### **APPENDIX A1: FIELD SURVEY REPORT – WOLLOMBI STATION**

Please refer to pdf file supplied separately.



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# BYERWEN COAL PROJECT STAGE 1 OFFSET ASSESSMENT

**Byerwen Coal Pty Ltd** 

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# Symbols and Abbreviations

# **1** Introduction

The Byerwen Coal Project (the project) is located approximately 20 km northwest of Glenden and 140 km west of Mackay in central Queensland. The project proposes to develop an open-cut mine to extract high quality hard coking coal for export overseas. The project will require water supply via a pipeline from the Burdekin-Moranbah Pipeline, a power supply upgrade, and rail facilities allowing transport of coal to the coal export terminal at the Port of Abbot Point near Bowen.

The project covers an area of approximately 20,993 ha over six Mining Leases (MLs): 10355 (application), 10356 (application), 10357 (application), 70434 (application), 70435 (granted) and 70436 (application). Impacts are proposed to occur over several stages over the 50 year project life. Offsets will be delivered in a staged approach with Stage 1 offsets addressing impacts across parts of MLs 70434, 70435 and 70436 and 388.6 ha of remnant vegetation. This assessment considers impacts and offsets for Stage 1 of the project only (Figure 1).

Residual impacts from the construction and operation of the project require that unavoidable and significant impacts to matters of national environmental significance (MNES) and state significant biodiversity values (SSBV) are offset. These matters have been described in the *Byerwen Coal Project: Biodiversity Offset Strategy* (BOS) (Earthtrade, 2015).

The Australian Government determined the overall project to be a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The controlling provisions for which offsets are required are:

- threatened ecological community Brigalow (Acacia harpophylla dominant and co-dominant)
- threatened ecological community Semi-evergreen Vine Thickets of the Brigalow Belt (North and South) and Nandewar Bioregions
- threatened ecological community Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
- threatened fauna species Ornamental Snake (*Denisonia maculata*)
- threatened fauna species Squatter Pigeon (southern) (*Geophaps scripta scripta*).

Offsets were not required for migratory species or the Black-throated Finch under the approval.

Two offset policies are relevant to the project, the:

- EPBC Act Environmental Offsets Policy (EOP) (SEWPaC, 2012)
- *Queensland Biodiversity Offset Policy* (QBOP) (DERM, 2011a).

However, the project has been declared a 'coordinated project' under the Queensland *State Development and Public Works Organisation Act 1971* and as

such it is at the discretion of the Queensland Coordinator-General as to the applicability of the QBOP to this project.

The Coordinator-General will not require additional offsets to those approved under the EOP if they offset impacts to SSBV. Additional offsets for impacts to SSBV, not accounted for by the MNES offsets, will require approval by the Queensland regulator (Earthtrade, 2015).

The majority of SSBV are also MNES and will therefore be offset under the EOP. These and additional offsets required under QBOP are assessed in this report. The relevant MNES and SSBV that require offsetting for Stage 1 are discussed in Sections 1.2 and 2.

### **1.1** Scope of works

The BOS that has been developed for the Byerwen Coal Project requires the development of a biodiversity offset management plan (BOMP) in order to satisfy both Australian Government and Queensland Government approval conditions. The assessment undertaken as part of this scope of works will assist in development of the BOMP. Vegetation assessment work that was undertaken in 2009, 2010 and 2011 has been used to support the completion of the environmental impact assessment process and an amendment to the regional ecosystem (RE) mapping via the Property Map of Assessable Vegetation (PMAV) process for the mine project area.

The purpose of this report is to assess the Stage 1 project impacts on Commonwealth and State environmental values (MNES and SSBV respectively) based on the field-validated vegetation mapping, regulated vegetation management mapping and offset areas proposed in the BOS. An assessment using the relevant Commonwealth or State methodology has been completed for both the impact and offset areas and is presented in Sections 2 and 3 of this report. This information will confirm the suitability of proposed offset areas for the project.

A revised Stage 1 impact area has been finalised for the project, whereby, a number of remnant vegetation polygons identified in the BOS have now been excluded from the impact area as they are either no longer shown as regulated vegetation on the DNRM regulated vegetation management map or are now outside the impact area. There are no new areas proposed to be impacted as part of Stage 1 (i.e. Stage 1 as shown in the approved Earthtrade (2015) BOS has not increased in extent). The Stage 1 assessment area and remnant vegetation impacted is shown in Figure 1.

### **1.2 Biodiversity offset strategy**

The current BOS for the project was prepared in 2015 (Earthtrade, 2015) and identified a number of MNES and SSBV to be offset in the Stage 1 mine impact area (as proposed at that time). The BOS was approved by the Queensland Government Office of the Coordinator-General on 3 December 2015. The approved matters are presented in Table 1.

Environmental Values (MNES & SSBV)	Impacted RE and vegetation management class (VM Act)	BVG 1M	Area (ha)	Possible co- location
MNES				
Brigalow (Acacia harpophylla dominant and co-dominant) threatened ecological community (TEC)	11.3.1 (E) 11.4.8 (E) 11.4.9 (E)	25a	40.3	Can be co-located with Ornamental Snake
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions TEC	11.8.13 (E)	7a	83.2	Can be co-located with Ornamental Snake
Ornamental Snake	11.3.1 (E),	25a	4.7	Can be co-located
(Denisonia maculata)	11.4.2 (OC)	17a	115.7	with Brigalow and
	11.4.8 (E)	25a	11.1	Squatter Pigeon (in
	11.4.9 (E)	25a	24.5	part)
	11.8.5 (LC)	11a	99.6	
	11.8.13 (E)	7a	83.2	
Squatter Pigeon (southern)	11.3.2 (OC)	17a	4.2	Can be co-located
(Geophaps scripta scripta)	11.7.4 (LC)	12a	111.7	with Ornamental Snake
Additional SSBV	1			
Of concern REs	11.9.7a (OC)	17a	7.1	Can be co-located with EOP Ornamental Snake and Squatter Pigeon offsets
Watercourses	Remnant vegetation within 50m of defined watercourses	n/a	8.1	Can potentially be co-located with TECs or habitat for protected wildlife
Connectivity (reduction of core remnant areas)	various	n/a	241.7	Offsets for MNES will consist of remnant vegetation that will have an area greater than 250 ha and this will achieve the State requirements
Black-throated Finch (southern) ( <i>Poephila cincta</i> <i>cincta</i> ) (likely to occur)	Based on remnant grassy woodland vegetation within 1 km of permanent water bodies	n/a	214.1	Can be co-located with EOP Squatter Pigeon offsets
Common Death Adder	11.3.1 (E)	25a	4.7	Can be co-located
( <i>Acanthophis antarcticus</i> ) (likely to occur)	11.7.4 (LC)	12a	111.7	with EOP Brigalow and Squatter Pigeon offsets

# Table 1: Stage 1 impacts to MNES and SSBV identified in the BOS (Earthtrade, 2015)

Environmental Values (MNES & SSBV)	Impacted RE and vegetation management class (VM Act)	BVG 1M	Area (ha)	Possible co- location
Australian Painted Snipe ( <i>Rostratula australis</i> ) (likely to occur)	11.3.2 (OC)	17a	4.2	Can be co-located with EOP Ornamental Snake and Squatter Pigeon offsets
Essential habitat for the Ornamental Snake	Based on historical records	n/a	51.0	Can be co-located with EOP Ornamental Snake offsets

VM Act (Vegetation Management Act 1999): (E) = Endangered RE, (OC) = Of concern RE, (LC) = Least concern RE

The assessment of the impact area that was used to guide the BOS was based on Queensland Herbarium RE mapping and studies completed for the Environmental Impact Statement (EIS) for the Byerwen Coal Project (Environmental and Licensing Professionals, 2013).

Fieldwork completed by Ecological Survey & Management in September 2015 found numerous discrepancies in the mapping of vegetation communities in the Stage 1 impact area (Figure 2). These findings are detailed further in Section 2, which presents the survey results for the impact area.

The BOS identified several potential offset options in the vicinity of the project area. One of these is considered as part of this assessment and is referred to in the BOS and this document as the Wollombi Station offset area (Lot 1 on SP278043).

Ecological Survey & Management assessed the Stage 1 offset area in the field in September 2015 and December 2015 to validate remnant RE mapping and correlate this mapping with relevant fauna habitat and environmental matters to be offset. The results of this assessment are provided in Section 3.

The BOS outlines in Section 3.3 that a major difference between the EOP and QBOP is in the differing requirements of each regarding the use of remnant vegetation. The EOP allows use of remnant vegetation, whereas QBOP does not. However, the most current Queensland offset policy, the *Queensland Environmental Offsets Policy* (QEOP) (EHP, 2014a) allows an offset to use remnant vegetation where suitable. Based on this current position by the Queensland Government, and the opportunity to use remnant vegetation to co-locate State and Commonwealth offsets, a mix of remnant and non-remnant vegetation is proposed to offset State matters.

### 1.3 Methodology

The MNES and SSBV that require offsetting due to the impacts of the project and identified in the BOS were re-calculated following the 2015 surveys and based on the revised mine plan, which was finalised in 2016. The revised impacts are presented in Tables 2 and 3. Sections 1.3.1 to 1.3.3 describe the 2015 field

surveys that resulted in the recalculation of areas requiring offsets in the Stage 1 impact area.

### 1.3.1 Field survey

A seven-day field survey was conducted between and including 24 and 30 August and 5 September 2015 to assess both the impact area and proposed Wollombi offset area. A survey of additional areas in the north of the Wollombi offset area adjacent to the Suttor River was conducted on 23 December 2015.

The field survey encompassed a broad investigation area. A total of 109 vegetation assessment sites were conducted and comprised: 50 detailed survey plots, 26 Tertiary assessment sites and 33 Quaternary assessment sites. An additional 30 Quaternary photo point sites were also included in the survey assessment (Figures 2 and 4). A total of 17 detailed survey plots were conducted in the polygons of remnant vegetation that are to be impacted by the finalised Stage 1 mine plan.

In order to facilitate the assessment of the potential offset liability the vegetation communities occurring in the finalised Stage 1 impact area that were representative of, or supported, a significant environmental matter were assessed using the *Guide to determining terrestrial habitat quality: a toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.1* (EHP, 2014b). This methodology is largely based on the *Ecological Equivalence Methodology (EEM) Version 1: Policy for Vegetation Management Offsets, Biodiversity Offset Policy* and therefore the data was used to develop an EEM score for each of the remnant REs, required under the QBOP (DERM, 2011b). Data collected as part of the 17 detailed survey plots is provided in Appendix A and plots are shown on Figure 2.

The composition, structure and remnant status of smaller polygons of remnant vegetation, i.e. too small to undertake a habitat quality plot, were assessed using a combination of tertiary or quaternary level vegetation assessment sites as defined by the Queensland Herbarium's *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2* (Neldner et al., 2012). This data was compared with data collated at the EEM plot(s) in the same vegetation type and a judgement made as to whether the habitat quality score could be applied to this polygon.

### **1.3.2** Threatened species habitat searches

The likelihood of occurrence of threatened flora and fauna along with their habitats were assessed through searches of likely habitat as well as opportunistic searches during foot and vehicular traverses.

### **1.3.3 Ecological equivalence scoring and determination of offset** *liabilities*

Impacts to MNES were assessed with reference to the EPBC Act EOP and using the *EPBC Act Offset Assessment Guide* to calculate the offset area required for each MNES.

Impacts to SSBV were assessed largely with reference to the QBOP. In both processes EEM scores and parameters established through field survey were considered when applying quality scores to the impact and offset areas.

This process was applied to the proposed Wollombi offset area that was presented in the BOS. The data collected was used to determine the suitability and size of the proposed offset area required to adequately offset MNES and SSBV identified in the finalised Stage 1 impact area.

# 2 Impact area survey results

### 2.1 Remnant regional ecosystems

The field surveys undertaken in 2015 identified discrepancies in the vegetation mapping presented in the EIS and BOS (Figure 2). These included:

- The various distributions of least concern RE 11.8.5 in the northern portion of Stage 1 were instead found to be representative of least concern RE 11.7.4 and, to a lesser extent, of concern RE 11.4.2 and non-remnant vegetation.
- The polygon of endangered SEVT RE 11.8.13 mapped in the centre of the Stage 1 impact area was found to be incorrect and instead is representative of endangered RE 11.4.9, which is considered a component of the Brigalow TEC. No SEVT REs or SEVT TEC were found to be present in the Stage 1 impact area.
- Under the current conservation advice for Brigalow TEC (TSSC 2013) none of the field-validated patches of REs 11.3.1, 11.4.8 and 11.4.9 would satisfy the condition threshold requirement for the patch to support less than 50% of the total vegetative cover of perennial exotic species in any given stratum. However, this project proposes to offset the impacts to these REs under EOP.
- Overall, substantially more Brigalow TEC is present in the Stage 1 impact area than was previously mapped and reflected in the BOS.
- A polygon of Poplar Box (*Eucalyptus populnea*) woodland on deeply weathered clays derived from basalt (RE 11.4.2) was identified in the centre of the Stage 1 impact area. This polygon was previously mapped as RE 11.8.5 and was not identified in the BOS as requiring an offset. Similarly, vegetation to the immediate east of this polygon was not identified in the BOS but was found to be representative of remnant REs 11.4.2 and 11.4.9. These areas are now included in the assessment, given their conservation status being of concern (RE 11.4.2) and endangered (RE 11.4.9).
- Based on the habitat REs described in Table 1 and the September 2015 field mapping, a larger area of known Squatter Pigeon habitat and potential Common Death Adder habitat will be impacted by Stage 1.
- A substantially smaller area of known Ornamental Snake habitat and potential Black-throated Finch habitat will be impacted and no Australian Painted Snipe habitat (RE 11.3.2) was found to be present in the Stage 1 impact area.
- 35.6 ha of watercourse vegetation (i.e. REs 1.3.2, 11.4.2 and 11.4.9) as mapped as by the Queensland Government as vegetation management watercourses and shown on Figure 3 will be impacted as a result of the revised field mapping rather than 41 ha previously calculated.

• A smaller area of connectivity impacts from 241.7 ha to 193.9 ha based on the revised polygon mapping and reduced Stage 1 area.

Table 2 provides a summary of the field-validated areas of each RE impacted in the Stage 1 area. Six of these REs are listed as endangered or of concern under the VM Act and are therefore SSBV. Of these SSBV, four are also MNES (i.e. four form Brigalow TEC and four form habitat for the Ornamental Snake). Only one RE, 11.9.7a, does not represent a MNES and would not be offset under the EOP.

Table 2: Field-validated remnant regional ecosystems impacted in the S           assessment area					Stage 1	
RE Code	Short Description (Queensland	VM Status	Biodiversity	EPBC Act	BVG	Area

RE Code	Short Description (Queensland Herbarium, 2015)	VM Status	Biodiversity Status	EPBC Act Status	BVG 1M	Area (ha)
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	Endangered	Endangered (Brigalow)	25a	4.5
11.4.2	<i>Eucalyptus</i> spp. and/or <i>Corymbia</i> spp. grassy or shrubby woodland on Cainozoic clay plains	Of concern	Of concern	Not listed	17a	107.2
11.4.8	<i>Eucalyptus</i> <i>cambageana</i> woodland to open forest with <i>Acacia</i> <i>harpophylla</i> or <i>A.</i> <i>argyrodendron</i> on Cainozoic clay plains	Endangered	Endangered	Endangered (Brigalow)	25a	43.9
11.4.9	<i>Acacia harpophylla</i> shrubby woodland with <i>Terminalia</i> <i>oblongata</i> on Cainozoic clay plains	Endangered	Endangered	Endangered (Brigalow)	25a	74.3
11.7.4	Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius woodland on Cainozoic lateritic duricrust	Least concern	No concern at present	Not listed	12a	141.8
11.9.1	Acacia harpophylla- Eucalyptus cambageana woodland to open forest on fine-grained sedimentary rocks	Endangered	Endangered	Endangered (Brigalow)	25a	0.1
11.9.7a	<i>Eucalyptus populnea</i> woodland on gently undulating to sloping plains on fine-grained sedimentary rocks	Of concern	Of concern	Not listed	17a	15.0

RE Code	Short Description (Queensland Herbarium, 2015)	VM Status	Biodiversity Status	EPBC Act Status	BVG 1M	Area (ha)
11.9.9	Eucalyptus crebra woodland on fine- grained sedimentary rocks	Least concern	No concern at present	Not listed	13c	1.8
Total						388.6

### 2.2 Threatened fauna habitat

The BOS established that Stage 1 of the project would likely impact habitat for five fauna listed under provisions of the EPBC Act and/or NC Act, including:

- Squatter Pigeon (southern) Vulnerable (EPBC Act & NC Act)
- Ornamental Snake Vulnerable (EPBC Act & NC Act)
- Black-throated Finch Endangered (EPBC Act & NC Act)
- Australian Painted Snipe Endangered (EPBC Act), Vulnerable (NC Act)
- Common Death Adder Near threatened (NC Act).

Table 1 lists the REs that form habitat for each of the threatened species in the Stage 1 impact area. September 2015 field mapping identified discrepancies in the previous mapping, and along with a revised Stage 1 mine plan finalised in 2016, has resulted in changes to the areas of habitat proposed to be impacted as part of Stage 1 of the project as described below.

### Squatter Pigeon

Squatter Pigeon habitat is formed by REs 11.3.2 and 11.7.4 described in the BOS. The BOS describes 115.9 ha of known habitat to be impacted as part of Stage 1 (Earthtrade, 2015). However, the more recent detailed mapping did not find RE 11.3.2 to be present in the Stage 1 impact area but did record a larger area of RE 11.7.4. Therefore, based on the September 2015 field mapping and the proximity to permanent or seasonal waterbodies (i.e. within 3 km), 141.8 ha of known Squatter Pigeon habitat will be impacted by Stage 1.

