH THE PRFERRED PROJECT LAYOUT

STRIPED LEGLESS LIZARD SURVEY EFFORT AND RESULTS MAP 1

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

March 2014 survey effort
- Transect start and habitat assessment
- Habitat assessment only

Previous reptile survey effort
- Reptile Tile Plot
- Funnel trap
- Reptile search

Data source
- Field based
- Extrapolated

Additional information
- Known habitat for SLL

SLL habitat quality
- Excellent
- Good
- Moderate
- Low

Vegetation Type
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

STRIPED LEGLESS LIZARD SURVEY EFFORT AND RESULTS MAP 2

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

March 2014 survey effort
- Transect start and habitat assessment
- Habitat assessment only

Previous reptile survey effort
- Reptile Tile Plot
- Funnel trap
- Reptile search

Data source
- Field based
- Extrapolated

Additional information
- Known habitat for SLL

SLL habitat quality
- Excellent
- Good
- Moderate
- Low

Vegetation Type
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

STRIPED LEGLESS LIZARD SURVEY EFFORT AND RESULTS MAP 3

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Previous reptile survey effort

- Reptile Tile Plot
- Funnel trap
- Reptile search

Data source

- Field based
- Extrapolated

Additional information

- Known habitat for SLL

SLL habitat quality

- Excellent
- Good
- Moderate
- Low

Vegetation Type

- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON

www.epuron.com.au

GOLDEN SUN MOTH SURVEY EFFORT AND RESULTS MAP 1

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

December 2013 survey results

- Golden Sun Moth records

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Data source

- Field based
- Extrapolated

Wallaby Grass abundance

- 76%-100%
- 51%-75%
- 26%-50%
- 0%-25%
- Absent

Vegetation Type

- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

GOLDEN SUN MOTH SURVEY EFFORT AND RESULTS MAP 2

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

December 2013 survey results

- Golden Sun Moth records

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Data source

- Field based
- Extrapolated

Wallaby Grass abundance

- 76%-100%
- 51%-75%
- 26%-50%
- 0%-25%
- Absent

Vegetation Type

- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

GOLDEN SUN MOTH SURVEY EFFORT AND RESULTS MAP 3

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

December 2013 survey results

- Golden Sun Moth records

March 2014 survey effort

- Transect start and habitat assessment
- Habitat assessment only

Data source

- Field based
- Extrapolated

Wallaby Grass abundance

- 76%-100%
- 51%-75%
- 26%-50%
- 0%-25%
- Absent

Vegetation Type

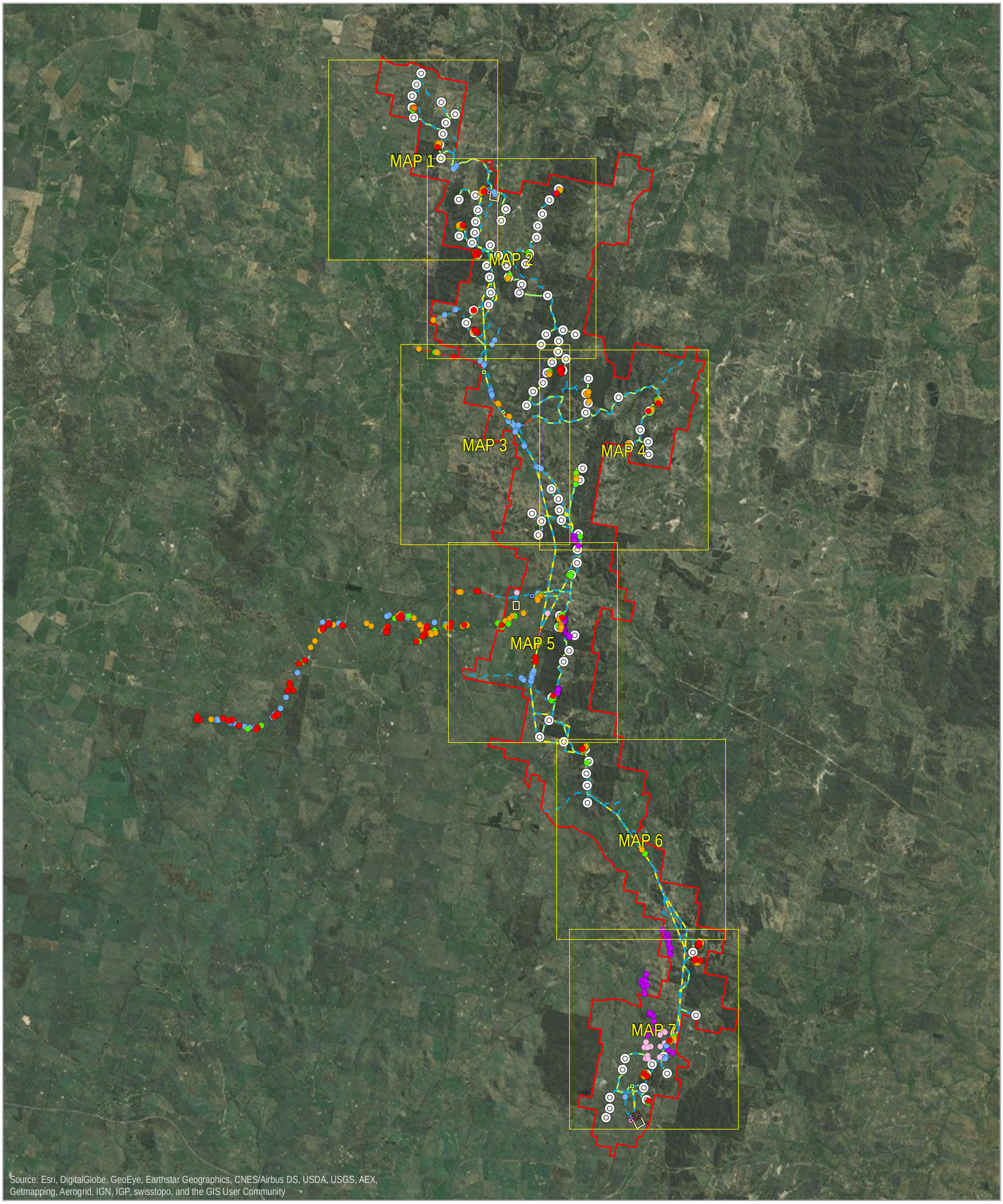
- Box-Gum Woodland
- Derived Grassland
- Exotic pasture
- Native pasture

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

E.8 HOLLOW-BEARING TREE SURVEY EFFORT AND RESULTS



HOLLOW-BEARING TREE SURVEY RESULTS INDEX MAP

Rye Park Wind Farm Biodiversity

Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -
Largest hollow size supported in each recorded HBT
- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information
- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 1,500 3,000 4,500
Meters

A3 @ 1:125,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 1

Rye Park Wind Farm Biodiversity

Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -

Largest hollow size supported in each recorded HBT

- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information

- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750

Meters

A3 @ 1:21,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 2

Rye Park Wind Farm Biodiversity

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -

Largest hollow size supported in each recorded HBT

- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information

- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750

Meters

A3 @ 1:21,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 3

Rye Park Wind Farm Biodiversity

Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -

Largest hollow size supported in each recorded HBT

- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information

- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750

Meters

A3 @ 1:21,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 4

Rye Park Wind Farm Biodiversity

Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data - Largest hollow size supported in each recorded HBT
- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information
- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750
Meters