### Ornamental Snake

REs 11.3.1, 11.4.2, 11.4.8, 11.4.9, 11.8.5 and 11.8.13 were described in the BOS as habitat for the Ornamental Snake in the Stage 1 impact area (Earthtrade, 2015). Vegetation representative of REs 11.8.5 and 11.8.13 was not found to be present as part of the September 2015 field surveys. Therefore, the 338.8 ha of impacts to known habitat that was outlined in the BOS has been reduced to impacts to 229.9 ha of known Ornamental Snake habitat in the finalised Stage 1 impact area.

### Black-throated Finch

Remnant grassy woodland vegetation within 1 km of permanent water bodies is described in the BOS as habitat for the Black-throated Finch. REs assessed as part of the September 2015 field surveys that correspond with this community description, include REs 11.4.2, 11.5.3, 11.9.7a and 11.9.9. Based on the EIS description of habitat for this species, water points at H2 and H13 as well as along the Suttor River are considered to provide permanent water for this species (Figure 2). Within the Stage 1 impact area, 25.8 ha of remnant grassy woodland communities occur within 1 km of these water bodies based on September 2015 field surveys. This is compared with 214.1 ha described in the BOS (Earthtrade, 2015).

### Common Death Adder

REs 11.3.1 and 11.7.4 form habitat for the Common Death Adder in the impact area (Earthtrade, 2015). Larger areas of RE 11.7.4 were identified as part of the September 2015 field surveys. In total 146.3 ha of likely habitat occurs in the Stage 1 impact area rather than 116.4 ha described in the BOS (Earthtrade, 2015).

### Australian Painted Snipe

The BOS describes RE 11.3.2 as forming habitat for the Australian Painted Snipe in the Stage 1 impact area (Earthtrade, 2015). RE 11.3.2 was not found during the September 2015 field surveys. Therefore, there are no impacts to Australian Painted Snipe habitat in the Stage 1 impact area.

It should be noted that while the Ornamental Snake and Squatter Pigeon are *known* to occur in the impact area, the Common Death Adder, Australian Painted Snipe and Black-throated Finch were not identified and therefore are only considered *likely* to occur in the impact area. Additionally, the DotE approval does not require the Black-throated Finch or Australian Painted Snipe to be offset, therefore, these species have not been included in the EPBC Act EOP assessment in Section 3.

### 2.3 Watercourse vegetation

Deemed watercourses under the *Water Act 2000* and vegetation management watercourses on the *Vegetation management watercourse map (1:100 000 and 1:250 000) – version 1.3* will be impacted by the Stage 1 impact area (Figure 3). Both are considered relevant to the Stage 1 impact area in the BOS. The BOS described the impact on watercourses based on the *Water Act 2000* definition as 8.1 ha and the impacts using the Vegetation management watercourse map (version 1.3) as 32.9 ha, using a 50 m buffer (Earthtrade, 2015).

However, discussions with EHP have indicated that their policy position regarding watercourses is for all watercourses and drainage features to be offset. Therefore, under the QBOP and using the current Queensland Government vegetation management watercourse mapping (Version 1.4), a number of 2<sup>nd</sup> and 3<sup>rd</sup> or streams have been included in the calculation of stage 1 impacts to watercourses

(Figures 2 and 3). The following stream protection distances defined in the superseded Regional Vegetation Management Code for the Brigalow Belt Bioregion have been applied:

- Stream order 1 or 2: 50 m from each defining bank
- Stream order 3 or 4: 100 m from each defining bank
- Stream order 5 or greater: 200 m from each defining bank.

Impacts to these watercourses using the distances above equates to 35.6 ha in total, as follows:

- 3.3 ha RE 11.3.1
- 0.1 ha of RE 11.4.2
- 32.2 ha of RE 11.4.9.

### 2.4 Connectivity areas

Impacts to connectivity were previously assessed using the Department of Environment and Heritage Protection's (EHP) Landscape Fragmentation and Connectivity Tool (LFC Tool) based on vegetation mapping pre-dating the September 2015 field surveys (Earthtrade, 2015). The core remnant area polygons identified through application of the LFC Tool and mapped in Figure 11 of the BOS, as being impacted in Stage 1 equated to 241.7 ha (Earthtrade, 2015).

Based on the current Queensland Government regulated remnant vegetation mapping (Version 1.33) (NRM, 2016) it is proposed that only those remnant polygons mapped as Category B areas, which will be removed as part of Stage 1 of the project and result in one less core remnant area (i.e.  $\geq$ 5 ha), will trigger a significant impact to connectivity and require offsetting. These core remnant areas proposed to be removed using the field-validated mapping and finalised mine plan include polygons 3, 9, 10, 11, 12, 13 and 14 shown in Figure 3 and equate to 193.9 ha.

### 2.5 Assessment of ecological condition of remnant vegetation.

Table 3 presents the MNES and SSBV in the Stage 1 impact area that are required to be offset for the project based on the approach detailed in the BOS and further defined in the preceding sections 2.1 to 2.4. This has been updated in consideration of the more detailed surveys undertaken in September 2015 (Section 1.3), the Stage 1 mine plan and the application of the EPBC Act EOP and QBOP offset requirement criteria.

Environmental Value	Impacted Regional Ecosystem	Approximate Total Impact (ha)	Offsets proposed (ha)
Brigalow TEC	REs 11.3.1, 11.4.8, 11.4.9, 11.9.1	122.8	165 ha - comprising non-remnant RE 11.4.9
Squatter pigeon (southern)	RE 11.7.4	141.8	198.3 ha - comprising 9.3 ha remnant RE 11.3.2 and 189.0 ha of non-remnant REs 11.3.2, 11.3.4, 11.5.3 and 11.5.9
Ornamental Snake	REs 11.3.1, 11.4.2, 11.4.8, 11.4.9	229.9	229.9 ha - non-remnant RE 11.4.9 and RE 11.4.9 +/- 11.4.2 (165 ha to be collocated with Brigalow TEC offsets)
Of concern remnant REs	REs 11.4.2 and 11.9.7a (BVG 17a)	122.2	149.2 ha - comprising 55.1 ha of remnant RE 11.3.2 and 94.1 ha of non-remnant RE 11.3.2 (51.2 ha to be co-located with Squatter Pigeon offsets)
Black-throated Finch (Southern)	Remnant woodland communities with a grassy understorey: REs 11.4.2, 11.9.7a and 11.9.9 within 1 km of permanent water	25.8	0 - to be entirely co-located in 271.1 ha of REs 11.3.2, 11.3.4, 11.5.3 and 11.5.9 with Squatter Pigeon and of concern vegetation offsets that occur within 1 Km of the Suttor River or Suttor Creek
Common Death Adder	REs 11.3.1 and 11.7.4	146.3	0 (to be entirely co-located in 229.9 ha of non-remnant RE 11.4.9 (BVG25a) with Brigalow TEC and Ornamental Snake offsets)
Australian Painted Snipe	RE 11.3.2	0	not applicable (see Section 2.2)
Watercourse vegetation	RE 11.4.9 (vegetation management watercourse)	35.6	0 (to be entirely co-located in 86.8 ha of remnant and non-remnant REs 11.3.2 and 11.3.4 with Squatter Pigeon and of concern vegetation offsets, within 200 m of the Suttor River and Suttor Creek)
Connectivity	Various	193.9	0 (to be entirely co-located in 222.1 ha of non-remnant REs 11.3.2, 11.3.4, 11.5.3 and 11.5.9 with Squatter Pigeon and of concern vegetation offsets, and 58.0 ha of non-remnant

### Table 3: Impacted MNES and SSBV in Stage 1 that are proposed to be offset based on September and December 2015 field-validated data

Environmental Value	Impacted Regional Ecosystem	Approximate Total Impact (ha)	Offsets proposed (ha)
			RE 11.4.9 +/- 11.4.2 with Ornamental Snake offsets, all of which are located within the BPA mapped regional ecological corridor)

An assessment of ecological condition and/or habitat quality of remnant vegetation in the impact area has been undertaken against QBOP as discussed in Section 1.1.

Appendix A, Table A1 presents a summary of the EEM for each assessment unit (AU) to be impacted. The site condition and site context scores were calculated using the *Guide to determining terrestrial habitat quality* (EHP, 2014b). This approach satisfies the EEM required under QBOP and also assists in determining the inputs for the EPBC Act Offset Assessment Guide (calculator) (refer to section 3.1). These EEM scores were developed using parameters of site condition and site context and comparing these assessment site metrics with the applicable biocondition benchmarks as per the QBOP process.

# **3** Offset areas survey results

Wollombi Station is located on Lot 1 on SP256594, adjacent to the south of the Stage 1 impact area. The property is approximately 9,785 ha in size. A portion of the property was mapped as part of the field surveys undertaken in September and December 2015 to assess the condition and suitability of the vegetation for offsets. The field-validated sections comprised remnant and non-remnant areas of the REs listed in Table 4 and shown on Figure 4. The section of the property investigated, is bordered on the west by the Suttor River and to the south by Suttor Creek, both fifth order watercourses (Figures 1 and 4).

The Wollombi Station investigation area, shown on Figure 4, was surveyed to provide offsets for all relevant MNES as well as protected fauna, watercourse and connectivity for SSBV not already co-located with MNES. This area provides both remnant (Category B) and non-remnant (Category X) areas. The latter were recorded in variable condition and/or stages of regrowth recovery.

RE Code	Short Description (Queensland Herbarium, 2015)	VM Status	Biodiversity Status	EPBC Act Status	BVG 1M	Area (ha)
11.3.1	Acacia harpophylla and/or Casuarina cristata open forest on alluvial plains	Endangered	Endangered	Endangered (Brigalow)	25a	17.2 (non- remnant)
11.3.2	<i>Eucalyptus populnea</i> woodland on alluvial plains	Of concern	Of concern	Potentially Endangered (component of Weeping Myall Woodland)	17a	215.0 (121.0 remnant, 94.0 non- remnant)
11.3.4	Eucalyptus tereticornis +/- Eucalyptus spp. woodland on alluvial plains	Of concern	Of concern	Not listed	16c	99.0 (1.8 remnant and 97.2 non- remnant)
11.3.7	<i>Corymbia spp.</i> woodland on alluvial plains	Least concern	Of concern	Not listed	9e	6.9 (remnant)
11.3.25	<i>Eucalyptus</i> <i>tereticornis</i> or <i>E.</i> <i>camaldulensis</i> woodland fringing drainage lines	Least concern	Of concern	Not listed	16a	60.9 (remnant)
11.3.27b	Lacustrine wetland	Least concern	Of concern	Not listed	34d	22.4 (remnant)
11.4.4	<i>Dichanthium spp., Astrebla spp.</i> grassland on	Least concern	Of concern	Endangered (Natural Grassland)	30b	79.9 (remnant)

Table 4: Field-validated remnant and non-remnant regional ecosystems in theWollombi Station offset investigation area

RE Code	Short Description (Queensland Herbarium, 2015)	VM Status	Biodiversity Status	EPBC Act Status	BVG 1M	Area (ha)
	Cainozoic clay plains					
11.4.8	<i>Eucalyptus</i> <i>cambageana</i> woodland to open forest with <i>Acacia</i> <i>harpophylla</i> on Cainozoic clay plains	Endangered	Endangered	Endangered (Brigalow, when Brigalow dominant or co-dominant within the patch)	25a	42.3 (non- remnant)
11.4.9	Acacia harpophylla shrubby woodland with Terminalia oblongata on Cainozoic clay plains	Endangered	Endangered	Endangered (Brigalow)	25a	1,350.3 (non- remnant) [Note: includes polygons 24, 39 and 43]
11.4.11	Dichanthium sericeum and Astrebla spp. grassland with patchy Acacia harpophylla or Eucalyptus coolabah on Cainozoic clay plains	Of concern	Of concern	Endangered (Natural Grassland)	30b	24.9 (remnant)
11.5.3	Eucalyptus populnea +/- E. melanophloia +/- Corymbia clarksoniana woodland on Cainozoic sand plains and/or remnant surfaces	Least concern	No concern at present	Not listed	17a	224.4 (119.7 remnant, 104.7 non- remnant)
11.5.9	Eucalyptus crebra and other Eucalyptus spp. and Corymbia spp. woodland on Cainozoic sand plains and/or remnant surfaces	Least concern	No concern at present	Not listed	18b	322.1 (287.7re mnant, 34.4 non- remnant)
Total						2469.4 (725.2 remnant and 1744.2 non- remnant)

Cattle grazing and associated regrowth and pasture improvement management activities are the primary land uses within the Wollombi Station investigation area. Cattle grazing is intensive in the proposed Wollombi Station offset area resulting in the poor condition that is reflected in the EEM scores. Cattle grazing can result in a continual degradation of the understory and native grass cover. Soil compaction, trampling, erosion associated with cattle tracks, predation of palatable native shrubs, herbs and grasses along with the spread of exotic grasses and weeds are the main threats to the natural integrity of the offset areas. A continuation of the existing land management practices will result in the continued decline in condition of these areas.

The BOS recommends the following broad management actions for the proposed offset area, which will be refined based on the specific threats and pressures acting on values:

- management of grazing
- weed management
- feral pest management
- management of fire
- if applicable, active revegetation.

The length of active management will be influenced by the condition of vegetation, type of habitat and vegetation on site, as well as existing management issues (Earthtrade, 2015).

Monitoring will involve photo monitoring and bio-condition monitoring assessments every seven years to provide a record of comparability of the progress of the offset returning to remnant vegetation over the term of the offset. Weed monitoring will also be conducted and recorded by the land manager (Earthtrade, 2015).

Appendix A, Table A2 provides the EEM scores for each of the offsets assessment units (O\_AUs) in the Wollombi offset area, based on EEM Plots shown on Figures 4 and 5.

### **3.1** Commonwealth EPBC Act Environmental Offsets Policy

The *EPBC Act Offset Assessment Guide* (calculator) has been used to determine the area required to offset impacts to MNES using the proposed offset areas (DotE, 2012). MNES requiring offsets under the approval conditions for the project in the Stage 1 area are:

- Brigalow (*Acacia harpophylla* dominant and co-dominant)
- Squatter Pigeon (southern)
- Ornamental Snake.

The finalised Stage 1 impact area does not impact on Natural Grassland TEC, and therefore Natural Grasslands have not been assessed further. Field-validated vegetation mapping undertaken in September 2015 found that vegetation representative of the SEVT TEC does not occur in the finalised Stage 1 impact area. As previously outlined in Section 2.1, the area previously mapped in the EIS and BOS as SEVT on basalt (land zone 8), was found to actually be located on land zone 4, being clay plains. Additionally, the community was comprised of Brigalow (*Acacia harpophylla*) and Yellowwood (*Terminalia oblongata*) and generally lacked vine thicket species. As such this community more closely represents the species assemblage of RE 11.4.9, which is considered a component of the Brigalow TEC (prior to the updated diagnostic criteria and condition thresholds). Therefore, no impact to SEVT TEC is proposed and SEVT has not been assessed further.

Sections 3.1.1 to 3.1.3 provide the assessments of each of these MNES against the EPBC Act Offset Assessment Guide. The Wollombi Station Stage 1 offset area is proposed to offset each of the MNES. Appendices B to D provide the calculator outputs.

### 3.1.1 Brigalow

Assessment of the Brigalow TEC using the EPBC Act Offset Assessment Guide (calculator) is provided in Appendix B. The proposed Wollombi Station offset area will achieve a 'measurable conservation gain' for the Brigalow TEC by:

- legally securing areas that have the potential to represent this TEC for the long term
- legally securing areas that would eventually represent this TEC and at present are exempt from any protections at a State and Commonwealth level (i.e. Category X vegetation on a PMAV; less than 15 years old)
- legally securing areas of this TEC that are connected with state and regional ecological corridors associated with the Suttor River (Figure 8)
- actively managing cattle grazing, fire and weeds in the Wollombi offset area and improving the quality of TEC.

### Sources of information

These include:

- Byerwen Coal Project: Biodiversity Offset Strategy (Earthtrade, 2015)
- field survey consistent with the *Guide to determining terrestrial habitat quality: a toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.1* (EHP, 2014b)
- Brigalow (Acacia harpophylla dominant and co-dominant) SPRAT profile (DotE, 2015a)
- Approved Conservation Advice for the Brigalow (Acacia harpophylla

dominant and co-dominant) ecological community (TSSC, 2013)

 Regulated Vegetation Management Map, Supporting Maps Version 8.0 (NRM, 2015).

### Weighting of quality components

The Brigalow TEC usually occurs on cracking clays in Queensland, and sometimes on texture contrast soils where eucalypt species are co-dominant. The majority of this community is formed on flat to gently undulating Cainozoic clay plains, not associated with current alluvium, and on gently undulating landscape on more or less horizontally bedded fine grained sedimentary rocks (DotE, 2015a).

For a Brigalow vegetation community to form part of the Brigalow TEC it must meet a set of key diagnostic characteristics and condition thresholds set out in the Commonwealth *Approved Conservation Advice for the Brigalow* (Acacia harpophylla *dominant and co-dominant*) *ecological community* (TSSC, 2013). For Brigalow communities in Queensland, the diagnostic characteristics include the presence of Brigalow as either a dominant or co-dominant component of the canopy, be in one of three bioregions, be representative of one or more of 16 REs, all of which are listed endangered under Queensland legislation and/or be regrowth that has not been cleared or modified for greater than 15 years with structural and floristic elements broadly typical of one of the identified REs. In addition to the diagnostic characteristics, two condition thresholds must also be met, namely the patch size must be greater than 0.5 ha and exotic perennial plants must comprise less than 50% of the total vegetation cover of any particular stratum (TSSC, 2013).

The conservation advice indicates that patches that are more species rich and less disturbed are likely to provide greater biodiversity value. Additionally, patches that provide corridors or linkages within a largely modified landscape are particularly important to the viability of the ecological community into the future, provided threats are adequately managed. General connectivity of patches with other native vegetation also provides value (TSSC, 2013).

Some indicators that should be factored in when considering important qualities to protect, or when considering recovery, management and funding priorities for a particular patch, include:

- large size and/or a large area to boundary ratio larger area/boundary ratios are less exposed and more resilient to edge effect disturbances such as weed invasion and human impacts
- evidence of recruitment of key native plant species or, the presence of a range of age cohorts (including through successful assisted regeneration), for example, key species are present as seedlings through to mature plants
- high species richness, most evident from the variety of native plant species but may also be shown by a high number of native fauna species
- areas with few weeds or feral animals or where these can be efficiently managed

 connectivity to other native vegetation remnants or restoration works (TSSC, 2013).

The conservation advice for the Brigalow TEC describes areas critical to the survival of the TEC to include all patches that meet the key diagnostic characteristics and condition thresholds for the TEC. Some other areas that don't meet condition thresholds may also be considered critical depending on the size, linkages and position in the landscape (TSSC, 2013).

Threats to the Brigalow TEC are reported to be factors that may further reduce its extent or cause a decline in condition. In order of significance, the most important threats include: clearing, fire, weeds, feral animals and inappropriate grazing and climate change (TSSC, 2013).

Given the importance of condition, threats and connectedness of Brigalow patches reported in the conservation advice for the TEC, all quality components are considered important. Nonetheless, condition is weighted marginally higher for this project as Brigalow communities were assessed as part of the EIS, prior to the release of the current EPBC Act condition threshold criteria. Therefore, a minimum condition level that meets the current diagnostic criteria cannot be assumed for all patches as described in point 3 of Section 2.1. Ecological equivalence scores and parameters were used where appropriate to apply quality scores to the impact and offset sites and are provided in Appendix B. Quality components are weighted as follows:

- Site condition = 4/10 according to weed presence (i.e. greater than 50% exotic perennial cover), structural composition, groundcover parameters (i.e. organic litter, vegetative cover, fallen woody debris), species richness and recruitment of key components
- Site context = 3/10 considering existing and likelihood of ongoing threats, fragmentation and connectedness with other vegetation
- Species stocking rate = 3/10 where larger connected patches are of higher value.

Table 5 provides a rationale for the scoring used in the EPBC Act Offset Assessment Guide for the Brigalow TEC (Appendix B).

Attribute	Value	Rationale/assumption
Impact Area		
Description	122.8 ha	Field-validation of the Stage 1 impact area found that vegetation representing three remnant REs comprised species and structure that would be considered to meet the Brigalow TEC description, prior to updated conservation advice being released in 2013 and in line with the REs originally identified in the BOS. These REs are 11.3.1, 11.4.8, 11.4.9 and 11.9.1 (Table 1) and are present across several polygons ranging in size from 3.1 ha to 59.9 ha. At present some of the polygons within the Stage 1 impact area do not meet the diagnostic criteria for the Brigalow TEC due to exotic perennial plants comprising greater than 50% of the total vegetation cover. However, the project approval and assessment of significance of impacts pre-dates this current listing advice.
Quality (REs 11.3.1 and 11.4.9 were assessed together as these areas of Brigalow TEC had similar characteristics and ecological equivalence score)	6/10	Site condition = 2 The overstorey of the vegetation communities is primarily comprised of Brigalow with Belah ( <i>Casuarina cristata</i> ) and Yellowwood occurring less commonly. The ground cover tended to be dominated by a mixture of exotic pasture grasses, particularly *Buffel Grass ( <i>Pennisetum ciliare</i> ) and to a lesser extent *Indian Bluegrass ( <i>Bothriochloa pertusa</i> ) with an average cover of 9.3%. Native grasses and herbs including Brigalow Grass ( <i>Paspalidium caespitosum</i> ), Brigalow Burr ( <i>Sclerolaena tetracuspis</i> ), Ruby Saltbush ( <i>Enchylaena tomentosa</i> ) and occasionally Curly Windmill Grass ( <i>Enteropogon ramosus</i> ) were less frequently encountered and had an average cover of 4.8%. The ground cover in many areas was moderately to heavily impacted through grazing by cattle. All except one polygon (19) failed to meet the current TEC diagnostic criteria, whereby exotic grasses comprised substantially more than 50% of the vegetative cover within the groundcover stratum.
(78.8 ha)		Site context = 2
		A number of the polygons of Brigalow TEC are small and isolated or have a high edge to area ratio. This is particularly the case with the largest polygon that flanks the unnamed creek in the south of the Stage 1 impact area. Although vegetation clearing for grazing purposes is not a pressure acting on this TEC at this location, the risk of incidences of fire due to increased fuel load in the ground cover layer and continual degradation through cattle grazing are ongoing threats to this community.
		Species stocking rate = 2

### Table 5: EOP offset assessment for Brigalow TEC impacted by Stage 1 of the project

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Stage 1 Offset Assessment

Attribute	Value	Rationale/assumption
		RE 11.4.9 comprises the largest polygon of Brigalow TEC at 59.9 ha. The remaining polygons are approximately 5 ha or greater. In total REs 11.3.1 and 11.4.9 account for 78.8 ha of the Brigalow TEC in the Stage 1 impact area.
Quality (REs	7/10	Site condition = 3
11.4.8 and 11.9.1 are considered to have a slightly higher ecological equivalence score) (44.0 ha)		The overstorey of the vegetation communities is comprised of Dawson River Gum ( <i>Eucalyptus cambageana</i> ), which represents the ecologically dominant layer (EDL). The mid-stratum was comprised of a variable cover of Brigalow. The ground cover tended to be dominated by a mixture of native grasses including Brigalow Grass, Curly Windmill Grass, Wiregrasses ( <i>Aristida spp.</i> ) and Golden Beard Grass ( <i>Chrysopogon fallax</i> ) with an average cover of 12.6%, and exotic pasture grasses, particularly *Buffel Grass with an average cover of 4.0%. The ground cover in many areas was moderately to heavily impacted through grazing by cattle. One polygon (6) was borderline remnant, whereby the height of the canopy species was slightly under 70% of the height of the undisturbed community. This community met the current TEC criteria in some cases.
		Site context = 2
		One large patch of RE 11.4.8 representing Brigalow TEC is connected with a larger tract of remnant vegetation to the south. Although vegetation clearing for grazing purposes is not a pressure acting on this TEC at this location, the risk of incidences of fire due to increased fuel load in the ground cover layer and continual degradation through cattle grazing are ongoing threats to this community.
		Species stocking rate = 2
		A total of 44 ha of RE 11.4.8 and 11.9.1 will be impacted in the Stage 1 impact area.
Offset Area		
Description	165.0 ha (non- remnant RE 11.4.9)	The proposed offset area is located on Wollombi Station (lands lease, Lot 1 on SP278043) and situated adjacent to a 3.6 km stretch of the Suttor River riparian corridor (Figures 5 and 8). The offset area is approximately 4 km south-west of the Stage 1 impact area, and connected to other extensive tracts of remnant vegetation to the south, west and north-west and framed by the Suttor River to the north and Suttor Creek to the south. The offset area is connected to the Stage 1 impact area via vegetation along the Suttor River. The proposed offset area also provides habitat for the Ornamental Snake as well as potential dispersal habitat for the Squatter pigeon and other SSBV (see Table 3).

Attribute	Value	Rationale/assumption
		The characteristics of the proposed offset area, particularly polygon 32 (see Figure 5), are considered to present opportunity for substantial improvement in condition of the Brigalow vegetation due to the low lying position of the vegetation in the landscape and moist condition of the ground layer.
Time over which loss averted	20 years	A legally binding mechanism will be established for the proposed offset area providing protection and management for the term of the management plan.
Time until ecological benefit	10 years	Ecological benefit will principally be achieved through the management of cattle grazing, appropriate management of fire regime, management of feral animals (particularly feral pigs) and control of weeds. These management actions will improve the cover of native grasses and/or sedges and other hydrophilic vegetation that is prevalent in the gilgai areas (e.g. <i>Eleocharis spp.</i> ) through reduced soil compaction, trampling and predation that is associated with cattle grazing. These benefits are likely to be realised in approximately 5-10 years when native grasses have had an opportunity to re-colonise areas currently dominated by exotic grasses. Reduced grazing pressure will also have the benefit of reduced soil compaction and trampling, which will provide more favourable conditions for recruitment.
Start quality (non-remnant RE 11.4.9, polygon 32 and part of polygon 30)	5/10	Site condition = 1.5 The proposed offset vegetation is represented by non-remnant RE 11.4.9 (polygon 32 and part of polygon 30, see Figure 5), which is dominated by Brigalow and associated Yellowwood and Red-flowered Bauhinia ( <i>Lysiphyllum carronii</i> ) and/or Belah, Sandalwood ( <i>Santalum lanceolatum</i> ) and False Sandalwood ( <i>Eremophila mitchellii</i> ). A high proportion of the ground cover layer is comprised of native sedges, including <i>Eleocharis</i> and <i>Cyperus</i> species and native grasses such as Early Spring Grass ( <i>Eriochloa crebra</i> ) and <i>Dinebra decipiens var. decipiens</i> . In polygon 32, native ground cover accounted for 37.7% average vegetative cover, while exotic vegetative cover was 5.5%. *Buffel Grass is more prevalent in polygon 30 and in conjunction with *Indian Bluegrass has an average cover of 21.0% compared with the average cover of native grasses, which is 4.8%. Overall, the vegetation does not currently meet the current diagnostic criteria for the Brigalow TEC (TSSC, 2013). The vegetation is non-remnant, although there is recruitment of key species, including Brigalow. Species richness is above average. There are large areas of low exotic grass cover, particularly in polygon 32. The moist condition of the ground layer across large sections of this proposed offset area impede *Buffel Grass growth to the extent that it does not readily outcompete native cover.
		Site context = 1.5

Attribute	Value	Rationale/assumption
		The proposed offset area is connected with other large tracts of remnant and non-remnant vegetation including the Suttor River ecological corridor to the north-west. The proposed Brigalow offset area is approximately 450 m from the Suttor River and the western portion is in the mapped biodiversity corridor. The offset area is generally well connected in the broader landscape and is within a broad distribution of largely contiguous remnant vegetation to the north, west and south. However, cattle grazing is intensive in the proposed offset area and this inhibits recruitment and the growth of the community to remnant structure. Minimal fencing also allows cattle to significantly overgraze and over-utilise preferable areas.
		Species stocking rate = 2
		The offset area is part of larger non-remnant polygons of RE 11.4.9 greater than 1,200 ha. These areas have the potential to form remnant vegetation representative of the Brigalow TEC in the future.
Risk of loss (%) without offset	100%	The Wollombi Station has been historically managed by an agistee for cattle grazing purposes. The vegetation in non-remnant (Category X) areas has been actively managed to suppress woody vegetation in order to increase livestock carrying capacity and ease of livestock management. Management actions have included removing juvenile trees and shrubs and managing fuel loads. It is understood that it is the intention of the agistee to continue these practices as routine management of the balance of the property once offsets have been finalised and set aside (Lane Infrastructure Pty Ltd pers. comms. 12 September 2016). Therefore, it is reasonable to expect that the proposed offset area would otherwise become gradually degraded from its current state as a result of the on-going land management practices. Cattle grazing will cause further decline in the condition of the ground stratum through ground compaction, erosion of drainage lines and banks of watercourses, spread of existing and infiltration by new weed species. Inappropriate fire management and a lack of legitimate fire-breaks is also a significant on-going risk for this community. Due to the Category X non-regulated classification of this area under the VM Act, it is anticipated that the area of regrowth will be maintained in a suppressed or cleared state in the future without the need
Future quality	4/10	Site condition =1.5
without offset	, -	The condition of vegetation particularly the abundance of native sedges will potentially be adversely affected over the long term, particularly on the edge of soak areas where existing land management is maintained. Cattle grazing will further degrade the ground cover layer and shrub layer, particularly

Attribute	Value	Rationale/assumption
		during times of extended drought, and the community will unlikely meet remnant and/or TEC status in the foreseeable future. Weed infiltration of other areas is a risk to this community.
		Site context = 1.5
		Connectivity is unlikely to be substantially affected as the proposed offset area is connected with large tracts of remnant vegetation to the west.
		There is potential for this vegetation to become an area of refuge for cattle during particularly dry conditions and seasons due to the moist conditions of the ground layer.
		Species stocking rate = 1.0
		There is potential for broad scale clearing within the offset area and adjacent non-remnant areas. The proposed offset area is currently non-remnant and mapped as non-regulated and therefore clearing associated with land management practices is possible and highly likely.
Risk of loss (%) with mitigation and management	5%	Unlikely, as habitat quality will be improved with cattle management and legal protection of the non- regulated vegetation from clearing for pasture production.
Future quality	8/10	Site condition = 3.5
with mitigation and management		The existing values and quality of habitat in the proposed offset area will be improved with active management of cattle grazing, fire regimes and weed invasion.
		Site context = 2.0
		Removing constant grazing pressure will allow gradual recovery of the vegetation to remnant status.
		Species stocking rate = 2.5
		Protection and improvement of the quality of this vegetation will result in a large patch of this TEC that is well connected in the broader landscape.
Confidence in averted loss	80%	There is a high level of confidence that loss will occur without protection and intervention through gradual decline in habitat quality particularly through continued heavy grazing by cattle and clearing for pasture production. This will affect recruitment of key species and inhibit natural regeneration of the community to reach remnant status and meet condition thresholds of the Brigalow TEC.

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Attribute	Value	Rationale/assumption
		The management and mitigation measures proposed are low risk measures and they are widely applied as standard techniques in the industry. The measures to be applied tend to result in incremental gains but the outcomes are positive and relatively certain.
Confidence in change of habitat quality	80%	The proposed offset area and broad management strategies are in line with managing the key threats to Brigalow TEC identified in the conservation advice, i.e. reducing vegetation clearing, managing fire risk and cattle grazing pressure (TSSC, 2013). Specifically, the proposed offset will legally secure a large area of vegetation and future land management will allow the vegetation to improve in structure and quality to meet remnant status and the condition thresholds for the Brigalow TEC.

### Outcomes of EPBC Act Offsets Assessment for Brigalow TEC

Using the scores described in Table 5, 101.30% of the proposed impact to 78.8 ha of Brigalow TEC represented by REs 11.3.1 and 11.4.9 is offset by the proposed mitigation and management of 100 ha of non-remnant Brigalow vegetation represented by RE 11.4.9 in polygon 32 and part of polygon 30. The remaining 44.0 ha of impacted Brigalow TEC, represented by REs 11.4.8 and 11.9.1 and which is of slightly higher quality, will be 101.08% offset by 65 ha of the same extended area of non-remnant RE 11.4.9 (i.e. a portion of polygon 30) (Figure 5). It is considered that this forms a positive and measurable conservation gain and therefore mitigates the impact to Brigalow TEC in the Stage 1 impact area.

### 3.1.2 Squatter Pigeon (southern)

Assessment of the Squatter Pigeon (southern) using the *EPBC Act Offset Assessment Guide* (calculator) is provided in Appendix C. The proposed offset area will achieve a 'measurable conservation gain' for the Squatter Pigeon (southern) by:

- legally securing habitat areas that are presently exempt from any protections at a State level (i.e. Category X vegetation on a PMAV)
- legally securing habitat suitable for foraging and breeding for the long term
- legally securing areas of habitat that are well connected in the regional landscape (including within state ecological corridors) (Figure 8), relatively intact and provide foraging and breeding habitat
- actively managing cattle grazing, fire and weeds in the offset area and therefore the risk of habitat degradation and predation.

### Sources of information

These include:

- Byerwen Coal Project: Biodiversity Offset Strategy (Earthtrade, 2015)
- field survey consistent with the *Guide to determining terrestrial habitat quality: a toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.1* (EHP, 2014b)
- Regulated Vegetation Management Map, Supporting Maps Version 8.0 (NRM, 2015)
- Squatter Pigeon (southern) (*Geophaps scripta scripta*) SPRAT Profile (DotE, 2015b).

### Weighting of quality components

Within its range, the Squatter Pigeon (southern) forages in open-forests to sparse, open-woodlands and scrub that have an over-storey generally dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species. The vegetation communities need to be on well-draining gravelly, sandy or loamy soils and be within 1 to 3 km of water (DotE, 2015b). Breeding habitat is described as stony rises occurring on

sandy or gravelly soils, within 1 km of a suitable, permanent waterbody (DotE, 2015b). As the species forages and nests on the ground, the ground covering vegetation layer is considerably patchy consisting of native, perennial tussock grasses or a mix of perennial tussock grasses and low shrubs or forbs. This patchy, ground layer of vegetation rarely exceeds 33% of the ground area. The remaining ground surface generally consists of bare patches of gravelly or dusty soil and areas lightly covered in leaf litter and coarse, woody debris (e.g. fallen trees, logs and smaller debris) (DotE, 2015b).

The Squatter Pigeon Workshop (2011) recommended the following threat abatement and recovery objectives:

- the protection of habitat critical to the survival of the subspecies throughout its range
- the restoration of habitat which is potentially critical to the survival of the subspecies
- reduction of mortality caused by predators, particularly cats and foxes.