A3 @ 1:21,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 5

Rye Park Wind Farm Biodiversity Assessment

Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -

Largest hollow size supported in each recorded HBT

- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information

- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750

Meters

A3 @ 1:21,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 6

Rye Park Wind Farm Biodiversity Assessment

Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -

Largest hollow size supported in each recorded HBT

- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information

- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750

Meters

A3 @ 1:21,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

HOLLOW-BEARING TREE SURVEY RESULTS MAP 7

Rye Park Wind Farm Biodiversity Assessment

Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

June 2015 survey data -

Largest hollow size supported in each recorded HBT

- Large hollow (>20cm)
- Potential large hollow
- Medium hollow (10-20cm)
- Potential medium hollow
- Small hollow (<10cm)
- Potential small hollow

Additional information

- Surveyed area
- Box-Gum woodland HBTs indentified through desktop analysis
- HBT previously recorded in Spring 2014 survey
- HBT previously recorded in Winter 2013 survey

0 250 500 750

Meters

A3 @ 1:21,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

E.9 PREFERRED PROJECT LAYOUT COMPARED TO THE CONSTRAINTS IDENTIFIED IN THE ORIGINAL BA

FLORA CONSTRAINTS MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Constraints

- High
- Moderate
- Low

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

FLORA CONSTRAINTS MAP 2

Rye Park Wind Farm Biodiversity Assessment

Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Constraints

- High
- Moderate
- Low

0 0.5 1 1.5

Kilometers

A3 @ 1:42,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au

FLORA CONSTRAINTS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure

- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Constraints

- High
- Moderate
- Low

0 0.5 1 1.5

Kilometers

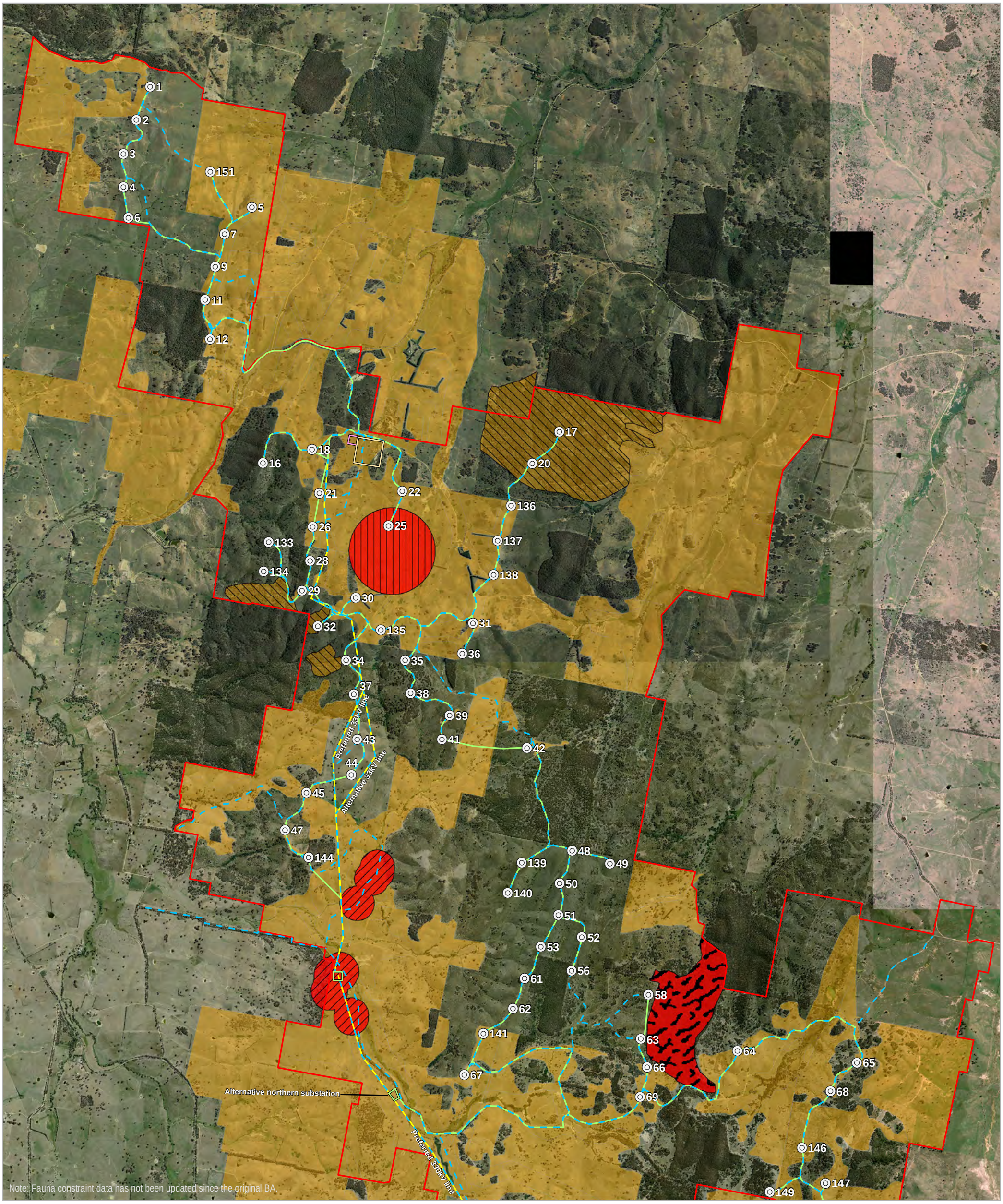
A3 @ 1:42,000

Date: 1/03/2016

Author: VR

EPURON

www.epuron.com.au



FAUNA CONSTRAINTS MAP 1

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Fauna constraints
- High constraint

Reason
- Dense area of HBTs
- GSM habitat 200m buffer
- Nest tree 100m buffer
- SLL habitat 500m buffer
- Superb Parrtot/Painted Honey Eater corridor and SP nest trees
- Turbine(s) on edge of continuous good quality woodland/forest

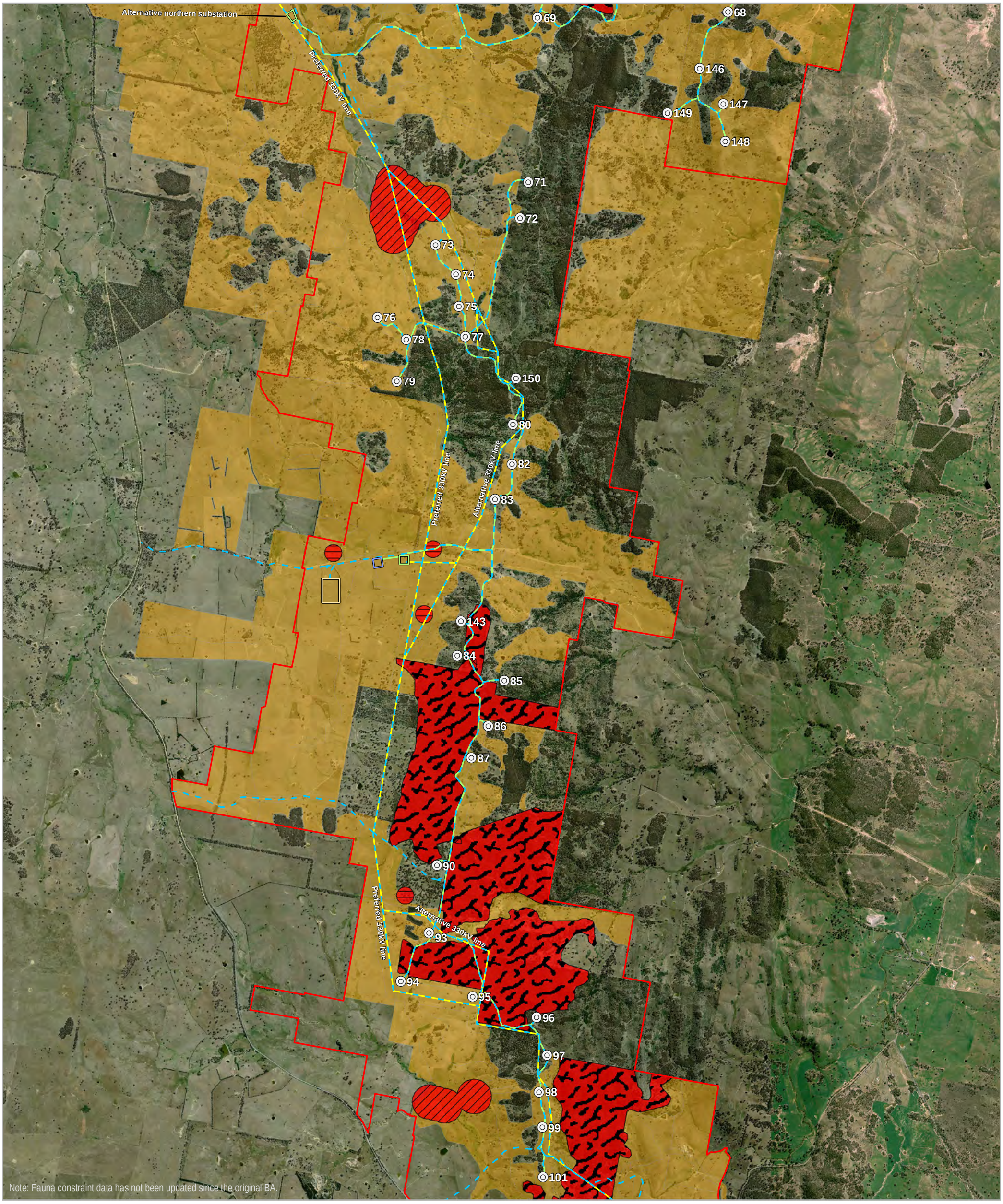
- Moderate constraint

Reason
- Potential GSM habitat
- High number of threatened species
- Turbine(s) surrounded by patchy good condition woodland/forest

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au



FAUNA CONSTRAINTS MAP 2

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Fauna constraints
- High constraint

Reason
- Dense area of HBTs
- GSM habitat 200m buffer
- Nest tree 100m buffer
- SLL habitat 500m buffer
- Superb Parrtot/Painted Honey Eater corridor and SP nest trees
- Turbine(s) on edge of continuous good quality woodland/forest

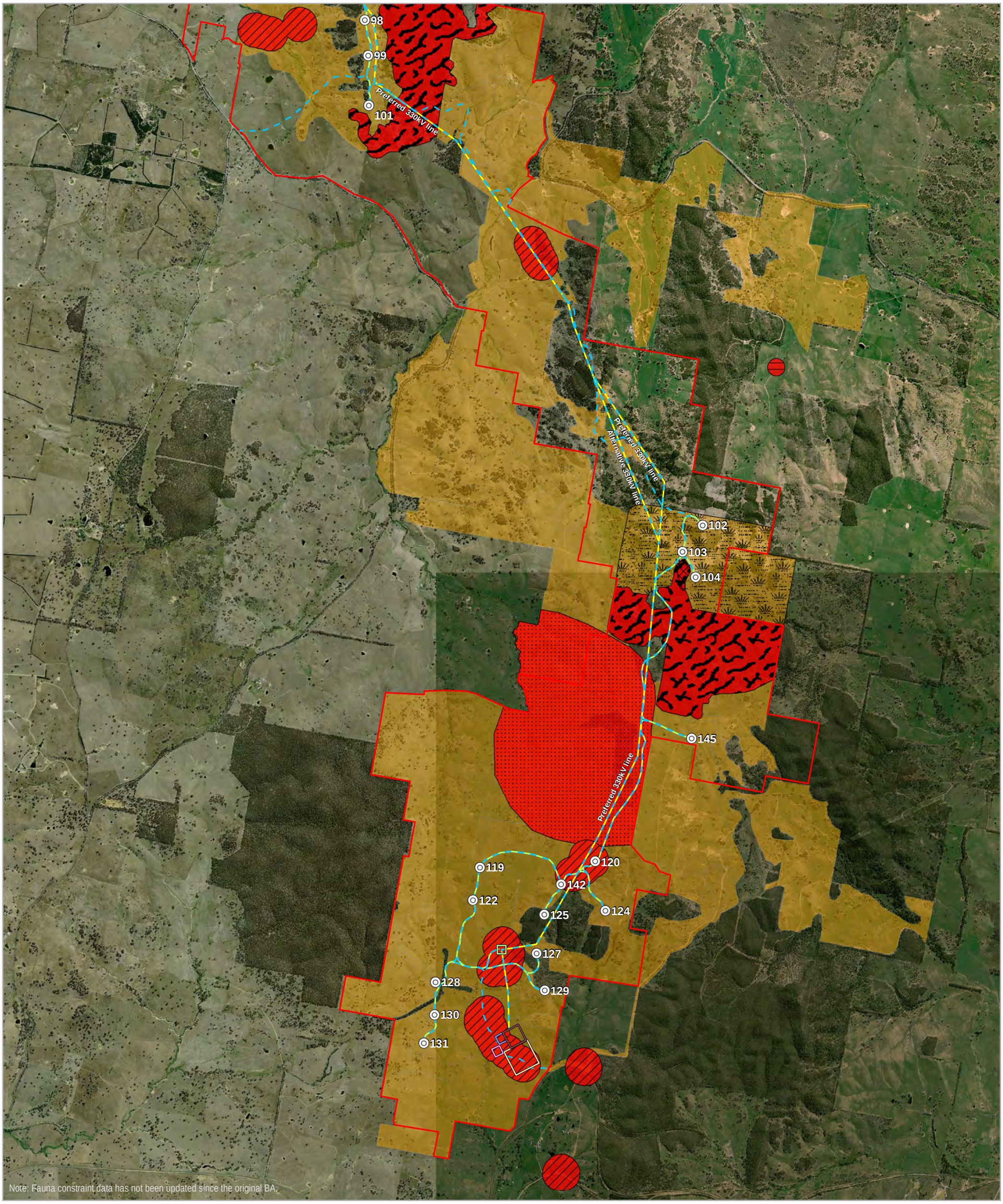
- Moderate constraint

Reason
- Potential GSM habitat
- High number of threatened species
- Turbine(s) surrounded by patchy good condition woodland/forest