The DotE does not define critical habitat for the Squatter Pigeon (southern). Due to the importance placed on habitat, site condition and site context (proximity to water), are considered more important habitat characteristics than species stocking rate in this instance. Stocking rate is not known for the impact area or offset area, however, the Squatter Pigeon (southern) was recorded in low numbers from both the impact and offset areas during the 2015 vegetation surveys. Further, the species is known to occur in the broader area based on Wildlife Online searches of the impact and offset areas with a 25 km buffer (EHP, 2015). Quality components have been weighted as follows:

- Site condition = 4/10 according to vegetation type in combination with abundance of habitat features (e.g. native perennial grasses) and condition of ground layer vegetation
- Site context = 4/10 according to size of habitat area, connectivity and proximity of habitat with other habitats and water bodies
- Species stocking rate = 2/10 where 0 = absent, 1 = present in low numbers, 2 = present in high numbers based on survey of the site and nearby records.

Table 6 provides a description rationale for the scoring used in the *EPBC Act Offset Assessment Guide* for the Squatter Pigeon (southern).

Attribute	Value	Rationale/assumption
Impact Area		
Description	141.8 ha	The project BOS considered the distributions of all polygons of REs 11.3.2 and 11.7.4 throughout the Stage 1 impact area as Squatter Pigeon (southern) habitat. Field-validation of these areas found that RE 11.3.2 was not present however a larger area of 11.7.4 was present (Figure 2). The field-validated area of impacted Squatter Pigeon (southern) habitat in the Stage 1 impact area is connected to larger tracts of remnant vegetation to the north and west. Connectivity of habitat immediately to the south and south-east is limited as these areas have been cleared of remnant vegetation. This cleared area is up to approximately 7 km in width in some areas between the Squatter Pigeon habitat and other remnant polygons to the south. The Squatter Pigeon habitat is directly connected by remnant vegetation with the Suttor River (fifth order watercourse) state and regional corridor, approximately 1.6 km to the west (Figures 2 and 8).
Quality	7/10	Site condition = 3 The overstorey of the vegetation communities are dominated by a variety of <i>Eucalyptus</i> and <i>Corymbia</i> species including Narrow-leaved Ironbark ( <i>Eucalyptus crebra</i> ), Poplar Box ( <i>Eucalyptus populnea</i> ), Ironwood ( <i>Acacia excelsa</i> ), with Erythroxylum ( <i>Erythroxylum australe</i> ), Leichhardt Bean ( <i>Cassia brewsteri</i> ) and Quinine Tree ( <i>Petalostigma pubescens</i> ). The ground cover tended to be dominated by a mixture of exotic pasture grasses, particularly *Buffel Grass and *Indian Blue Grass. Native grasses include <i>Aristida sp.</i> , Dark Wiregrass ( <i>Aristida calycina</i> ), Jericho Wiregrass ( <i>Aristida jerichoensis</i> ), Pitted Bluegrass ( <i>Bothriochloa decipiens</i> ). The ground cover in many areas was moderately impacted through grazing by cattle, which greatly reduces the amount of cover provided to the Squatter Pigeon (southern). However, these communities exhibited relatively low exotic grass cover and shrub cover was high in these polygons and they would provide suitable breeding and foraging habitat. A second order ephemeral stream and dam is located approximately 500 m to the south of RE 11.7.4 (Figures 2 and 3).
		Site context = 3 Large tracts of remnant vegetation occur to the north and west of the Squatter Pigeon (southern) habitat. However, expanses of cleared land occur to the south and south-east The Stage 1 impacted area is within 500 m of permanent and seasonal drainage lines and within 3 km of the Suttor River to the west. Easement clearing for existing water and gas pipelines is also present, particularly in a north-

### Table 6: EOP offset assessment for Squatter Pigeon (southern) known habitat impacted by Stage 1 of the project

Stage 1 Offset Assessment

Attribute	Value	Rationale/assumption
		south direction between parts of the habitat and the Suttor River, however, the extent of fragmentation in this northern area is not substantial and would not be an impediment to the species' movement across the larger remnant landscape.
		Species stocking rate = 1 The Squatter Pigeon (southern) was recorded regularly from the Stage 1 impact area during both the EIS surveys (Environmental and Licensing Professionals, 2013) and the recent assessment of habitat condition in September 2015. Seven records of the Squatter Pigeon (southern) were returned from a Wildlife Online search of the impact area and a surrounding 25 km area. Though no evidence of feral cat or fox were observed in the impact area, it is considered likely that they occur within the broader landscape. The feral dog, cat or fox is therefore likely to exert some predation pressure on the Squatter Pigeon (southern).
Offset Area		
Description	198.3 ha (9.3 ha of remnant RE 11.3.2 and 189.0 ha of non-remnant RE s 11.3.2,	The proposed offset area is located on Wollombi Station (lands lease, Lot 1 on SP278043) and situated adjacent to a 3.6 km stretch of the Suttor River riparian corridor (Figures 5 and 8). The offset area is approximately 4 km south-west of the Stage 1 impact area. The proposed offset area is connected to other extensive tracts of remnant vegetation to the south, west and north-west and framed by the Suttor River to the north and Suttor Creek to the south. The Wollombi offset area is connected to the Stage 1 impact area via remnant vegetation along the Suttor River.
	11.3.4, 11.5.3 and 11.5.9)	assemblages and close proximity to Suttor Creek and Suttor River (i.e. <3 km). The Species Profile and Threats (SPRAT) Database for the Squatter Pigeon describes foraging habitat as being 'mostly dominated in the overstorey by <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Acacia</i> or <i>Callitris</i> species, as part of remnant, regrowth or partly modified vegetation and within 3 km of waterbodies or watercourses (seasonal or permanent)'. REs on land zones 5 and 7 are specifically referred to as potential habitat for the Squatter Pigeon in Queensland (DotE, 2015b).
		Remnant and non-remnant REs 11.3.2 and 11.3.4 in the offset area are also considered to provide potential habitat for this species as although land zone 3 is not specifically referred to in the SPRAT profile for the Squatter Pigeon, this community provides a grassy woodland habitat dominated by eucalypt species (Poplar Box in RE 11.3.2, and mixed eucalypt species in RE 11.3.4) on well-draining, sandy and loosely consolidated soils and is within 3 km of seasonal watercourses being the Suttor

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Stage 1 Offset Assessment

Attribute	Value	Rationale/assumption
		River and Suttor Creek. Squatter Pigeon has previously been recorded on other sites on land zone 3 (Ecological Survey & Management, 2015).
Time over which loss averted	20 years	A legally binding mechanism would be established for the proposed offset area providing protection and management over the timeframe required to achieve the management plan outcomes.
Time until ecological benefit	5 years	Ecological benefit will principally be achieved through the management of cattle grazing, appropriate management of fire regimes, control of weeds and managing pest animal populations. These management actions will improve the cover of native grasses through reduced soil compaction, trampling and predation that is associated with cattle grazing. These benefits are likely to be realised in approximately 5 years when native grasses have had an opportunity to re-colonise areas currently dominated by exotic grasses.
Start quality	7/10	Site condition = 3
(remnant RE 11.3.2, polygons 47, 50, 53 & 54) (9.3 ha)		A large portion of this habitat is of remnant condition and species richness is high. The overstorey of the vegetation community is dominated by Poplar Box and Sally Wattle ( <i>Acacia salicina</i> ). The groundcover in many areas showed moderate grazing damage and an exotic grass cover averaging more than 43%, with *Indian Blue Grass being common. Native species including Jericho Wiregrass and Forest Bluegrass ( <i>Bothriochloa bladhii</i> ) and Pitted Bluegrass ( <i>Bothriochloa decipiens</i> ) were common.
		Site context = 3
		The proposed offset area flanks other remnant communities along Suttor River. Connectivity with the broader landscape is maintained along this riparian corridor joining the Suttor Creek to the south-west where large tracts of endangered and remnant vegetation adjoin the confluence of the two watercourses. These watercourses provide seasonal if not permanent (ponded) water sources.
		Species stocking rate = 1
		Squatter Pigeon (southern) was recorded in the local area just outside the offset area during recent vegetation surveys (September 2015) (Figure 4). It is considered to be widespread in central Queensland (Environmental and Licensing Professionals, 2013). The proposed offset area is considered to provide foraging habitat for this species. Breeding habitat is more likely to be restricted to land zone 5 or 7, where sandy or gravelly conditions identified as important in the DotE SPRAT profile are more likely to occur.
Attribute	Value	Rationale/assumption
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Start Quality (non-remnant RE	6/10	Site condition = 2 This habitat is of non-remnant condition and species richness is moderate. The overstorey of the
11.3.2, polygon 34) (41.9 ha)		ecologically dominant layer is most commonly the shrub layer where recruitment of canopy species was prevalent and the distribution relatively consistent. The groundcover in many areas showed moderate to major grazing pressure and an exotic grass cover in excess of 50%.
		Site context = 3
		The proposed offset area flanks the Suttor Creek, which is a fifth order watercourse. Connectivity with the broader landscape is maintained along this riparian corridor where large tracts of endangered and remnant vegetation adjoin the confluence of this watercourse with Suttor River. These watercourses provide seasonal if not permanent (ponded) water sources, which are important for breeding habitat in the area.
		Species stocking rate = 1
		A pair of Squatter Pigeon (southern) were recorded in non-remnant RE 11.3.2 to the north of the offset investigation area in September 2015 (Figure 4).
Start Quality	6/10	Site condition = 1.5
(non-remnant RE 11.3.4, polygons 45, 46 & 55) (96.4 ha)		This habitat is of non-remnant condition and species richness is moderate. The overstorey of the vegetation community is generally comprised of isolated mature and mid-mature Clarkson's Bloodwood, Carbeen, Queensland Blue Gum, Dallachy's Gum and/or Narrow-leaved Red Ironbark. The ecologically dominant layer is most commonly the shrub layer where recruitment of canopy species was prevalent but the distribution inconsistent. The groundcover in many areas showed moderate to major grazing pressure and an exotic grass cover in excess of 50%.
		Site context = 3
		The proposed offset area flanks the Suttor River, which is a fifth order watercourses. Connectivity with the broader landscape is maintained along this riparian corridor joining the Suttor Creek to the south- west where large tracts of endangered and remnant vegetation adjoin the confluence of the two watercourses. These watercourses provide seasonal if not permanent (ponded) water sources, which are important for breeding habitat in the area.
		Species stocking rate = 1.5

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Attribute	Value	Rationale/assumption
		Nine specimens of Squatter Pigeon (southern) were recorded in polygon 45 in December 2015 (Figure 5).         Image: Speciment of Squatter Pigeon (southern) were recorded in polygon 45 in December 2015 (Figure 5).         Image: Speciment of Squatter Pigeon (southern) were recorded in polygon 45 in the Wollombi investigation area (December 2015).
Start Quality	6/10	Site condition = 1.5
(non-remnant RE 11.5.3, polygons	RE IS	vegetation community is generally comprised of isolated mature and mid-mature Poplar Box. The ecologically dominant layer is most commonly the shrub layer where recruitment of canopy species
(21.3 ha)		was prevalent and the distribution relatively consistent. The groundcover in many areas showed moderate to major grazing pressure and an exotic grass cover in excess of 50%.
		Site context = 3
		The proposed offset area flanks the Suttor River, a fifth order watercourse. Connectivity with the broader landscape is maintained along this riparian corridor joining the Suttor Creek to the south-west

Attribute	Value	Rationale/assumption
		where large tracts of endangered and remnant vegetation adjoin the confluence of the two watercourses. These watercourses provide seasonal if not permanent (ponded) water sources, which are important for breeding habitat in the area.
		Species stocking rate = 1.5
		Nine specimens of Squatter Pigeon (southern) were recorded adjacent to polygon 61 in December 2015 (Figure 5).
Start Quality	6/10	Site condition = 2
(non-remnant RE 11.5.9, polygons 41, 56 & 57) (29.4 ha)		This habitat is of non-remnant condition and species richness is moderate. The overstorey of the vegetation community is generally comprised of isolated mature and mid-mature Clarkson's Bloodwood, Carbeen and/or Narrow-leaved Red Ironbark. The ecologically dominant layer is most commonly the shrub layer where recruitment of canopy species was prevalent but the distribution inconsistent. The groundcover in many areas showed moderate to major grazing pressure and an exotic grass cover in excess of 50%.
		Site context = 3
		The proposed offset area flanks the Suttor River, a fifth order watercourse. Connectivity with the broader landscape is maintained along this riparian corridor joining the Suttor Creek to the south-west where large tracts of endangered and remnant vegetation adjoin the confluence of the two watercourses. These watercourses provide seasonal if not permanent (ponded) water sources, which are important for breeding habitat in the area.
		Species stocking rate = 1
		Squatter Pigeon (southern) were recorded in adjacent polygons in December 2015 (Figure 5).
Risk of loss (%) without offset	30% (remnant areas) 100% (non-remnant areas)	The Wollombi Station has been historically managed by an agistee for cattle grazing purposes. It is reasonable to expect that the proposed offset area would become gradually degraded from its current state as a result of cattle grazing. Cattle grazing will cause further decline in the condition of the ground stratum through ground compaction, erosion of drainage lines, spread of existing and infiltration by new weed species.
		vegetation in order to increase livestock carrying capacity and ease of livestock management. Management actions have included removing juvenile trees and shrubs and managing fuel loads. It is

Attribute	Value	Rationale/assumption
		understood that it is the intention of the agistee to continue these practices as routine management of the balance of the property once offsets have been finalised and set aside (Lane Infrastructure Pty Ltd pers. comms. 12 September 2016). Therefore, it is reasonable to expect that the proposed offset area would otherwise become gradually degraded from its current state as a result of the on-going land management practices. Cattle grazing will cause further decline in the condition of the ground stratum through ground compaction, erosion of drainage lines and banks of watercourses, spread of existing and infiltration by new weed species. Inappropriate fire management and a lack of legitimate fire-breaks is also a significant on-going risk for this community.
		Due to the Category X non-regulated classification of portions of this habitat area under the VM Act, it is anticipated that the area of regrowth will be maintained in a suppressed or cleared state in the future without the need for permits.
Future quality without offset	5/10	Site condition = 1.5 The condition/quality of Squatter Pigeon (southern) habitat particularly the abundance of native grasses general diversity of habitat features in the ground cover layer will potentially be affected over the long term where active management is not provided for habitat areas. Cattle grazing and gradual invasion of improved pasture species, particularly *Buffel Grass, along with understorey management for exotic pasture improvement and minor clearing for cattle yards, fencing etc. will likely continue to some extent. Once improved grazing management practices are imposed, the area will be subject to minimal disturbance. Predation pressure from feral dogs, cats and foxes will be monitored and managed as required. All non-remnant areas within the offset area are at risk of being cleared without the security of the offset being put in place
		Site context = 2.5 Connectivity is unlikely to be substantially affected as all habitat proposed as offsets are within or adjacent to a riparian corridor. There is potential for all non-remnant areas of REs 11.3.2, 11.3.4, 11.5.3 and 11.5.9 to be cleared as these are Category X (unregulated) vegetation. Nonetheless, a conservative approach has been adopted whereby it is considered unlikely that connectivity will be substantially affected in the foreseeable future due to the presence of remnant regulated vegetation management areas.
		Species stocking rate = 1 As a result of the reduced site condition there may be a reduction in the Squatter Pigeon (southern) stocking rate of the proposed offset area. However, this is unlikely to be substantial as they are known

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Attribute	Value	Rationale/assumption
		to use degraded habitats and they are considered widespread in central Queensland (Environmental and Licensing Professionals, 2013).
Risk of loss (%) with mitigation and management	5%	Unlikely, as habitat quality will be maintained and improved with periodic cattle exclusion and active management and monitoring and the prevention of clearing.
Future quality	8/10	Site condition = 3.5
with mitigation and management		The existing values and quality of habitat in the proposed offset area, particularly in the ground cover layer, will be improved with active management of cattle grazing, fire regimes and weed invasion. This will occur through establishment of greater diversity of micro-habitat features, cover and native foraging resources for the Squatter Pigeon (southern). Once improved grazing management practices are imposed, the area will be subject to minimal disturbance with the maintenance of fire breaks and weed management undertaken as required. Predation pressure from feral dogs, cats and foxes will be monitored and managed as required.
		Site context = 3
		This element is unlikely to change with management.
		Species stocking rate = 1.5
		It is expected that where habitat quality is improved from its current state, use of these areas by the Squatter Pigeon (southern) will increase, particularly where breeding habitat is improved in REs 11.5.3 and 11.5.9.
Confidence in averted loss	80%	There is reasonable confidence that loss will occur without intervention through gradual decline in habitat quality particularly in native grass cover by being over sown with Buffel Grass and continued heavy grazing by cattle and prevention of clearing.
		The management and mitigation measures proposed are low risk measures and they are widely applied as standard techniques in the industry. The measures to be applied tend to result in small gains but the outcomes are positive and relatively certain.
Confidence in change of habitat quality	80%	The proposed offset area and broad management strategies are in line with the threat abatement actions in the SPRAT profile for the Squatter Pigeon (southern) (DotE, 2015b). Specifically, the proposed offset will legally secure a large area of foraging and breeding habitat close to a permanent

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Attribute	Value	Rationale/assumption
		water-point (the Suttor River and Suttor Creek). In addition the proposed management actions will improve habitat quality in this area.