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au



FAUNA CONSTRAINTS MAP 3

Rye Park Wind Farm Biodiversity Assessment

- Site perimeter

Infrastructure
- Turbine location
- Access track
- Underground cabling
- Overhead transmission line
- Collection substation
- Connection substation
- Construction compound
- Concrete batching plant
- O&M building

Fauna constraints
- High constraint

Reason
- Dense area of HBTs
- GSM habitat 200m buffer
- Nest tree 100m buffer
- SLL habitat 500m buffer
- Superb Parrtot/Painted Honey Eater corridor and SP nest trees
- Turbine(s) on edge of continuous good quality woodland/forest

- Moderate constraint

Reason
- Potential GSM habitat
- High number of threatened species
- Turbine(s) surrounded by patchy good condition woodland/forest

0 0.5 1 1.5
Kilometers

A3 @ 1:42,000
Date: 1/03/2016
Author: VR

EPURON
www.epuron.com.au

APPENDIX F HOLLOW-BEARING TREE SURVEY RESULTS

F.1 PATCH VALIDATION AND IMAGES

Patch	Surveyed area	Additional areas verified
B3	 Track between Turbine 71 to Turbine 72	Entire track route surveyed, no additional verification required.
S23	 Turbine 104	Separated out as its own patch, no additional verification required.
S14	 Turbine 102 – Mixed age forest	 Track between Turbine 103 and Turbine 102

Patch	Surveyed area	Additional areas verified
S18	 Track/transmission line north of Turbine 120 mostly regrowth Acacia scrub with young regrowth and occasional stags most not hollow-bearing.	 Track/transmission line further north past Turbine 145 (Turbine 145 would be to right of frame)
	 Isolated patch of trees 550m north – northwest of Turbine 120	 Acacia regrowth to the south of the isolated patch of trees
S15	 Turbine 125 – Mixed age forest	Separated out as its own patch, no additional verification required.

Patch	Surveyed area	Additional areas verified
S20	 Turbine 142 and track from Turbine 125 – No HBTs	Separated out as its own patch, no additional verification required.
S26	 Turbine 129 – HBTs in isolated paddock trees only	Separated out as its own patch, no additional verification required.
S16	 Turbine 127 – No HBTs within 100m of turbine or along track from Turbine 129	Separated out as its own patch, no additional verification required.

Patch	Surveyed area	Additional areas verified
S7	 Turbine 56 – Mixed age forest	Mixed age forest with high numbers of HBTs. No verification conducted. Unable to access Turbine 48 (Patch 6) and extrapolation of Patch 7 results considered appropriate as a worst case.
	 Turbine 61 – Mixed age forest	
S8	 Turbine 63	 Vegetation near Turbine 64

Patch	Surveyed area	Additional areas verified
	 Turbine 149	
S10	 Turbine 72	All areas surveyed, no additional verification required.
	 Turbine 71	

Patch	Surveyed area	Additional areas verified
BX3	 Flakney Creek Road west	Survey areas placed to capture variation
	 Flakney Creek Road east	
BX1, BX2	 High Rock Road – Box-Gum Woodland	Survey areas placed to capture variation

Patch	Surveyed area	Additional areas verified
		
	High Rock Road – Box-Gum Woodland	
		
	High Rock Road – Box-Gum Woodland	
S6, S24		
	High Rock Road – Dry Forest	

Patch	Surveyed area	Additional areas verified
	 High Rock Road – Dry Forest	
S21	 Access from High Rock Road towards Turbine 67 & Turbine 69	Access to Turbine 67 not verified but forest vegetation in the vicinity observed to be generally young and without hollows.
S2	 Turbine 20	All areas surveyed, including access track. No verification required.

Patch	Surveyed area	Additional areas verified
	 Turbine 17	
	 Turbine 31	
S4	 Turbine 32	Mixed age mature forest with high densities of HBTs at Turbine 32 will be the basis of extrapolation. No additional verification considered necessary.

Patch	Surveyed area	Additional areas verified
	 Turbine 38	
S3	 Turbine 133	 Turbine 19 (no longer part of current layout) – Only one or two trees that could potentially be hollow-bearing. Extrapolating from surveyed areas appropriate.
	 Turbine 132 (no longer part of current layout)	Forest vegetation in the vicinity observed to be of similar age class.

Patch	Surveyed area	Additional areas verified
S1	 Turbine 11	Mixed age mature forest with high density of HBTs at Turbine 11. Turbine 12 only other turbine in patch and in close proximity.
S5	 Turbine 45	All areas surveyed, no additional verification required.
	 Turbine 144	

Patch	Surveyed area	Additional areas verified
S9		
	Turbine 65	Track towards Turbine 147
		
	Turbine 68	
A1		All areas surveyed, no additional verification required.
	Turbine 66	

Patch	Surveyed area	Additional areas verified
S10		
	Turbine 150	Turbine 77
		
		Turbine 80
S25		Turbine and track to south surveyed as its own patch.
	Turbine 83	

Patch	Surveyed area	Additional areas verified
S11		
	Turbine 84	Turbine 86
		
	Turbine 143	
S22		Surveyed as its own patch.
	Turbine 90	

Patch	Surveyed area	Additional areas verified
S19	 Track/transmission line west of Turbine 87	Surveyed as its own patch.
S12	 Turbine 96	 Vegetation north of Turbine 95. Generally less mature in this area across to Turbine 94 so extrapolation from Turbine 96 is considered worst case.
S13	 Turbine 97	Separated out as its own patch

Patch	Surveyed area	Additional areas verified
S13		
	Turbine 98	Track to east of Turbine 101
		
	Turbine 99	Track to east of Turbine 101
		
	Turbine 101	

Patch	Surveyed area	Additional areas verified
S17	 Track south-west of Blakney Creek Road South	Surveyed as its own patch.
B1	 Turbine 4	 Track to east of Turbine 4

F.2 HOLLOW-BEARING TREE SURVEY DATA

									Average number of hollows by type (per tree)									Estimated number of hollows impacted								
Patch	Orientation	Density (HBTs/ha)	Area impacted (ha)	Area surveyed (ha)	No. HBTs impacted (surveyed)	No. HBTs impacted	Avg. DBH	Avg. Height	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure
A1	E		0.0	0.0	0	0.0																				
A1	N	2.3	0.9	0.9	2	2.0	70.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
A1	S		0.0	0.0	0	0.0																				
A1	W	0.0	0.2	0.2	0	0.0																				
A1	Tracks/trans	1.1	0.2	0.0	0	0.3												0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
A1 Total			**1.3**	**1.1**	**2**	**2.3**			**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.1**	**0.0**	**0.0**	**0.0**	**0.0**
A2	E		0.0	0.0	0	0.0																				
A2	N		0.0	0.0	0	0.0																				
A2	S		0.0	0.0	0	0.0																				
A2	W		0.0	0.0	0	0.0																				
A2	Tracks/trans	0.0	0.1	0.1	0	0.0																				
A2 Total			**0.1**	**0.1**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
B1	E	0.0	0.1	0.1	0	0.0																				
B1	N		0.0	0.0	0	0.0																				
B1	S		0.0	0.0	0	0.0																				
B1	W	0.0	0.2	0.1	0	0.0																				
B1	Tracks/trans	0.0	0.2	0.0	0	0.0																				
B1 Total			**0.6**	**0.2**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
B2	E		0.0	0.0	0	0.0																				
B2	N		0.0	0.0	0	0.0																				
B2	S		0.0	0.0	0	0.0																				
B2	W	10.1	0.4	0.4	4	4.0	52.5	11.8	0.5	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0
B2	Tracks/trans	10.1	0.0	0.0	0	0.0																				
B2 Total			**0.4**	**0.4**	**4**	**4.0**			**0.5**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.0**	**0.0**	**0.0**	**4.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
B3	E		0.0	0.0	0	0.0																				
B3	N		0.0	0.0	0	0.0																				
B3	S		0.0	0.0	0	0.0																				
B3	W		0.0	0.0	0	0.0																				
B3	Tracks/trans	2.5	2.5	0.4	1	6.4	110.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B3 Total			**2.5**	**0.4**	**1**	**6.4**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S1	E		0.0	0.0	0	0.0																				
S1	N		0.0	0.0	0	0.0																				
S1	S		0.0	0.0	0	0.0																				
S1	W	10.3	0.7	0.6	6	7.4	50.0	10.2	0.3	0.5	0.0	0.3	0.2	0.0	0.2	0.0	0.0	2.5	3.7	0.0	2.5	1.2	0.0	1.2	0.0	0.0
S1	Tracks/trans	0.0	0.1	0.1	0	0.0																				
S1 Total			**0.8**	**0.6**	**6**	**7.4**			**0.3**	**0.5**	**0.0**	**0.3**	**0.2**	**0.0**	**0.2**	**0.0**	**0.0**	**2.5**	**3.7**	**0.0**	**2.5**	**1.2**	**0.0**	**1.2**	**0.0**	**0.0**
S2	E	0.0	0.8	0.8	0	0.0																				
S2	N	0.0	0.2	0.2	0	0.0																				
S2	S	0.0	0.2	0.2	0	0.0																				
S2	W	0.0	0.7	0.7	0	0.0																				
S2	Tracks/trans	0.0	0.4	0.4	0	0.0																				
S2 Total			**2.3**	**2.3**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S3	E		0.0	0.0	0	0.0																				
S3	N	0.0	0.0	0.0	0	0.0																				
S3	S	0.0	0.1	0.1	0	0.0																				
S3	W	0.0	0.5	0.3	0	0.0																				
S3	Tracks/trans	0.0	5.4	0.2	0	0.0																				
S3 Total			**6.0**	**0.6**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S4	E	5.3	0.8	0.8	4	4.3	41.3	13.0	0.3	0.3	0.0	0.8	0.0	0.0	0.0	0.0	0.0	1.1	1.1	0.0	3.2	0.0	0.0	0.0	0.0	0.0
S4	N		0.0	0.0	0	0.0																				
S4	S		0.0	0.0	0	0.0																				
S4	W	11.6	1.6	0.5	6	18.4	55.8	12.3	0.2	0.8	0.2	0.3	0.2	0.2	0.0	0.0	0.0	3.1	15.4	3.1	6.1	3.1	3.1	0.0	0.0	0.0
S4	Tracks/trans	8.5	1.1	0.1	0	9.0												1.9	4.9	0.8	4.9	0.8	0.8	0.0	0.0	0.0
S4 Total			**3.5**	**1.3**	**10**	**31.8**			**0.4**	**1.1**	**0.2**	**1.1**	**0.2**	**0.2**	**0.0**	**0.0**	**0.0**	**6.0**	**21.3**	**3.8**	**14.3**	**3.8**	**3.8**	**0.0**	**0.0**	**0.0**