### Outcomes of EPBC Act Offsets Assessment for Squatter Pigeon (southern)

Using the scores described in Table 6, 114.21% of the proposed impact to 141.8 ha of Squatter Pigeon habitat represented by RE 11.7.4 is offset by the proposed mitigation and management of:

- 9.3 ha of remnant vegetation represented by RE 11.3.2 (polygons 47, 50, 53 and 54)
- 189.0 ha of non-remnant vegetation represented by RE 11.3.2 (polygon 34), RE 11.3.4 (polygon 45, 46 and 55), RE 11.5.3 (polygon 58 and 59) and RE 11.5.9 (polygons 41, 56 and 57) (Figure 5).

It is considered that this forms a positive and measurable conservation gain and therefore mitigates the impact to Squatter Pigeon habitat in the Stage 1 impact area.

# 3.1.3 Ornamental Snake

Assessment of Ornamental Snake habitat using the *EPBC Act Offset Assessment Guide* (calculator) is provided in Appendix D. The proposed Wollombi Station offset area will achieve a 'measurable conservation gain' for the Ornamental Snake by:

- legally securing areas that would provide habitat for the Ornamental Snake
- legally securing areas that at present has limited protection at a State and Commonwealth level (i.e. Category X vegetation on a PMAV; less than 15 years old therefore does not meet the Brigalow TEC criteria)
- legally securing areas of this TEC that are connected with state and regional ecological corridors associated with the Suttor River (Figure 8)
- actively managing threats to habitat, including cattle grazing, fire and weeds in the habitat area and improving the quality of habitat
- averting the loss of a protected matter or its habitat that is currently under threat in the offset area.

### Sources of information

These include:

- Byerwen Coal Project: Biodiversity Offset Strategy (Earthtrade, 2015)
- field survey consistent with the *Guide to determining terrestrial habitat quality: a toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy, Version 1.2* (EHP, 2016)
- Regulated Vegetation Management Map, Supporting Maps Version 8.0 (NRM, 2015).
- Ornamental Snake (*Denisonia maculata*) SPRAT Profile (DotE, 2015c).

# Weighting of quality components

Specific habitat requirements of Ornamental Snake include presence of gilgai (diet is predominantly frogs) in Brigalow, Gidgee, Blackwood or Coolabah woodland or open forest ideally with course woody debris and ground litter, connectivity of suitable habitat and remnant vegetation is considered important for dispersal. The species is known to travel at least 1 km from remnant/wooded gilgai habitat, in drought conditions for example (DotE, 2015c). According to the *Draft Referral guidelines for the nationally listed Brigalow Belt reptiles* 'suitable habitat' for the Ornamental Snake is considered important if it is:

- habitat where the species has been identified during a survey
- near the limit of the species' known range
- large patches of contiguous, suitable habitat and viable landscape corridors (necessary for the purposes of breeding, dispersal or maintaining the genetic diversity of the species over successive generations); or
- a habitat type where the species is identified during a survey, but which was previously thought not to support the species (SEWPaC, 2011).

The Draft Referral guidelines also states that due to the limited information about the Ornamental Snake, important habitat should be considered a surrogate for important populations (SEWPaC, 2011).

It is therefore considered that site condition and site context are more important habitat characteristics than species stocking rate in this instance, as stocking rate is not known for the site, although it is known to be present (Earthtrade, 2015).

- Site condition = 4/10 according to vegetation type in combination with microhabitat features (gilgai and course woody debris and ground litter) and condition of vegetation
- Site context = 4/10 according to size of habitat areas, connectivity and proximity of habitat with other vegetated habitats and larger remnant areas
- Species stocking rate = 2/10 where 0 = absent, 1 = present in low numbers,
   2 = present in high numbers based on survey of the site and nearby records.

Table 7 provides a description rationale for the scoring used in the EPBC Act Offset Assessment Guide for the Ornamental Snake.

Attribute	Value	Rationale/assumption
Impact Area		
Description	229.9 ha	Field-validation of the Stage 1 impact area found that vegetation representing four remnant REs would be considered to provide habitat for the Ornamental Snake, in line with the habitat REs originally identified in the BOS. These REs are 11.3.1, 11.4.2, 11.4.8 and 11.4.9 (Table 1). These REs are comprised of a range of polygons ranging in size from 3.1 ha to 66.4 ha. At present some of the polygons within the Stage 1 impact area comprise a ground layer with a perennial weed cover (i.e. exotic grasses) greater than 50%. Gilgai is present throughout most habitat areas, but ranges from low to moderate quality depending on the extent of thinning and cattle trampling present.
Quality	6/10	Site condition = 2.5 The overstorey of the vegetation communities is primarily comprised of Brigalow with Belah and Yellowwood occurring less commonly. The ground cover tended to be dominated by a mixture of exotic pasture grasses, particularly *Buffel Grass and to a lesser extent *Indian Bluegrass and had an average cover of 9.3%. Native grasses and herbs including Brigalow Grass, Brigalow Burr, Ruby Saltbush and occasionally Curly Windmill Grass were less frequently encountered and had an average cover of 4.8%. The ground cover in many areas was moderately to heavily impacted as a result of grazing by cattle. The majority of RE 11.4.2 did not support gilgai, but in many cases was connected with areas that did, e.g. RE 11.4.9 and contained substantial coarse woody debris. Coarse woody debris in REs 11.3.1, 11.4.8 and 11.4.9 ranged from very low to moderately high.
		Site context = 2.5 A number of the polygons of habitat are small and isolated or have a high edge to area ratio. This is particularly the case with the largest polygon that flanks the unnamed creek in the south of the Stage 1 impact area. Although vegetation clearing as part of the existing land use is not a significant pressure acting on the habitat area at this location, the risk of incidences of fire due to increased fuel load in the ground cover layer and continual degradation through cattle grazing are ongoing threats to this habitat. Species stocking rate = 1 The Stage 1 impact area is within the known distribution of the Ornamental Snake in Queensland, it

# Table 7: EOP offset assessment for Ornamental Snake known habitat impacted by Stage 1 of the project

Attribute	Value	Rationale/assumption
		Licensing Professionals, 2013). It is assumed to be present as potential habitat is available, however, it is not assumed to be present in high numbers.
Offset Area		
Description	229.9 ha (165.0 ha of non-remnant RE 11.4.9 (polygons 30 and 32) and 64.9 ha of non- remnant RE	The proposed offset area is located on Wollombi Station (lands lease, Lot 1 on SP278043) and situated adjacent to a stretch of the Suttor River riparian corridor. The offset area is approximately 4 km south-west of the Stage 1 impact area. The proposed offset area is connected to other extensive tracts of remnant vegetation to the south, west and north-west and framed by the Suttor River to the west and north-west and Suttor Creek to the south. The Wollombi offset area is connected to the Stage 1 impact area via remnant vegetation along the Suttor River. The proposed offset area also provides habitat for Brigalow TEC, and dispersal habitat for the Squatter Pigeon as well as other SSBV (see Table 3).
	11.4.9 +/- 11.4.2 (polygons 39 and 43)	The characteristics of the proposed offset area, particularly polygon 32 (see Figure 5), are considered to present opportunity for substantial improvement in condition of the Brigalow vegetation and gilgai due to the low lying position of the vegetation in the landscape, underlying clay soils and moist condition of the ground layer.
Time over which loss averted	20 years	A legally binding mechanism would be established for the proposed offset area providing protection and management over the timeframe required to achieve the management plan outcomes.
Time until ecological benefit	5 years	Ecological benefit will principally be achieved through the management of cattle grazing, appropriate management of fire regime, management of feral animals (particularly pigs) and control of weeds. These management actions will improve the cover of native grasses and/or sedges and other hydrophilic vegetation that is prevalent in the gilgai areas (e.g. <i>Eleocharis spp.</i> ) through reduced soil compaction, trampling and predation that is associated with cattle grazing. These benefits are likely to be realised in approximately 5-10 years when native grasses have had an opportunity to recolonise areas currently dominated by exotic grasses. Reduced grazing pressure will also have the benefit of reduced soil compaction and trampling, which will provide more favourable conditions for recruitment and improve gilgai formation and water quality within gilgai.
Start quality (non-remnant RE 11.4.9, polygon	6/10	Site condition = 2.5 The proposed offset vegetation is represented by non-remnant RE 11.4.9 (polygon 32, part of polygon 30, see Figure 5), which is dominated by Brigalow and associated Yellowwood and Red-flowered Bauhinia and/or Belah, Sandalwood and False Sandalwood. A high proportion of the ground cover

Attribute	Value	Rationale/assumption
32 and part of polygon 30) (165.0 ha)		layer was comprised of native sedges, including <i>Eleocharis</i> and <i>Cyperus</i> species and native grasses such as Early Spring Grass and <i>Dinebra decipiens var. decipiens</i> . In polygon 32, native ground cover accounted for 37.7% average vegetative cover, while exotic vegetative cover was 5.5%. *Buffel Grass is more prevalent in polygon 30 and in conjunction with *Indian Bluegrass has an average cover of 21.0% compared with the average cover of native grasses, which is 4.8%. Gilgai formation is of good condition with clay cracks in excess of 2 m deep. There is limited course woody debris most likely due to the age of the vegetation and there was evidence of stick raking throughout this habitat. Overall, the vegetation does not currently meet the current diagnostic criteria for the Brigalow TEC (TSSC, 2013). The vegetation is non-remnant, although there is recruitment of key species, including Brigalow. Species richness is above average. There are large areas of low weed cover compared with exotic grass cover. The moist condition of the ground layer across large sections of this proposed offset area impede *Buffel Grass growth to the extent that it does not readily outcompete native cover. These conditions have also allowed persistence of native sedges in the ground layer, which further improves the quality of the gilgai for Ornamental Snake.
		Site context = 3 The proposed offset area is connected with other large tracts of remnant and non-remnant vegetation and these are connected to the Suttor River corridor only 0.4 km to the north-west (Figures 5 and 8). The offset area is generally well connected in the broader landscape and is within a broad distribution of largely contiguous remnant vegetation to the north, west and south. However, cattle grazing is intensive in the area in which the proposed offset is located and this inhibits recruitment and the growth of the community to remnant structure. It also affects condition and suitability of the understorey to support Ornamental Snake. Species stocking rate = 0.5
		The offset area is well within the known distribution of the Ornamental Snake and there is good connectivity with expansive remnant areas to the north-west. It is considered highly likely to be present, particularly in areas such as Polygon 32, as gilgai formation is in good condition and numerous deep cracks are present. Although, species abundance cannot be assumed.
		Site condition = 2

Attribute	Value	Rationale/assumption
Start quality (non-remnant RE 11.4.9, polygons 39 and 43) (64.9 ha)	5/10	The regional ecosystem type of the vegetation within these polygons was difficult to determine due to the variability of composition, influence from adjacent vegetation types and apparent frequency of clearing. Regrowth vegetation was representative by non-remnant RE 11.4.9, wherein shrubby Yellowwood, Currant Bush ( <i>Carissa ovata</i> ) and/or Red-flowered Bauhinia, Whitewood, Brigalow, Sandalwood and False Sandalwood were commonly recorded. A high proportion of the ground cover layer was comprised of *Buffel Grass +/- *Indian Bluegrass. Minor gilgai formation was also recorded, but it would appear that the historic structure and depth of these has been impacted through the frequency of clearing. There is limited course woody debris most likely due to the age of the vegetation and there was evidence of stick raking throughout this habitat. Overall, the vegetation does not currently meet the current diagnostic criteria for the Brigalow TEC (TSSC, 2013). The vegetation is non-remnant, although there is recruitment of key species, including Brigalow. Species richness is moderate. There are large areas of low weed cover compared with exotic grass cover. The moist condition of the ground layer across large sections of this proposed offset area
		Site context = $3$
		The proposed offset area is connected with other large tracts of remnant and non-remnant vegetation and these are connected to the Suttor River corridor only 0.4 km to the north-west (Figures 5 and 8). The offset area is generally well connected in the broader landscape and is within a broad distribution of largely contiguous remnant vegetation to the north, west and south. However, cattle grazing is intensive in the area in which the proposed offset is located and this inhibits recruitment and the growth of the community to remnant structure. It also affects condition and suitability of the understorey and gilgais to support Ornamental Snake.
		Species stocking rate = 0.5
		The offset area is well within the known distribution of the Ornamental Snake and there is good connectivity with expansive remnant areas to the north-west. It is considered highly likely to be present, particularly in areas such as Polygon 32, although species abundance cannot be assumed.
Risk of loss (%) without offset	100%	The Wollombi Station has been historically managed by an agistee for cattle grazing purposes. The vegetation in non-remnant (Category X) areas has been actively managed to suppress woody vegetation in order to increase livestock carrying capacity and ease of livestock management. Management actions have included removing juvenile trees and shrubs and managing fuel loads. It

Attribute	Value	Rationale/assumption
		is understood that it is the intention of the agistee to continue these practices as routine management of the balance of the property once offsets have been finalised and set aside (Lane Infrastructure Pty Ltd pers. comms. 12 September 2016). Therefore, it is reasonable to expect that the proposed offset area would otherwise become gradually degraded from its current state as a result of the on-going land management practices. Cattle grazing will cause further decline in the condition of the ground stratum through ground compaction, erosion of drainage lines and banks of watercourses, spread of existing and infiltration by new weed species. Inappropriate fire management and a lack of legitimate fire-breaks is also a significant on-going risk for this community.
		Due to the Category X non-regulated classification of this area under the VM Act, it is anticipated that the area of regrowth will be maintained in a suppressed or cleared state in the future without the need for permits.
Future quality	4/10	Site condition =1.5
without offset		The condition of gilgai and ground layer vegetation particularly the abundance of native sedges will be affected over the long term, especially on the edge of soak areas where existing land management is maintained. Cattle grazing may further degrade the ground cover layer and shrub layer, particularly during times of extended drought, and the community will struggle to meet remnant status. Gilgai formation will likely be shallow, edges degraded and may potentially be lost altogether across large sections of the RE 11.4.9 community due to clearing.
		Site context = 2.5
		Connectivity is unlikely to be substantially affected as the proposed offset area is connected with large tracts of remnant vegetation to the west.
		There is potential for this vegetation to become an area of refuge for cattle during particularly dry conditions and seasons due to the moist conditions of the ground layer.
		Species stocking rate = 0
		There is potential for broad scale clearing within the offset area and adjacent non-remnant areas. The proposed offset area is currently non-remnant and mapped as non-regulated and therefore clearing associated with land management practices is possible. Cattle trampling of gilgai could continue to the extent that gilgai formation is no longer present.

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Attribute	Value	Rationale/assumption
Risk of loss (%) with mitigation and management	5%	Unlikely, as habitat quality will be improved with cattle exclusion and legal protection of the non-remnant, non-regulated vegetation.
Future quality	9/10	Site condition = 3.5
with mitigation and management (non-remnant RE 11.4.9, polygon 32 and part of polygon 30)		The existing values and quality of habitat in the proposed offset area will be improved by preventing clearing and with active management of cattle grazing, fire regimes, weed invasion and feral animal (particularly pigs). As native vegetation is allowed to regenerate, microhabitat features such as fallen timber and leaf litter will develop to form the coarse woody debris that is required by Ornamental Snake. However, in some areas that are not as moist as polygon 32, it may take longer than 15 years to establish a canopy of Brigalow that will allow shading out of the Buffel Grass.
		Site context = 3.5
		Removing clearing and grazing pressure will allow gradual recovery of the vegetation to remnant status and remove the process of trampling and compaction of gilgai. Water quality of gilgai will improve, which will likely improve quality of habitat for frogs, which are the preferred food of Ornamental Snake.
		Species stocking rate = 2
		Protection and improvement of the quality of this vegetation will result in a large patch of this habitat that is well connected in the broader landscape and will likely support an important population at some point in the future, based on the current DotE definition of an important population (SEWPaC, 2011).
Future quality	8/10	Site condition = 3
with mitigation and management (non-remnant RE 11.4.9, polygons 39 and 43)		The existing values and quality of habitat in the proposed offset area will be improved with active management of cattle grazing, fire regimes, weed invasion and feral animal (particularly pigs). As native vegetation is allowed to regenerate, microhabitat features such as fallen timber and leaf litter will develop to form the course woody debris that is required by Ornamental Snake. However, in some areas that are not as moist as polygon 32 and which have been more heavily used by cattle as is the case for polygons 39 and 43, some exotic grass cover may persist and gilgai may not reform as well.

Attribute	Value	Rationale/assumption
		Site context = 3.5 Removing clearing and grazing pressure will allow gradual recovery of the vegetation to remnant status and remove the process of trampling and compaction of gilgai. Water quality of gilgai will improve, which will likely improve quality of habitat for frogs, which are the preferred food of Ornamental Snake. These polygons abut remnant areas and are relatively close to the Suttor River and form part of the riparian corridor.
		Species stocking rate = 1.5 Protection and improvement of the quality of this vegetation will result in reasonably sized patches of this habitat that is well connected in the broader landscape and located within remnant areas. Therefore, this habitat will likely support an important population at some point in the future, based on the current DotE definition of an important population, although the gilgai may not match the qualities of polygons 30 and 32 (SEWPaC, 2011).
Confidence in averted loss	80%	There is reasonable confidence that loss will occur without intervention through gradual decline in habitat quality particularly through continued heavy grazing by cattle. This will affect recruitment of key species, inhibit natural regeneration of the community and degrade gilgai features. The management and mitigation measures proposed are low risk measures and they are widely applied as standard techniques in the industry. The measures to be applied tend to result in small gains but the outcomes are positive and relatively certain.
Confidence in change of habitat quality	80%	The proposed offset area and broad management strategies are in line with managing the key threats to Ornamental Snake habitat identified in the conservation advice, i.e. reducing vegetation clearing, managing fire risk and cattle grazing pressure (TSSC, 2013). Specifically, the proposed offset will legally secure a large area of habitat and future land management will allow the vegetation to improve in structure and quality to meet remnant status and the condition thresholds for the Brigalow TEC and deep well formed gilgai will be maintained.