									Average number of hollows by type (per tree)									Estimated number of hollows impacted								
Patch	Orientation	Density (HBTs/ha)	Area impacted (ha)	Area surveyed (ha)	No. HBTs impacted (surveyed)	No. HBTs impacted	Avg. DBH	Avg. Height	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure
S5	E	3.2	0.3	0.3	1	1.0	90.0	9.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S5	N	20.3	0.6	0.6	12	12.0	56.3	10.3	0.9	0.5	0.1	0.3	0.2	0.3	0.1	0.0	0.0	11.0	6.0	1.0	3.0	2.0	3.0	1.0	0.0	0.0
S5	S	1.4	0.7	0.7	1	1.0	75.0	20.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S5	W	0.0	0.4	0.2	0	0.0																				
S5	Tracks/trans	0.0	0.5	0.2	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S5 Total			**2.5**	**2.1**	**14**	**14.0**			**0.9**	**2.5**	**0.1**	**0.3**	**0.2**	**0.3**	**0.1**	**0.0**	**0.0**	**11.0**	**8.0**	**1.0**	**3.0**	**2.0**	**3.0**	**1.0**	**0.0**	**0.0**
S6	E		0.0	0.0	0	0.0																				
S6	N		0.0	0.0	0	0.0																				
S6	S		0.0	0.0	0	0.0																				
S6	W		0.0	0.0	0	0.0																				
S6	Tracks/trans	0.7	1.5	1.5	1	1.0	150.0	18.0	1.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
S6 Total			**1.5**	**1.5**	**1**	**1.0**			**1.0**	**1.0**	**0.0**	**0.0**	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**1.0**	**0.0**	**0.0**	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**
S7	E		0.1	0.0	0	0.0																				
S7	N		0.0	0.0	0	0.0																				
S7	S		0.0	0.0	0	0.0																				
S7	W	25.4	0.8	0.8	20	20.9	73.4	14.8	0.2	0.3	0.4	0.5	0.3	0.2	0.1	0.1	0.1	3.1	5.2	7.3	9.4	6.3	4.2	2.1	2.1	1.0
S7	Tracks/trans	25.4	1.8	0.0	0	46.2												6.9	11.5	16.2	20.8	13.9	9.2	4.6	4.6	2.3
S7 Total			**2.8**	**0.8**	**20**	**67.1**			**0.2**	**0.3**	**0.4**	**0.5**	**0.3**	**0.2**	**0.1**	**0.1**	**0.1**	**10.1**	**16.8**	**23.5**	**30.2**	**20.1**	**13.4**	**6.7**	**6.7**	**3.4**
S8	E		0.1	0.0	0	0.0																				
S8	N	7.4	1.1	0.4	3	8.3	95.0	15.3	0.3	0.0	0.0	0.3	0.7	0.0	0.0	0.0	0.0	2.8	0.0	0.0	2.8	5.5	0.0	0.0	0.0	0.0
S8	S	4.9	0.7	0.4	2	3.4	55.0	14.5	0.5	0.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0	1.7	1.7	0.0	5.0	0.0	0.0	0.0	0.0	0.0
S8	W		0.6	0.0	0	0.0																				
S8	Tracks/trans	6.1	1.3	0.0	0	7.9												3.3	2.0	0.0	7.3	2.6	0.0	0.0	0.0	0.0
S8 Total			**3.8**	**0.8**	**5**	**19.6**			**0.8**	**0.5**	**0.0**	**1.8**	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**	**7.8**	**3.7**	**0.0**	**15.1**	**8.2**	**0.0**	**0.0**	**0.0**	**0.0**
S9	E	38.1	0.0	0.0	1	1.0	130.0	19.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S9	N	9.2	0.4	0.4	4	4.0	88.8	17.8	0.3	1.0	0.0	0.3	0.3	0.0	0.3	0.0	0.0	1.0	4.0	0.0	1.0	1.0	0.0	1.0	0.0	0.0
S9	S	1.3	0.7	0.7	1	1.0	130.0	18.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
S9	W	5.2	0.2	0.2	1	1.0	110.0	19.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
S9	Tracks/trans	13.4	1.7	0.0	0	23.0												1.4	11.5	0.0	7.2	1.4	5.7	1.4	0.0	0.0
S9 Total			**3.1**	**1.4**	**7**	**30.0**			**0.3**	**2.0**	**0.0**	**1.3**	**0.3**	**1.0**	**0.3**	**0.0**	**0.0**	**2.4**	**16.5**	**0.0**	**9.2**	**2.4**	**6.7**	**2.4**	**0.0**	**0.0**
S10	E	0.0	1.5	1.2	0	0.0																				
S10	N	0.0	2.6	0.2	0	0.0																				
S10	S	0.0	0.2	0.2	0	0.0																				
S10	W	0.0	0.8	0.6	0	0.0																				
S10	Tracks/trans	0.0	14.9	0.3	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S10 Total			**19.9**	**2.5**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S11	E	7.1	1.1	0.4	3	7.6	45.0	14.0	0.0	0.0	0.0	1.0	0.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	7.6	5.1	0.0	0.0	0.0	5.1
S11	N	3.1	2.5	0.6	2	7.8	42.5	10.5	0.5	0.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0	3.9	3.9	0.0	3.9	3.9	0.0	0.0	0.0	0.0
S11	S	0.0	1.0	0.4	0	0.0																				
S11	W	0.0	0.7	0.7	0	0.0																				
S11	Tracks/trans	28.9	0.9	0.0	1	24.9	50.0	13.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	6.2	6.2	0.0	18.7	14.5	0.0	0.0	0.0	8.3
S11 Total			**6.2**	**2.2**	**6**	**40.3**			**0.5**	**0.5**	**0.0**	**1.5**	**2.2**	**0.0**	**0.0**	**0.0**	**0.7**	**10.1**	**10.1**	**0.0**	**30.2**	**23.5**	**0.0**	**0.0**	**0.0**	**13.4**
S12	E	0.0	0.6	0.6	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S12	N	8.0	0.3	0.2	2	2.2	70.0	15.5	0.5	0.5	0.0	1.0	0.0	0.0	0.5	0.0	0.0	1.1	1.1	0.0	2.2	0.0	0.0	1.1	0.0	0.0
S12	S		0.0	0.0	0	0.0																				
S12	W	2.8	0.4	0.4	1	1.0	60.0	13.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
S12	Tracks/trans	3.6	9.0	0.0	0	32.6												8.2	8.2	0.0	32.6	0.0	0.0	8.2	0.0	0.0
S12 Total			**10.2**	**1.2**	**3**	**35.8**			**0.5**	**0.5**	**0.0**	**2.0**	**0.0**	**0.0**	**0.5**	**0.0**	**0.0**	**9.2**	**9.2**	**0.0**	**35.8**	**0.0**	**0.0**	**9.2**	**0.0**	**0.0**
S13	E	0.0	0.6	0.6	0	0.0																				
S13	N		0.0	0.0	0	0.0																				
S13	S		0.0	0.0	0	0.0																				
S13	W	0.0	0.8	0.8	0	0.0																				
S13	Tracks/trans	0.0	10.3	0.3	0	0.0																				
S13 Total			**11.7**	**1.7**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

									Average number of hollows by type (per tree)									Estimated number of hollows impacted								
Patch	Orientation	Density (HBTs/ha)	Area impacted (ha)	Area surveyed (ha)	No. HBTs impacted (surveyed)	No. HBTs impacted	Avg. DBH	Avg. Height	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure
S14	E		0.0	0.0	0	0.0																				
S14	N		0.0	0.0	0	0.0																				
S14	S		0.0	0.0	0	0.0																				
S14	W	35.8	0.1	0.1	5	5.0	52.0	8.0	0.4	0.8	0.0	0.0	0.4	0.0	0.0	0.0	0.0	2.0	4.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
S14	Tracks/trans	35.8	3.1	0.0	0	110.2												44.1	88.2	0.0	0.0	44.1	0.0	0.0	0.0	0.0
S14 Total			**3.2**	**0.1**	**5**	**115.2**			**0.4**	**0.8**	**0.0**	**0.0**	**0.4**	**0.0**	**0.0**	**0.0**	**0.0**	**46.1**	**92.2**	**0.0**	**0.0**	**46.1**	**0.0**	**0.0**	**0.0**	**0.0**
S15	E	28.2	0.7	0.3	8	20.3	44.4	12.1	0.4	0.5	0.0	0.4	0.3	0.0	0.0	0.0	0.0	7.6	10.2	0.0	7.6	5.1	0.0	0.0	0.0	0.0
S15	N		0.0	0.0	0	0.0																				
S15	S	34.3	0.1	0.1	3	3.0	56.7	11.0	1.0	0.3	0.0	0.3	0.0	0.0	0.0	0.3	0.0	3.0	1.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0
S15	W	19.7	1.1	1.1	21	21.0	48.8	12.1	0.5	0.3	0.0	0.4	0.2	0.0	0.0	0.0	0.0	10.0	7.0	0.0	9.0	4.0	0.0	0.0	0.0	0.0
S15	Tracks/trans	11.3	2.6	0.4	4	29.9	58.8	10.3	0.5	0.3	0.0	0.3	0.0	0.0	0.3	0.0	0.0	14.9	7.5	0.0	7.5	0.0	0.0	7.5	0.0	0.0
S15 Total			**4.5**	**1.8**	**36**	**74.2**			**2.4**	**1.4**	**0.0**	**1.4**	**0.4**	**0.0**	**0.3**	**0.3**	**0.0**	**35.6**	**25.6**	**0.0**	**25.1**	**9.1**	**0.0**	**7.5**	**1.0**	**0.0**
S16	E	0.0	0.3	0.3	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S16	N	0.0	0.6	0.6	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S16	S		0.0	0.0	0	0.0																				
S16	W	0.0	0.3	0.3	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S16	Tracks/trans	0.0	1.5	0.0	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S16 Total			**2.7**	**1.2**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S17	E		0.0	0.0	0	0.0																				
S17	N		0.0	0.0	0	0.0																				
S17	S		0.0	0.0	0	0.0																				
S17	W		0.0	0.0	0	0.0																				
S17	Tracks/trans	0.0	0.4	0.3	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S17 Total			**0.4**	**0.3**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S18	E		0.0	0.0	0	0.0																				
S18	N		0.0	0.0	0	0.0																				
S18	S		0.0	0.0	0	0.0																				
S18	W		0.0	0.0	0	0.0																				
S18	Tracks/trans	9.0	0.9	0.3	3	7.7	68.3	15.3	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	2.6	0.0	0.0	2.6	0.0	0.0	2.6	0.0
S18 Total			**0.9**	**0.3**	**3**	**7.7**			**0.0**	**0.3**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**2.6**	**0.0**	**0.0**	**2.6**	**0.0**	**0.0**	**2.6**	**0.0**
S19	E		0.0	0.0	0	0.0																				
S19	N		0.0	0.0	0	0.0																				
S19	S		0.0	0.0	0	0.0																				
S19	W		0.0	0.0	0	0.0																				
S19	Tracks/trans	0.0	3.9	3.9	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S19 Total			**3.9**	**3.9**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S20	E	0.0	0.2	0.2	0	0.0																				
S20	N		0.0	0.0	0	0.0																				
S20	S		0.0	0.0	0	0.0																				
S20	W		0.0	0.0	0	0.0																				
S20	Tracks/trans	0.0	2.2	0.3	0	0.0																				
S20 Total			**2.4**	**0.4**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S21	E		0.0	0.0	0	0.0																				
S21	N		0.0	0.0	0	0.0																				
S21	S		0.0	0.0	0	0.0																				
S21	W		0.0	0.0	0	0.0																				
S21	Tracks/trans	0.0	1.6	0.4	0	0.0																				
S21 Total			**1.6**	**0.4**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
S22	E	4.2	0.2	0.2	1	1.0	80.0	18.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
S22	N	2.2	2.3	2.3	5	5.0	92.0	16.2	0.4	0.0	0.0	0.6	0.4	0.2	0.0	0.0	0.0	2.0	0.0	0.0	3.0	2.0	1.0	0.0	0.0	0.0
S22	S	0.0	0.1	0.1	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S22	W		0.0	0.0	0	0.0																				
S22	Tracks/trans	2.1	2.3	0.0	0	4.8												1.0	0.0	0.0	3.8	1.0	0.5	0.0	0.0	0.0
S22 Total			**4.9**	**2.6**	**6**	**10.8**			**0.4**	**0.0**	**0.0**	**1.6**	**0.4**	**0.2**	**0.0**	**0.0**	**0.0**	**3.0**	**0.0**	**0.0**	**7.8**	**3.0**	**1.5**	**0.0**	**0.0**	**0.0**