### Outcomes of EPBC Act Offsets Assessment for Ornamental Snake

Using the scores described in Table 7, 106.1% of the proposed impact to 229.9 ha of important Ornamental Snake habitat is compensated by the proposed protection and management of 229.9 ha of non-remnant medium to good quality Ornamental Snake habitat (i.e. RE 11.4.9). It is considered that this forms a positive and measurable conservation gain and therefore mitigates the impact to important Ornamental Snake habitat from the project.

# 3.2 Queensland Biodiversity Offsets Policy

SSBV requiring offsets under the approval conditions for the project and in addition to those addressed under the EOP, are:

- of concern REs 11.4.2 and 11.9.7a both BVG 17a
- watercourses
- connectivity
- habitat for:
  - Common Death Adder
  - Australian Painted Snipe
  - King Bluegrass.

Ornamental Snake, Squatter Pigeon, all endangered REs and the majority of of concern REs are captured by EOP offset areas as outlined in Table 3. As described in the BOS, the Coordinator-General will not require any additional offsets for impact to SSBV if the Australian Government also requires an offset for the same values (Earthtrade, 2015).

Impacts to wetlands were assessed as temporary impacts as part of the EIS, therefore no offsets to wetlands are proposed as part of the BOS and have not been assessed further (Earthtrade, 2015).

The proposed offset areas are comprised of remnant and non-remnant (category X non-regulated) vegetation communities representing a range of REs (Figure 4). Offsets will be located on Wollombi Station, which is located at the confluence of two 5<sup>th</sup> order watercourses, the Suttor River and Suttor Creek. Both of these watercourses are recognised in the Brigalow Belt Biodiversity Planning Assessment as being of state significance with patches of remnant vegetation adjacent to these watercourses forming regional significance (EPA, 2008). The Suttor River is recognised as a regional ecological corridor and the Suttor Creek, although not mapped as an ecological corridor, strengthens connectivity in the local area. The Suttor Creek is connected via areas of state significance with large state ecological corridors less than 5 km to the south and with a node of state ecological corridors approximately 40 km to the east (EPA, 2008).

# 3.2.1 Of concern REs

Stage 1 impacts to of concern vegetation include 122.2 ha of REs 11.4.2 (107.2 ha, AU2) and 11.9.7a (15.0 ha, AU6), both of which correspond to BVG 17a. A total of 215 ha of vegetation representing of concern RE 11.3.2, and corresponding to BVG 17a, (121.02 ha remnant and 94 ha non-remnant) was identified in the Wollombi Station Stage 1 offset investigation area (Figure 4).

When comparing the ecological equivalence scores for the impacted of concern vegetation (BVG17a, AU2 and AU6) in Appendix A, Table A1 with the of concern RE 11.3.2 in the offset area in Appendix A, Table A2 (O\_AUs 1 and 2), the ecological equivalence scores of the impacted vegetation communities range from 63 to 80 (average 72.2), while the vegetation within the offset areas range from 48.3 to 69 with an average of 66.5 in the remnant patches and 55.6 in the non-remnant patches.

In order to adequately offset the impacts to REs 11.4.2 and 11.9.7a, only the patches of vegetation that were representative of BVG 17a could be used in the offset area (i.e. RE 11.3.2). The areas that have been selected as suitable offsets were, as much as possible, co-located with offsets for MNES. A total of 149.2 ha of remnant and non-remnant RE 11.3.2 has been proposed as an offset for the impacts to remnant of concern vegetation within the impact area. This includes 55.1 ha of remnant vegetation (polygons 1, 8, 47, 50, 53 and 54) and 94.1 ha of non-remnant vegetation (polygons 31, 34 and 64).

It should be noted that two areas of non-remnant vegetation (polygons 39 and 43, REs 11.4.9 +/- 11.4.2) were recorded as partially comprising non-remnant of concern vegetation. RE 11.4.2 also corresponds to BVG 17a. The spatial extent of vegetation representing the of concern RE 11.4.2 could not be definitively demarcated within these polygons due to the variable amount and type of regrowth that has occurred following clearing. Poplar Box is prevalent within these patches, however this may be an artefact of opportunistic establishment of Poplar Box following the readily evident ongoing management of Brigalow regrowth that is also prevalent within both patches. Nonetheless, in addition to the 149.2 ha of RE 11.3.2 proposed to be used to offset impact BVG 17a, these non-remnant polygons 39 and 43 (i.e. 64.9 ha) will also form part of the proposed Ornamental Snake offset area and the RE 11.4.2 component of these polygons will further contribute to the overall BVG 17a proposed to be offset at Wollombi Station.

Table 8 compares the ecological condition scores of the impacted patches of BVG 17a that is representative of of concern vegetation and demonstrates how equivalence has been achieved with the proposed offset areas of BVG 17a. In addition to the proposed BVG 17a offset area, the non-remnant polygons 39 and 43 (i.e. 64.9 ha) that are proposed as offset for Ornamental Snake, support elements of RE 11.4.2, which is also representative of BVG17a. These areas will further contribute to offset of of concern vegetation in addition to the polygons presented in Table 8.

Impact Area										
Regional Ecosystem		1	1.4.2 (AU2)		11.9.7a (AU6)					
Polygon	14	10	9	5	17					
Area (ha)	66.4	3.5	29.8	7.6	14.97					
<i>Ecological Equivalence Score</i> ( <i>Site Condition plus Site</i> <i>Context</i> )	74.0	67.0	63.0	77.0	80					
EEM for polygon (Ecological equivalence Score * Polygon Area/100)	49.10	10 2.32 18.77		5.85	12.0					
EEM Score for AU			76		12					
TOTAL	88									
Offset Area										
Regional Ecosystem	RE 11.3.2 (O_AU1, part thereof)			non-remnant RE 11.3.2 (O_AU2)						
Polygon	1	8	47, 50, 53, 54	31, 64	34					
Area (ha)	17.71	28.15	9.25	52.13	41.91					
<i>Ecological Equivalence Score (Site Condition plus Site Context)</i>	66	65	66.5	48.25	63					
EEM for polygon (Ecological equivalence Score * Polygon Area/100)	11.69 18.30 6.15			25.15	26.40					
EEM Score for AU	36 52									
TOTAL	88									

# Table 8: Comparison of ecological condition scores for BVG 17a in the Stage 1impact area and proposed offset area

# 3.2.2 Watercourses

The area of watercourse vegetation impacted in Stage 1 comprises 35.6 ha along vegetation management watercourses and shown on Figures 2 and 3.

The proposed Wollombi offset area provides 86.8 ha of remnant and non-remnant REs 11.3.2 and 11.3.4 (i.e. portions of polygons 1, 8, 31, 34, 45, 46, 50, 53, 54 and 55) along the Suttor Creek and Suttor River, which are both fifth order streams and shown on Figures 4, 5 and 6. These polygons are also proposed as offsets for the Squatter Pigeon and of concern vegetation. A portion of these non-remnant REs have been designated as a watercourse offset using the ratio of 1:1 in line with the QBOP and shown on Figure 6.

It should be noted that these areas support functioning ecosystems as defined in QBOP.

# 3.2.3 Connectivity

The area of core remnant areas to be impacted has been recalculated using the 2015 field survey mapping, regulated vegetation mapping and finalised impact area. The result is 193.9 ha of impacts to the connectivity SSBV. This area is proposed to be offset using the non-remnant vegetation communities that are also

proposed as offsets for Squatter Pigeon, Ornamental Snake and of concern vegetation that fall within the Suttor River ecological corridor, including:

- 84.9 ha of of concern non-remnant (category X non-regulated) RE 11.3.2 (polygons 31 and 64)
- 86.4 ha of of concern non-remnant (category X non-regulated) RE 11.3.4 (polygons 45, 46 and 55)
- 21.2 ha of least concern non-remnant (category X non-regulated) RE 11.5.3 (polygons 58, 59)
- 29.5 ha of least concern non-remnant (category X non-regulated) RE 11.5.9 (polygons 41, 56, 57)
- 58.0 ha of non-remnant (category X non-regulated) RE 11.4.9 +/- RE 11.4.2 (polygons 39 and 43).

The 193.9 ha of connectivity impacts will be offset using 280.1 ha of the aforementioned polygons (or part thereof) that are located within the Suttor River ecological corridor. This will exceed a 1:1 offset ratio. EEM scores for these areas are provided in Appendix A, Table A2. Connectivity offset areas are shown in Figure 6.

It should be noted that these areas support functioning ecosystems as defined in QBOP.

# 3.2.4 Black-throated Finch

Within the Stage 1 impact area, 25.8 ha of remnant grassy woodland communities occur within 1 km of permanent water bodies based on September 2015 field surveys. This Black-throated Finch was considered *likely* to occur in this habitat as part of the EIS (Environmental and Licensing Professionals, 2013). Based on the definition provided in the BOS and EIS (Earthtrade, 2015; Environmental and Licensing Professionals, 2013) remnant and non-remnant distributions of REs 11.3.2, 11.3.4, 11.5.3 and 11.5.9 form likely habitat for this species in the Wollombi offset area. The Suttor River and Suttor Creek are considered likely to provide permanent water sources as fifth order streams, with standing water observed during both survey periods (September and December 2015). The area of these REs proposed as Squatter Pigeon offsets in the Wollombi offset area and within 1 km of these watercourses is 271.1 ha (233.7 ha non-remnant and 37.4 ha remnant) (Figures 4 and 5). Therefore this requirement is exceeded significantly.

# 3.2.5 Common Death Adder

In total 146.3 ha of *likely* habitat occurs in the Stage 1 impact area based on the September 2015 field survey. It is proposed that offsets for Common Death Adder (assessed as likely to occur) be co-located in the Wollombi offset area in non-remnant RE 11.4.9, which is a proposed offset for the Brigalow TEC and the Ornamental Snake. This RE is part of BVG 25a, which was identified in the BOS

and EIS as one of the BVGs that forms habitat for this species (Earthtrade, 2015; Environmental and Licensing Professionals, 2013). A total of 229.9 ha of non-remnant RE 11.4.9 is proposed as an offset in the Wollombi Station offset area (Figures 4 and 5). Therefore this requirement is exceeded significantly.

# 3.2.6 Australian Painted Snipe

This species was considered *likely* to occur in the Stage 1 impact area. No habitat represented by RE 11.3.2 was identified in the Stage 1 impact area as part of the September 2015 field surveys and therefore, this species has not been assessed further.

# 3.2.7 King Bluegrass

This species was considered *likely* to occur in the larger project area but not specifically in the Stage 1 impact area. No natural grassland communities, i.e. RE 11.8.11, were recorded in the Stage 1 impact area as part of the September 2015 field surveys and therefore, this species has not been assessed further.

# 4 Outcomes

The proposed Wollombi offset area has been identified as providing Stage 1 offsets for impacts of the Byerwen project. A number of MNES and SSBV were identified in the BOS as requiring offsets based on the EIS undertaken in 2013.

Further field validation was undertaken in September 2015 to assess the ecological equivalence of impact and offset areas and at this time discrepancies in the vegetation mapping of the impact area were identified. As a result vegetation mapping was refined and impacts to be offset were recalculated. Since preparation of the BOS in late 2015, the Stage 1 mine plan has been refined and therefore, calculations prepared as part of this assessment report also reflect the refined Stage 1 impact area shown in Figures 1, 2 and 3.

Based on September 2015 field-validated mapping of the Stage 1 impact area, an area of 388.6 ha was assessed as requiring offsets for impacts to MNES and SSBV, including:

- Brigalow TEC
- Squatter Pigeon habitat
- Ornamental Snake habitat
- of concern vegetation
- watercourse vegetation
- connectivity
- Black-throated Finch habitat
- Common Death Adder habitat (refer Table 3).

MNES will be offset under the EOP and the Coordinator-General will not require additional offsets to those approved under the EOP if they already offset impacts to SSBV. All SSBV impacts, with the exception of of concern vegetation, are able to be co-located with areas proposed as offsets for MNES.

Using a combination of remnant and non-remnant REs within the proposed Wollombi offset area, 428.2 ha is proposed to offset impacts to MNES under EOP. With the exception of of concern vegetation, all MSES under QBOP can be entirely co-located within this 428.2 ha. An additional 98 ha is proposed as offset for impacts to of concern vegetation under QBOP and this area incidentally provides additional offsets for watercourses, connectivity, Squatter Pigeon and Black-throated Finch habitat.

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# **Figures**



	Remnant vegetation to be impacted as part of Stage 1
	Remaine vegetation to be impletted as part of brage 1
	Additional Stage 1 impacts to remnant vegetation identified as part of September 2015 field surveys
	Wollombi Station Stage 1 offset investigation area
	Wollombi Station (Lot 1 on SP278043)
222	Stage 1 Footprint
	Mining leases
	State Controlled Roads
	Railway
	Cadastral Boundary

#### Figure 1 : Location of Stage 1, remnant vegetation to be impacted and offset investigation area

Byerwen Mine Offset Assessment

Map Number: 15061\_01\_J Date: 09 September 2016 Map Projection: GDA 1994 MGA Zone 55 Data: Road, Watercourse, ML - (c)DNRM 2016 0 0.5 1 2 3 4 5 Kilometres



-
Vegetation to be impacted by Stage 1 as described in the BOS
Additional Stage 1 impacts to vegetation identified as part of September 2015 field surveys
Mining leases
State Controlled Roads
Railway
Significant Fauna Records

Squatter Pigeon (*Geophaps scripta scripta*) [Vulnerable (EPBC Act, NC Act)] 

#### **Remnant Vegetation Impacted Vegetation Management Act Status**

- Endangered Of concern
- Least concern

#### **Assessment Site**

- Ecological Equivalence Methodology Plots
- 0 Tertiary Site

- 0 Quaternary Site
- 0 Quaternary (Photo Point only)

#### Figure 2 : Field-validated remnant vegetation mapping in the Stage 1 impact area

Byerwen Mine Offset Assessment

Data	Map Project : Road, Wate	Map Nun Date: 0 tion: GDA 1 ercourse, M	nber: 15061_02_K 9 September 2016 1994 MGA Zone 55 1L - (c)DNRM 2016						
0	0.5	1	2						
Kilometres									
ecological									



Vegetation Management Act Watercourse

#### Significant Fauna Records

Squatter Pigeon (*Geophaps scripta scripta*) [Vulnerable (EPBC Act, NC Act)]

#### Assessment Site

0

0

Tertiary Site

Quaternary Site

Ecological Equivalence Methodology Plots

Quaternary (Photo Point only)

#### Figure 3 : Assessment Units in the Stage 1 impact area

Byerwen Mine Offset Assessment

Map Number: 15061\_03\_K Date: 06 September 2016 Map Projection: GDA 1994 MGA Zone 55 Data: Road, Watercourse, ML - (c)DNRM 2016 0 0.5 1 2



Ν



- Wollombi Station Stage 1 offset investigation area
  - Mining leases
- Cadastral Boundary

Vegetation Management Act Watercourse

#### Assessment Site

- Tertiary Site
- Quaternary Site
- Quaternary (Photo Point only)

#### Significant Fauna

 Squatter Pigeon (*Geophaps scripta scripta*) [Vulnerable (EPBC Act, NC Act)]

#### Remnant Vegetation Vegetation Management Act Status

- Of concern
- Least concern
- Non-remnant Endangered
- 🕖 Non-remnant Of concern
- Non-remnant Least concern

#### Figure 4 : Field-validated vegetation mapping in the Wollombi Station Stage 1 offset investigation area

Byerwen Mine Offset Assessment







- Wollombi Station Stage 1 offset investigation area
- Mining leases
  - Cadastral Boundary
  - Vegetation Management Act Watercourse

#### **Assessment Site**

- Ecological Equivalence Methodology Plots
- Tertiary Site
- Quaternary Site
- Quaternary (Photo Point only)

#### Significant Fauna

 Squatter Pigeon (Geophaps scripta scripta) [Vulnerable (EPBC Act, NC Act)]

#### **MNES Offset Areas**

- Squatter Pigeon offset area Polygons 34, 41, 45, 46, 47, 50, 53, 54, 55, 56, 57, 58, 59
- Brigalow TEC offset area Regrowth RE 11.4.9 (Polygon 32 and a portion of Polygon 30)
- Ornamental Snake offset area Regrowth RE 11.4.9 (Polygons 30 (part of), 32, 39 and 43)
- Figure 5 : Assessment units and proposed MNES offsets in the Wollombi Station ons 34, 57, 58. Stage 1 offset investigation area
  - Byerwen Mine Offset Assessment
  - Map Number: 15061\_05\_R Date: 12 September 2016 Map Projection: GDA 1994 MGA Zone 55 Data: Road, Watercourse, ML - (c)DNRM 2016 0 0.5 1 2 Kilometres



- Wollombi Station Stage 1 offset investigation area
- Mining leases
- Cadastral Boundary
  - Vegetation Management Act Watercourse

#### Assessment Site

- Tertiary Site
- Quaternary Site
- Quaternary (Photo Point only)

#### Significant Fauna

Squatter Pigeon (*Geophaps scripta scripta*) [Vulnerable (EPBC Act, NC Act)]

#### SSBV Offset Areas

- Watercourse vegetation offset area Remnant and non-remnant REs 11.3.2 and
- 11.3.4 in portions of polygons 1, 8, 31, 34, 45, 46, 50, 53, 54, 55 within 200m of 5th order streams
- Of concern offset area Remnant and nonremnant RE 11.3.2 in polygons 1, 8, 31, 34, 47, 50, 53, 54, 64

Connectivity offset area –Non-remnant REs in portions of polygons 8, 31, 39, 41, 43, 45, 46, 55, 56, 57, 58, 59, 64

within the Biodiversity Planning Assessment regional ecological corridor

#### Figure 6 : Assessment units and SSBV offsets in the Wollombi Station Stage 1 offset investigation area

Byerwen Mine Offset Assessment





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Wollombi Station Stage 1 offset investigation area

Wollombi Station Stage 1 offset area - 526.2ha (proposed as at September 2016)

Wollombi Station (Lot 1 on SP278043)

Cadastral Boundary

Vegetation Management Act Watercourse

#### Figure 7 : Proposed offset areas

Byerwen Mine Offset Assessment

Map Number: 15061\_07\_0 Date: 10 September 2016 Map Projection: GDA 1994 MGA Zone 55 Imagery: Digital Globe 2008 Data: Road, Watercourse, ML - (c)DNRM 2016 0 0.5 2 Kilometres Ν SCOLO CLOS



**Biodiversity Planning Assessment Mapping** 

#### Other Special Features

#### **Ecological Corridors**

- Regional Ecological Corridor
- State Ecological Corridor

Map Number: 15061\_08\_J Date: 10 September 2016 Map Projection: GDA 1994 MGA Zone 55 Data: Road, Watercourse, ML, BPA mapping - (c)DNRM 2016 0 0.5 1 2 3 4 5 Kilometres

# **Appendix A**

EEM plot output summaries for each RE in the impact and offset areas

Assessment Unit:	AU1		Α	U2		AU3				
Regional Ecosystem	11.3.1	11.4.2				11.4.8				
Assessment Unit Size (ha):	4.5	107.2				43.9				
BVG1M:	25a		1	7a		25a				
Polygon No.:	8	14	10	9	5	18	13	7	6	
Polygon Size (ha):	4.5	66.4	3.5	29.8	7.6	25.6	6.4	3.1	8.9	
Site Condition Score:	47.5	67.0	61.0	61.0	61.0	55.0	55.0	55.0	64.5	
Site Context Score	12.0	7.0	6.0	2.0	16.0	18.0	11.0	19.0	2.0	
Ecological Condition Score (Site Condition plus Site Context)	59.5	74.0	67.0	63.0	77.0	73.0	66.0	74.0	66.5	
	2.71	49.10	2.32	18.77	5.85	18.69	4.19	2.27	5.91	
EEM for AU	2.7	2.7 7			5.0		31.1			
Assessment Unit:		AU4		AU5		AU6	AU7	AU8		
Regional Ecosystem		11.4.9		11	.7.4	11.9.7a	11.9.9	11.9.1		
Assessment Unit Size (ha):		74.3			141.8		1.84	88	1	
BVG1M:		25a		12a		17a	13c	25a	1	
Polygon No.:	12	11	19	4	1, 2, 3	17	16	15	1	
Polygon Size (ha):	59.9	5.05 9.4		30.1	111.7	15.0	1.8	88 (0.1 within Stage 1)		
Site Condition Score:	50.75	41.0	60.0	65.0	50.0	62.0	53.5	59.5	1	
Site Context Score	7.0	18.0	12.0	18.0	16.0	18.0	18.0	14		
Ecological Condition Score (Site Condition plus Site Context)	57.75	59.0	72.0	83.0	66.0	80.0	71.5	73.5		
	34.6	3.0	6.8	25.0	73.7	12.0	1.3	64.7		
EEM for AU	44.4			98.7		12.0	1.3	64.7		

# Table A1: EEM scores for remnant vegetation impacted by Stage 1 of the project

Stage 1 Offset Assessment

Offset Type		er pigeo:	n (Black-I death add	throated F ler)	Of Concern RE, Watercourse and Connectivity (Squatter Pigeon, Black-throated Finch and Death Adder)		Connectivity (Squatter Pigeon, Black- throated Finch and Death Adder)	
Assessment Unit:		O_AU1					AU2	O_AU4
Regional Ecosystem	11.3.2					n-r 11.3.2		n-r 11.3.4
Assessment Unit Size (ha)		121.015					.047	97.197
BVG1M:	17a					17a		16c
Polygon Number	1	25*	7*	8	47, 50, 53, 54	34	31, 64	44, 45, 46, 55
Polygon Size (ha)	17.711	8.477	57.430	28.148	9.249	41.915	52.132	97.197
Site Condition Score	58.0	58.0 58.0 58.0 54.0 60.5		48.0	41.3	47.7		
Site Context Score	8.0	8.0	11.0	11.0	6.0	14.0	7.0	11.0
Ecological Equivalence Score (Site Condition plus Site Context)	66.0	66.0	69.0	65.0	66.5	63.0	48.3	44.7
EEM for AU		5.59	39.63	18.30	6.15	26.41	25.15	43.44
			81.4		51.6		43.4	

# Table A2: EEM scores for the proposed Stage 1 Wollombi Station offset investigation area - Assessment Units (or part thereof) used for Stage 1 Offsets

Byerwen Coal Project

Stage 1 Offset Assessment

Offset Type		ow & al Snake set	Connectivity (and Squatter Pigeon, Black-throated Finch and Death Adder)	Connectivity (and Squatter Pigeon, Black-throated Finch and Death Adder)	Connectivity (Ornamental Snake)		
Assessment Unit:	0_A	U6	O_AU9	0_AU10	0_AU11		
Regional Ecosystem	n-r 11.4.9		n-r 11.4.9		n-r 11.5.3	n-r 11.5.9	n-r 11.4.9 +/- 11.4.2
Assessment Unit Size (ha)		592	79.111	34.443	64.933		
BVG1M:	25a		17a	18b	25a/17a		
Polygon Number	30 32		58, 59, 60*, 61*	37*, 41, 42*, 56, 57	39, 43		
Polygon Size (ha)	1180.210	104.382	79.111	34.443			
Site Condition Score		37.3	37.5	44.0			
Site Context Score		14.0	8.0	8.0			
Ecological Equivalence Score (Site Condition plus Site Context)		51.3	45.5	52.0	n.p.		
	586.56	53.50	36.00	17.91			
EEM for AU	640.1		36.0	17.9			

\*Polygons within assessment units, which are not proposed to be used as offsets for Stage 1
Stage 1 Offset Assessment

Offset Type	Squatter Pigeon (Black- throated Finch and Death Adder)	Briga Ornaı Snake	llow & mental 9 Offset	Squatter Pig Finch a	Natural Grassland TEC Offset		
Assessment Unit:	O_AU3	<b>o_</b>	AU5	O_AU7	0_A	U8	0_AU12
Regional Ecosystem	11.3.4	n-r 1	1.4.8	11.5.3	11.5	5.9	n-r 11.4.4
Assessment Unit Size (ha)	1.796	42	.34	119.693	287.	738	79.938
BVG1M:	16c	25a		17a	18b		30b
Polygon Number	48, 49	66	62, 63	5, 10, 11, 12, 13, 15, 20, 23	4, 14, 17, 18	21, 40	2
Polygon Size (ha)	1.796	30.287 12.053		119.693	142.488	145.25	79.938
Site Condition Score	51.5	24	44	67	67	57	16
Site Context Score	6	11	8	14	4.8	14	14
Ecological Equivalence Score (Site Condition plus Site Context)	57.5	35	52	81	71.8	71	30
	1.03	9.99	6.27	96.95	102.24	103.13	47.96
	1	10.6	6.3	97	205	5.4	48

# Table A3: EEM scores for the proposed Stage 1 Wollombi Station offset investigation area - Assessment Units (not proposed to be used for Stage 1 Offsets

#### Byerwen Coal Project

#### Stage 1 Offset Assessment

Offset Type	Brigalow and Ornamental Snake	Squ	atter Pigeon (	Black-throat	ed Finch and Death Adder)				
Assessment Unit:	0_AU13	0_/	AU14	0_AU15	0_AU16	0_AU17	0_AU18		
Regional Ecosystem	n-r 11.3.1	11.	3.25	11.3.27b	11.4.11	11.3.7	n-r 11.5.3		
Assessment Unit Size (ha)	17.156	60	.939	22.449	24.906	6.923	25.563		
BVG1M:	25a	1	6a	34d	30b	9e	17a		
Polygon Number	33	26, 27, 28	36, 38, 51, 52, 65, 67	9, 22	3,16,19	6	29		
Polygon Size (ha)	17.156	47.355	13.584	22.449					
Site Condition Score	47	58.5	56	51.5					
Site Context Score	14	18	18	10					
Ecological Equivalence Score (Site Condition plus Site Context)	61	76.5	74	61.5	n.p.	n.p.	n.p.		
	10.47	36.23	10.05	13.81					
	10.5	4	6.3	13.8					

### Appendix B

Brigalow TEC – EPBC Act EOP Offset Calculator Assessment

### Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Signif	Matter of National Environmental Significance									
Name	Brigalow (Acacia harpophylla									
EPBC Act status	Endangered									
Annual probability of extinction Based on IUCN category definitions	1.2%									

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

			Impact calcu	lator								
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source					
			Ecological c		• •							
			This portion of Brigalow TEC in the impact area, is	Area	78.8	Hectares	1. Byerwen Coal Project: Biodiversity Offset Strategy					
	Area of community	Yes	comprised of REs 11.3.1 and 11.4.9. This vegetation ranges in size from 3.14ha to 59.9ha in	Quality 6		Scale 0-10	(Earthtrade 2015). 2. Field survey consistent with the Guide to determining terrestrial habitat quality: a tookit					
			size. Some are fragmented and some are connected to larger tracts in	Total quantum of impact	47.28	Adjusted hectares	for assessing land based offsets under the Queensland Environmental Offsets					
			Threatened species habitat									
				Area								
ator	Area of habitat	No		Quality								
act calcul				Total quantum of impact	0.00							
Imp	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source					
	Number of features e.g. Nest hollows, habitat trees	No										
	Condition of habitat Change in habitat condition, but no change in extent	No										
			Threatene	ed species								
	Birth rate e.g. Change in nest success	No										
	Mortality rate e.g Change in number of road kills per year	No										
	Number of individuals e.g. Individual plants/animals	No										

										Offset o	alculat	or										
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon )	Start are qual	ea and ity	Future are quality withe	ea and out offset	Future ar quality wit	ea and h offset	Raw gain	Confidence in result (%)	Adjusted gain	Net prese (adjusted	ent value hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
										Ecolog	gical Con	nmunities										
	Area of community	Yes	47.28	Adjusted hectares	The proposed offset area is located on Wollombi Station (lot 1 on SP256594) and situated adjacent to a 3.6km stretch of the Suttor River riparian corridor. The offset is 9km to the	Risk-related time horizon (max. 20 years)	20	Start area (hectares)	100	Risk of loss (%) without offset Future area without offset (adjusted hectares)	100% 0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	5% 95.0	95.00	80%	76.00	59.87	47.90	101.30%	Yes		
					south-west of the Stage 1 impact area. Refer to Table 5, Section 3.1.1.	Time until ecological benefit	10	Start quality (scale of 0-10)	5	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	8	4.00	80%	3.20	2.84					
										Threate	ened spec	ies habitat										
						Time over		Start area		Risk of loss (%) without offset		Risk of loss (%) with offset										
ator	Area of habitat	No				averted (max. 20 years)		(hectares)		Future area without offset (adjusted hectares)	0.0	Future area with offset (adjusted hectares)	0.0									
et calcu						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
OIIS	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon )	Start v	alue	Future value offse	without t	Future val offse	ue with t	Raw gain	Confidence in result (%)	Adjusted gain	Net prese	nt value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
	Number of features e.g. Nest hollows, habitat trees	No																				
	Condition of habitat Change in habitat condition, but no change in extent	No																				
										Thi	eatened :	species										
	Birth rate e.g. Change in nest success	No																				
	Mortality rate e.g. Change in number of road kills per year	No																				
	Number of individuals e.g. Individual plants/animals	No																				

				Sur	nmary							
						Cost (\$)						
	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Direct offset (\$)	Other compensatory measures (\$)	Total (\$)				
	Birth rate	0				\$0.00		\$0.00				
Summary	Mortality rate	0				\$0.00		\$0.00				
	Number of individuals	0				\$0.00		\$0.00				
•1	Number of features	0				\$0.00		\$0.00				
	Condition of habitat	0				\$0.00		\$0.00				
	Area of habitat	0				\$0.00		\$0.00				
	Area of community	47.28	47.90	101.30%	Yes	\$0.00	N/A	\$0.00				
						\$0.00	\$0.00	\$0.00				

### Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Signif	icance
Name	Brigalow (Acacia harpophylla
EPBC Act status	Endangered
Annual probability of extinction Based on IUCN category definitions	1.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

			Impact calcu	lator								
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source					
			Ecological c	ommunities			• •					
			This Brigalow TEC in the impact area, is comprised of RE	Area	44	Hectares	1. Byerwen Coal Project: Biodiversity Offset Strategy					
	Area of community	Yes	11.4.8 and a very small component of RE 11.9.1. This vegetation ranges in size from 3.1ha	Quality	7	Scale 0-10	(Earthtrade 2015). 2. Field survey consistent with the Guide to determining terrestrial habitat quality: a tookit					
			to 26.6 ha in size. Some are fragmented some are connected to	Total quantum of impact	30.80	Adjusted hectares	for assessing land based offsets under the Queensland Environmental Offsets					
			Threatened species habitat									
				Area								
ator	Area of habitat	No		Quality								
act calcul				Total quantum of impact	0.00							
Imp	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source					
	Number of features e.g. Nest hollows, habitat trees	No										
	Condition of habitat Change in habitat condition, but no change in extent	No										
			Threatene	ed species								
	Birth rate e.g. Change in nest success	No										
	Mortality rate e.g Change in number of road kills per year	No										
	Number of individuals e.g. Individual plants/animals	No										

										Offset c	alculat	or										
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	izon )	Start are quali	ea and ity	Future are quality witho	a and ut offset	Future ar quality wit	ea and h offset	Raw gain	Confidence in result (%)	Adjusted gain	Net prese (adjusted )	ent value hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
										Ecolog	gical Con	nmunities										
	Area of community	Yes	30.80	Adjusted hectares	The proposed offset area is located on Wollombi Station (lot 1 on SP256594) and situated adjacent to a 3.6km stretch of the Suttor River riparian corridor. The offset is 9km to the	Risk-related time horizon (max. 20 years)	20	Start area (hectares)	65	Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	5% 61.8	61.75	80%	49.40	38.91	31.13	101.08%	Yes		
					south-west of the Stage 1 impact area. Refer to Table 5, Section 3.1.1.	Time until ecological benefit	10	Start quality (scale of 0-10)	5	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	8	4.00	80%	3.20	2.84					
										Threate	ned spec	ies habitat										
						Time over which loss is averted (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset		Risk of loss (%) with offset Future area with offset										
llator	Area of habitat	No				-				(adjusted hectares)	0.0	(adjusted hectares)	0.0									
et calct						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
OIIS	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	izon )	Start v	alue	Future value offse	without t	Future val offse	ue with et	Raw gain	Confidence in result (%)	Adjusted gain	Net prese	nt value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
	Number of features e.g. Nest hollows, habitat trees	No																				
	Condition of habitat Change in habitat condition, but no change in extent	No																				
										Thr	eatened :	species										
	Birth rate e.g. Change in nest success	No																				
	Mortality rate e.g. Change in number of road kills per year	No																				
	Number of individuals e.g. Individual plants/animals	No																				

				Sur	nmary							
						Cost (\$)						
	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Direct offset (\$)	Other compensatory measures (\$)	Total (\$)				
	Birth rate	0				\$0.00		\$0.00				
mary	Mortality rate	0				\$0.00		\$0.00				
Sumr	Number of individuals	0				\$0.00		\$0.00				
•1	Number of features	0				\$0.00		\$0.00				
	Condition of habitat	0				\$0.00		\$0.00				
	Area of habitat	0				\$0.00		\$0.00				
	Area of community	30.8	31.13	101.08%	Yes	\$0.00	N/A	\$0.00				
						\$0.00	\$0.00	\$0.00				

## Appendix C

Squatter Pigeon – EPBC Act EOP Offset Calculator Assessment

### Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance								
Name	Squatter Pigeon (southern)							
EPBC Act status	Vulnerable							
Annual probability of extinction Based on IUCN category definitions	0.2%							

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

			Impact calcu	lator								
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source					
			Ecological c	ommunities			• •					
				Area								
	Area of community	No		Quality								
				Total quantum of impact 0.								
		Threatened species habitat										
			Field-validation of vegetation mapping found that of the	Area	141.8	Hectares	1. Byerwen Coal Project: Biodiversity Offset Strategy					
ator	Area of habitat	Yes	RES outlined in the BOS as providing habitat for the Squatter Pigeon, only remnant RE 11.7.4 was present	Quality	7	Scale 0-10	(Earthfrade 2015). 2. Field survey consistent with the Guide to determining terrestrial habitat quality: a toolkit for assessing					
act calcul			in the Stage 1 impact area. Connectivity of this habitat to the south	Total quantum of impact	99.26	Adjusted hectares	land based offsets under the Queensland Environmental Offsets Policy, Version 1.2					
ImI	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imp	pact	Units	Information source					
	Number of features e.g. Nest hollows, habitat trees	No										
	Condition of habitat Change in habitat condition, but no change in extent	No										
			Threatene	ed species								
	Birth rate e.g. Change in nest success	No										
	Mortality rate e.g Change in number of road kills per year	No										
	Number of individuals e.g. Individual plants/animals	No										