									Average number of hollows by type (per tree)									Estimated number of hollows impacted								
Patch	Orientation	Density (HBTs/ha)	Area impacted (ha)	Area surveyed (ha)	No. HBTs impacted (surveyed)	No. HBTs impacted	Avg. DBH	Avg. Height	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure	Small limb	Medium limb	Large limb	Small trunk	Medium trunk	Large trunk	Small fissure	Medium fissure	Large fissure
S23	E	13.3	0.1	0.1	1	1.0	45.0	6.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
S23	N		0.0	0.0	0	0.0																				
S23	S	3.3	2.4	2.4	8	8.0	63.1	11.5	0.8	0.5	0.0	0.0	0.3	0.0	0.0	0.0	0.0	6.0	4.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0
S23	W	31.1	0.1	0.1	2	2.0	75.0	15.5	0.5	1.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	1.0	2.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0
S23	Tracks/trans	15.9	14.6	0.0	0	231.9												96.6	115.9	0.0	0.0	135.3	38.6	0.0	0.0	0.0
S23 Total			**17.1**	**2.5**	**11**	**242.9**			**1.3**	**1.5**	**0.0**	**0.0**	**1.8**	**0.5**	**0.0**	**0.0**	**0.0**	**103.6**	**121.9**	**0.0**	**0.0**	**139.3**	**39.6**	**0.0**	**0.0**	**0.0**
S24	E		0.0	0.0	0	0.0																				
S24	N		0.0	0.0	0	0.0																				
S24	S		0.0	0.0	0	0.0																				
S24	W		0.0	0.0	0	0.0																				
S24	Tracks/trans	1.4	1.4	1.4	2	2.0	70.0	14.5	1.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	2.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0
S24 Total			**1.4**	**1.4**	**2**	**2.0**			**1.0**	**0.0**	**0.0**	**0.5**	**0.5**	**0.0**	**0.0**	**0.0**	**0.5**	**2.0**	**0.0**	**0.0**	**1.0**	**1.0**	**0.0**	**0.0**	**0.0**	**1.0**
S25	E	1.4	0.7	0.7	1	1.0	100.0	13.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S25	N		0.0	0.0	0	0.0																				
S25	S	1.0	1.0	1.0	1	1.0	90.0	12.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0
S25	W	4.1	0.2	0.2	1	1.0	120.0	13.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
S25	Tracks/trans	0.0	0.6	0.1	0	0.0												0.6	0.0	0.0	0.9	0.0	0.0	0.3	0.0	0.0
S25 Total			**2.6**	**2.0**	**3**	**3.0**			**2.0**	**0.0**	**0.0**	**3.0**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**2.6**	**0.0**	**0.0**	**3.9**	**0.0**	**0.0**	**1.3**	**0.0**	**0.0**
S26	E	14.3	0.1	0.1	2	2.0	70.0	12.5	0.5	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0
S26	N	0.0	0.0	0.0	0	0.0																				
S26	S		0.0	0.0	0	0.0																				
S26	W		0.0	0.0	0	0.0																				
S26	Tracks/trans	7.1	0.0	0.0	0	0.0																				
S26 Total			**0.1**	**0.1**	**2**	**2.0**			**0.5**	**0.0**	**0.5**	**0.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**0.0**	**1.0**	**1.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
BX1	E		0.0	0.0	0	0.0																				
BX1	N		0.0	0.0	0	0.0																				
BX1	S		0.0	0.0	0	0.0																				
BX1	W		0.0	0.0	0	0.0																				
BX1	Tracks/trans	2.0	1.5	1.5	3	3.0	81.7	13.0	0.3	0.3	0.0	1.3	0.3	0.0	0.0	0.3	0.0	1.0	1.0	0.0	4.0	1.0	0.0	0.0	1.0	0.0
BX1 Total			**1.5**	**1.5**	**3**	**3.0**			**0.3**	**0.3**	**0.0**	**1.3**	**0.3**	**0.0**	**0.0**	**0.3**	**0.0**	**1.0**	**1.0**	**0.0**	**4.0**	**1.0**	**0.0**	**0.0**	**1.0**	**0.0**
BX2	E		0.0	0.0	0	0.0																				
BX2	N		0.0	0.0	0	0.0																				
BX2	S		0.0	0.0	0	0.0																				
BX2	W		0.0	0.0	0	0.0																				
BX2	Tracks/trans	0.0	0.3	0.3	0	0.0												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BX2 Total			**0.3**	**0.3**	**0**	**0.0**			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
BX3	E		0.0	0.0	0	0.0																				
BX3	N		0.0	0.0	0	0.0																				
BX3	S		0.0	0.0	0	0.0																				
BX3	W		0.0	0.0	0	0.0																				
BX3	Tracks/trans	0.7	1.5	1.4	1	1.1	140.0	18.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0
BX3 Total			**1.5**	**1.4**	**1**	**1.1**			**0.0**	**1.0**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.1**	**0.0**	**0.0**	**1.1**	**0.0**	**0.0**	**0.0**	**0.0**
Cumulative Total			**128.2**	**41.6**	**151.0**	**723.0**												**256.9**	**334.7**	**29.3**	**187.0**	**267.5**	**68.1**	**29.4**	**11.3**	**17.8**
																		Total Number of Hollows:			**1202**					

APPENDIX G THREATENED SPECIES HABITAT EVALUATION

The tables in this attachment present the habitat evaluation for additional threatened species, ecological communities and endangered populations (compared to the searches conducted for the original BA for the proposal) returned from database searches undertaken as described in Section 3.5. The likelihood of occurrence is based on presence of habitat, proximity of nearest records and mobility of the species (where relevant). The assessment of potential impact is based on the nature of the proposal, the ecology of the species and its likelihood of occurrence. The following classifications are used:

Presence of habitat

Present: Potential or known habitat is present within the project area

Marginal: Habitat present is not typical but may be suitable, or habitat type is suitable but condition and microhabitat requirements of species are not present

Absent: No potential or known habitat is present within the project area

Likelihood of occurrence

None: Species known or predicted within the locality but no suitable habitat present within the study area

Unlikely: Species known or predicted within the locality. Suitable habitat may be present in the study area but the proximity of nearest records suggest it is unlikely to occur

Possible: Suitable habitat present and the species could occur in the study area based on the proximity of nearest records

Present: Species was recorded during the field investigations

Potential for impact

No: The proposal would not result in an impact to this species. No Assessment of Significance is necessary for this species

Low: The proposal is unlikely to result in an impact to this species. No Assessment of Significance is necessary for this species

Moderate: The proposal could impact this species or its habitats. This species is considered further in this assessment. The risk to this species is considered manageable and an AoS is not considered necessary

High: The proposal is likely to impact this species or its habitats. An AOS has been applied to these entities

Information on habitat is sourced from species profiles on the NSW OEH threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

FLORA

Species and Status	Ecology and distribution[3]	Presence of habitat	Likelihood of occurrence	Potential to be impacted?	Assessment of Significance?
Forbs					
Omeo Stork's-bill ***Pelargonium sp.* (G.W. Carr 10345) Syn. *P. striatellum*** **E – TSC** **E - EPBC**	Currently known to occur at four localities in the Southern Tablelands, at altitudes ranging from 680-1030m a.s.l.: Lake Bathurst near Goulburn, on grazing leasehold; two sites (one probably extinct) on private grazing properties south-west of Cooma; and at Maffra Lake near Dalgety in a fenced Travelling Stock Reserve assessed as having high conservation values. A terrestrial plant with a narrow habitat just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the paludal and aquatic communities. It colonises exposed lake beds during dry periods.	Absent	None	No	No

[3] Information sourced from species profiles on NSW DECCW's threatened species database or the Australian Government's Species Profiles and Threats database (SPRAT) unless otherwise stated.

DECCW threatened species database: http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Species and Status	Ecology and distribution[3]	Presence of habitat	Likelihood of occurrence	Potential to be impacted?	Assessment of Significance?
Orchids					
A Leek-orchid **Prasophyllum sp. Wybong** **CE - EPBC**	A perennial orchid, appearing as a single leaf over winter and spring. The species flowers in spring and dies back to a tuber over summer and autumn. Leek orchids are generally found in shrubby and grassy habitats in dry to wet soil. Prasophyllum sp. Wybong (C. Phelps ORG 5269) is known to occur in open eucalypt woodland and grassland.	Present	Unlikely (only known population over 200km north)	No	No

FAUNA

Species and Status	Ecology and distribution[3]	Presence of habitat	Likelihood of occurrence	Potential to be impacted?	AoS?
Amphibians					
Growling Grass frog ***Litoria raniformis*** **E - TSC** **V -EPBC**	In NSW the species was once distributed along the Murray and Murrumbidgee Rivers and their tributaries, the southern slopes of the Monaro district and the central southern tablelands as far north as Tarana, near Bathurst. Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat.	Marginal, farm dams and reed lined minor waterways	Unlikely, all records south and west of the site over 50km away	Low	No

Species and Status	Ecology and distribution[3]	Presence of habitat	Likelihood of occurrence	Potential to be impacted?	AoS?
Yellow-spotted Tree Frog ***Litoria castanea*** **CE - TSC** **E - EPBC**	There is only a single known population of the Yellow-Spotted Bell Frog, which occurs on the Southern Tablelands. Lives in large permanent ponds or slow flowing streams with plenty of emergent vegetation such as bulrushes.	Present within Blakney Creek	Known to occur in Blakney Creek	Moderate. Tracks are proposed that would require crossings across Blakney Creek and its tributaries	No, impacts are manageable
Birds					
Australian Bustard ***Ardeotis australis*** **E-TSC**	Mainly occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover.	Absent	Unlikely, all records west of the site over 100km away	None	No
Black Bittern ***Ixobrychus flavicollis*** **V - TSC**	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Marginal, farm dams and reed lined minor waterways	Unlikely, all records coastal in the region	None	No

Species and Status	Ecology and distribution[3]	Presence of habitat	Likelihood of occurrence	Potential to be impacted?	AoS?
Black Falcon ***Falco subniger*** **V - TSC**	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population. Occurs on plains, foothills, timbered watercourses, wetlands, agricultural lands and occasionally over towns and cities.	Present	Possible although not recorded within 30km	Low. Not recorded in the locality. No breeding habitat identified and highly mobile species.	No
Mammals (microbats)					
Corben's Long-eared Bat ***Nyctophilus corbeni*** **V – TSC** **V - EPBC**	Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, Bulloke *Allocasuarina luehmannii* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.	Present	Unlikely, nearest records over 100km away	Low	No
Mammals (other)					
Boodie, Burrowing Bettong (mainland) ***Bettongia lesueur graii*** **PX – TSC** **X - EPBC**	The Burrowing Bettong was once common over a range that encompassed nearly half of Australia, including most of Western Australia (with the exception of the north Kimberley), South Australia, Queensland, western New South Wales and the Victorian mallee. The Boodie once lived in a range of dry subtropical and tropical habitats, from open *Eucalyptus* and *Acacia* woodlands to arid spinifex grasslands. In its current range on the islands, it seems to prefer open *Triodia* (spinifex) and dune habitats, but will burrow anywhere except places with rocky substrate.	Present	None, species presumed extinct and not recorded on the mainland since 1940	None	No

Species and Status	Ecology and distribution[3]	Presence of habitat	Likelihood of occurrence	Potential to be impacted?	AoS?
Brush-tailed Rock-wallaby ***Petrogale penicillata*** **E – TSC** **V - EPBC**	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north.	Absent	Unlikely, suitable habitat not present	None	No
New Holland Mouse ***Pseudomys novaehollandiae*** **V – TSC**	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes.	Marginal, open woodlands but lacking heathy understorey	Unlikely, nearest records over 100km eat and north of the site	None	No
Fish					
Southern Pygmy Perch ***Nannoperca australis*** **V - FM**	The Southern Pygmy Perch is found in well-vegetated, slow-flowing or still waters including streams, lakes, billabongs and other types of wetlands. Recently discovered in Blakney Creek and released into Pudman Creek which traverse the proposal site.	Present	Known to occur within Pudman Creek and Blakney Creek which crosses	Moderate. Tracks are proposed that would require crossings across Blakney Creek and its tributaries known to contain the species	No, impacts are manageable