										Offset o	alculate	or										
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start are quali	ea and ity	Future are quality withe	ea and out offset	Future ar quality wit	ea and h offset	Raw gain	Confidence in result (%)	Adjusted gain	Net prese (adjusted l	nt value hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
										Ecological Communities												
	Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0									
						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
										Threate	ened spec	ies habitat										
				Adjusted	The proposed offset area is located on Wollombi Station (Lot 1 on SP256594) - refer to Table 6, Section 3.1.2. This offset area is	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	189	Risk of loss (%) without offset Future area without offset	100%	Risk of loss (%) with offset Future area with offset	5%	179.55	80%	143.64	138.01					
culator	Area of habitat	Yes	99.26	hectares	comprised of non- remnant REs 11.3.2 (polygon 34), 11.3.4 (polygons 45, 46 & 55),	Time until		6 F.		(adjusted hectares) Future quality	0.0	(adjusted hectares) Future quality	179.6					110.41	111.23%	Yes		
et cal					11.5.3 (polygons 58, 59) & 11.5.9 (polygons 41, 56 & 57).	ecological benefit	5	Start quality (scale of 0-10)	6	without offset (scale of 0-10)	5	with offset (scale of 0-10)	8	3.00	80%	2.40	2.38					
OIIS	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start v	alue	Future value offse	without t	Future val offse	ue with t	Raw gain	Confidence in result (%)	Adjusted gain	Net prese	nt value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
	Number of features e.g. Nest hollows, habitat trees	No																				
	Condition of habitat Change in habitat condition, but no change in extent	No																				
										Thi	reatened s	species										
	Birth rate e.g. Change in nest success	No																				
	Mortality rate e.g. Change in number of road kills per year	No																				
	Number of individuals e.g. Individual plants/animals	No																				

				Sur	nmary							
						Cost (\$)						
	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Direct offset (\$)	Other compensatory measures (\$)	Total (\$)				
	Birth rate	0				\$0.00		\$0.00				
nary	Mortality rate	0				\$0.00		\$0.00				
Sumr	Number of individuals	0				\$0.00		\$0.00				
•1	Number of features	0				\$0.00		\$0.00				
	Condition of habitat	0				\$0.00		\$0.00				
	Area of habitat	99.26	110.41	111.23%	Yes	\$0.00	N/A	\$0.00				
	Area of community	0				\$0.00		\$0.00				
						\$0.00	\$0.00	\$0.00				

### Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance								
Name	Squatter Pigeon (southern)							
EPBC Act status	Vulnerable							
Annual probability of extinction Based on IUCN category definitions	0.2%							

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

			Impact calcu	lator			
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source
			Ecological c	ommunities			
				Area			
	Area of community	No		Quality			
				Total quantum of impact	0.00		
			Threatened sp	ecies habitat			
			Field-validation of vegetation mapping found that of the	Area	141.8	Hectares	1. Byerwen Coal Project: Biodiversity Offset Strategy
ator	Area of habitat	Yes	BOS as providing habitat for the Squatter Pigeon, only remnant RE 11.7.4 was present	Quality	7	Scale 0-10	(Earthfrade 2013), 2. Field survey consistent with the Guide to determining terrestrial habitat quality: a toolkit for assessing
act calcul			in the Stage 1 impact area. Connectivity of this habitat to the south	Total quantum of impact	99.26	Adjusted hectares	land based offsets under the Queensland Environmental Offsets Policy, Version 1.2
Iml	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source
	Number of features e.g. Nest hollows, habitat trees	No					
	Condition of habitat Change in habitat condition, but no change in extent	No					
			Threatene	ed species			
	Birth rate e.g. Change in nest success	No					
	Mortality rate e.g Change in number of road kills per year	No					
	Number of individuals e.g. Individual plants/animals	No					

										Offset o	alculate	or										
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start are quali	ea and ity	Future are quality withe	ea and out offset	Future ar quality wit	ea and h offset	Raw gain	Confidence in result (%)	Adjusted gain	Net prese (adjusted	ent value hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
										Ecolog	gical Con	nmunities										
	Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0									
						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
										Threate	ened spec	ies habitat										
-	Area of habitat	Yes	99.26	Adjusted	The proposed offset area is located on Wollombi Station (Lot 1 on SP256594) - refer to Table 6. Section 3.1.2.	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	9.25	Risk of loss (%) without offset Future area without offset (adjusted	30% 6.5	Risk of loss (%) with offset Future area with offset (adjusted	5%	2.31	80%	1.85	1.78	2.96	2.98%	No		
et calculato				hectares	This offset area is comprised of remnant REs 11.3.2 (polygons 47, 50, 53 & 54).	Time until ecological benefit	5	Start quality (scale of 0-10)	7	hectares) Future quality without offset (scale of 0-10)	5	hectares) Future quality with offset (scale of 0-10)	8	3.00	80%	2.40	2.38					
OIIS	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori: (years)	zon	Start v	alue	Future value offse	without t	Future val offse	ue with t	Raw gain	Confidence in result (%)	Adjusted gain	Net prese	ent value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
	Number of features e.g. Nest hollows, habitat trees	No																				
	Condition of habitat Change in habitat condition, but no change in extent	No																				
										Thi	eatened s	species										
	Birth rate e.g. Change in nest success	No																				
	Mortality rate e.g. Change in number of road kills per year	No																				
	Number of individuals e.g. Individual plants/animals	No																				

				Sur	nmary							
						Cost (\$)						
	Protected matter attributes	Quantum of impact	impact Present value of offset % of impact of		Direct offset adequate?	Direct offset (\$) Other compensa measures (\$)		Total (\$)				
	Birth rate	0				\$0.00		\$0.00				
nary	Mortality rate	0				\$0.00		\$0.00				
Sumr	Number of individuals	0				\$0.00		\$0.00				
•1	Number of features	0				\$0.00		\$0.00				
	Condition of habitat	0				\$0.00		\$0.00				
	Area of habitat	99.26	2.96	2.98%	No	\$0.00	#DIV/0!	#DIV/0!				
	Area of community	0				\$0.00		\$0.00				
						\$0.00	#DIV/0!	#DIV/0!				

### Appendix D

Ornamental Snake – EPBC Act EOP Offset Calculator Assessment

### Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Signif	icance
Name	Ornamental Snake (Denisonia
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	0.2%

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

			Impact calcu	lator										
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source							
			Ecological c	ommunities										
				Area										
	Area of community	No		Quality										
				Total quantum of impact	0.00									
	Threatened species habitat													
			Orecentral Sector	Area	229.9	Hectares	1. Byerwen Coal Project: Biodiversity Offset Strategy							
ator	Area of habitat	Yes	habitat proposed to be impacted is comprised of remnant REs 11.3.1, 11.4.2,	Quality	6	Scale 0-10	(Earthfrade 2013). 2. Field survey consistent with the Guide to determining terrestrial habitat quality: a toolkit for assessing							
act calcul			11.4.8, 11.4.9	Total quantum of impact	137.94	Adjusted hectares	land based offsets under the Queensland Environmental Offsets Policy, Version 1.2							
Imi	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imp	pact	Units	Information source							
	Number of features e.g. Nest hollows, habitat trees	No												
	Condition of habitat Change in habitat condition, but no change in extent	No												
			Threatene	ed species										
	Birth rate e.g. Change in nest success	No												
	Mortality rate e.g Change in number of road kills per year	No												
	Number of individuals e.g. Individual plants/animals	No												

										Offset o	alculato	or										
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start are quali	ea and ity	Future are quality witho	ea and out offset	Future are quality with	ea and h offset	Raw gain	Confidence in result (%)	Adjusted gain	Net prese (adjusted l	ent value hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
										Ecolog	gical Com	amunities										
	Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0									
						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
										Threate	ened speci	ies habitat										
ator	Area of habitat	Yes	137.94	Adjusted hectares	The proposed offset area is lcoated on Wollombi Station (Lot 1 on SP256594) and situated adjacnet to the Suttor River riparian corridor. Refer to Table 7, Section 3.1.3. This	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	165	Risk of loss (%) without offset Future area without offset (adjusted hectares)	100% 0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	5%	156.75	80%	125.40	120.49	108.44	78.61%	No		
et calcul					offset area is comprised of non-remnant RE 11.4.9 (polygons 30 (in part) and 32).	Time until ecological benefit	5	Start quality (scale of 0-10)	6	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	9	5.00	80%	4.00	3.96					
Offs	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start v	alue	Future value offse	without t	Future valı offse	ıe with t	Raw gain	Confidence in result (%)	Adjusted gain	Net prese	nt value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
	Number of features e.g. Nest hollows, habitat trees	No																				
	Condition of habitat Change in habitat condition, but no change in extent	No																				
										Thr	eatened s	pecies										
	Birth rate e.g. Change in nest success	No																				
	Mortality rate e.g Change in number of road kills per year	No																				
	Number of individuals e.g. Individual plants/animals	No																				

				Sur	nmary			
							Cost (\$)	
	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
	Birth rate	0				\$0.00		\$0.00
nary	Mortality rate	0				\$0.00		\$0.00
Sumr	Number of individuals	0				\$0.00		\$0.00
•1	Number of features	0				\$0.00		\$0.00
	Condition of habitat	0				\$0.00		\$0.00
	Area of habitat	137.94	108.44	78.61%	No	\$0.00	#DIV/0!	#DIV/0!
	Area of community	0				\$0.00		\$0.00
						\$0.00	#DIV/0!	#DIV/0!

### Offsets Assessment Guide

For use in determining offsets under the Environment Protection and Biodiversity Conservation Act 1999 2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance									
Name	Ornamental Snake (Denisonia								
EPBC Act status	Vulnerable								
Annual probability of extinction Based on IUCN category definitions	0.2%								

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

			Impact calcu	lator										
	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source							
			Ecological c	ommunities										
				Area										
	Area of community	No		Quality										
				Total quantum of impact	0.00									
	Threatened species habitat													
			Ornemental Speke	Area	229.9	Hectares	1. Byerwen Coal Project: Biodiversity Offset Strategy (Earthtrade 2015) 2							
ator	Area of habitat	Yes	habitat proposed to be impacted is comprised of remnant REs 11.3.1, 11.4.2,	Quality	6	Scale 0-10	(Earthfrade 2013). 2. Field survey consistent with the Guide to determining terrestrial habitat quality: a toolkit for assessing							
act calcul			11.4.8 and 11.4.9.	Total quantum of impact	137.94	Adjusted hectares	land based offsets under the Queensland Environmental Offsets Policy, Version 1.2							
Imp	Protected matter attributes	Attribute relevant to case?	Description	Quantum of imj	pact	Units	Information source							
	Number of features e.g. Nest hollows, habitat trees	No												
	Condition of habitat Change in habitat condition, but no change in extent	No												
			Threatene	ed species										
	Birth rate e.g. Change in nest success	No												
	Mortality rate e.g Change in number of road kills per year	No												
	Number of individuals e.g. Individual plants/animals	No												

										Offset c	alculato	or										
	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start are quali	ea and ity	Future are quality witho	ea and out offset	Future are quality with	ea and h offset	Raw gain	Confidence in result (%)	Adjusted gain	Net prese (adjusted l	ent value hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
										Ecolog	gical Com	amunities										
	Area of community	No				Risk-related time horizon (max. 20 years)		Start area (hectares)		Risk of loss (%) without offset Future area without offset (adjusted hectares)	0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	0.0									
						Time until ecological benefit		Start quality (scale of 0-10)		Future quality without offset (scale of 0-10)		Future quality with offset (scale of 0-10)										
										Threate	ened speci	ies habitat										
tor	Area of habitat	Yes	137.94	Adjusted hectares	The proposed offset area is lcoated on Wollombi Station (Lot 1 on SP256594) and situated adjacnet to the Suttor River riparian corridor. Refer to Table 7, Section 3.1.3. This	Time over which loss is averted (max. 20 years)	20	Start area (hectares)	64.9	Risk of loss (%) without offset Future area without offset (adjusted hectares)	100% 0.0	Risk of loss (%) with offset Future area with offset (adjusted hectares)	5% 61.7	61.66	80%	49.32	47.39	37.91	27.49%	No		
et calcula					portion of the offset area is comprised of non- remnant RE 11.4.9 (polygon 39 and 43).	Time until ecological benefit	5	Start quality (scale of 0-10)	5	Future quality without offset (scale of 0-10)	4	Future quality with offset (scale of 0-10)	8	4.00	80%	3.20	3.17					
Offs	Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time hori (years)	zon	Start v	alue	Future value offse	without t	Future valı offse	ue with t	Raw gain	Confidence in result (%)	Adjusted gain	Net prese	nt value	% of impact offset	Minimum (90%) direct offset requirement met?	Cost (\$ total)	Information source
	Number of features e.g. Nest hollows, habitat trees	No																				
	Condition of habitat Change in habitat condition, but no change in extent	No																				
										Thr	eatened s	pecies										
	Birth rate e.g. Change in nest success	No																				
	Mortality rate e.g Change in number of road kills per year	No																				
	Number of individuals e.g. Individual plants/animals	No																				

				Sur	nmary			
							Cost (\$)	
	Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Direct offset (\$)	Other compensatory measures (\$)	Total (\$)
	Birth rate	0				\$0.00		\$0.00
nary	Mortality rate	0				\$0.00		\$0.00
Sumr	Number of individuals	0				\$0.00		\$0.00
•1	Number of features	0				\$0.00		\$0.00
	Condition of habitat	0				\$0.00		\$0.00
	Area of habitat	137.94	37.91	27.49%	No	\$0.00	#DIV/0!	#DIV/0!
	Area of community	0				\$0.00		\$0.00
						\$0.00	#DIV/0!	#DIV/0!

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G Herbarium RE de dominance: d -	efinitions dominant; c-cod	ominant; a - associated; s - supp	ressed	M: mid-dense	(50-80%); 0	jense (80-100%)
G Herbarium RE di dominance: d - crown cover into	efinitions dominant; c - co-d ercept: 1: isolated	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%),	ressed S: sparse (20-50%)	: M: mid-dense	(50-80%); <b>D</b> m - very tall,	dense (80-100%) 35m - extremely tail
G Herbarium RE dd dominance: d- crown cover intu Walter and Hop	efinitions dominant; c - co-d ercept: 1: isolated skins height classes	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12	ressed S: sparse (20-50%) m - mid-high, <b>12-2</b> 0% -	; M: mid-dense Om - tall, 20-35r	(50-80%); <b>D</b> m - very tali , 20-50% - <b>v</b>	dense (80-100%) 35m - <i>extremely tail</i> odiand; 50-80% - open forest, 80-100% - closed forest
G Herbarium RE dd dominance: d- crown cover into Walter and Hop Walter and Hop	efinitions dominant; e - co-d ercept: 1: isolated iskins height classes okins crown cover c	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or	ressed S: sparse (20-50%) m - mid-high, 12-21 clumps; 0.2-20% - 4	: M: mid-dense Om - tall, 20-35r open woodland,	(50-80%); D m - very tall , 20-50% - w	dense (80-100%) 35m - extremely tall odland; 50-80% - open forest, 80-100% - closed forest CONDITION
G Herbarium RE dd dominance: d- crown cover into Walter and Hop Walter and Hop BASAL ARE	efinitions dominant: c - co-d ercept: 1: isolated ( okins height classes okins crown cover c A [fixed point	0. 01-0 4 ominant; a - associated; s - supp 0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or Bitterlich technique: fac	ressed S: sparse (20-50%) m - mid-high, 12-20 clumps; 0.2-20% - 4 tor 1cm]	M: mid-dense Om - tall, 20-35r open woodland,	(50-80%); D m - very tali , 20-50% - v	Idense (80-100%) I35m - extremely tall odiand; 50-80% - open forest, 80-100% - closed forest CONDITION Type Severity (0 to 3)
G Herbarium RE de dominance: d- crown cover into Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant; c - co-d ercept: 1: isolated ( okins height classes okins crown cover c A [fixed point	0.01-04 ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 iasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/S2 12/S	ressed \$: sparse (20-50%) m - mid-high, 12-20 clumps; 0.2-20% - o tor 1cm] L T2	; M: mid-dense Dm - tail, 20-35r open woodland, T1	(50-80%); D m - very tall, , 20-50% - v E	dense (80-100%) 35m - extremely tall odiand; 50-80% - open forest, 80-100% - closed forest CONDITION Type Severity (0 to 3) Fire (& height in m)
G Herbarium RE di dominance: d- crown cover into Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant; c - co d ercept: 1: isolated i okins height classes okins crown cover c A [fixed point	0.01-04 ominant; a - associated; s - supp 0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 iasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/52 13/5:	ressed S: sparse (20-50%) m - mid-high, 12-21 clumps; 0.2-20% - o tor 1cm] L) T2	: M: mld-dense Om - tall, 20-35r open woodland, T1	(50-80%); D m - very tali , 20-50% - v E	tiense (80-100%) 35m - extremely tail ordiand; 50-80% - open forest, 80-100% - closed forest CONDITION Type Severity (0 to 3) Fire (& height in m) Clearing O (historic - 3)
G Herbarium RE dd dominance: d - crown cover into Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant; c - co-d ercept: 1: isolated okins height classes okins crown cover c A [fixed point	0.01-04 ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/52 73/5:	ressed S: sparse (20-50%) m - mid-high, 12-21 clumps; 0.2-20% - 0 tor 1cm] L) T2	: M: mid-dense Dm - tall, 20-35r Open woodland, T1	(50-80%); D m - very tall , 20-50% - w E	tiense (80-100%) 35m - extremely tail codiand; 50-80% - open forest, 80-100% - closed forest CONDITION Type Severity (0 to 3) Fire (& height in m) Clearing O (historic - 3) Thinning / Bingbarking O (historic - 2)
G Herbarium RE di dominance: d - crown cover into Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant; c - co-d ercept: 1: isolated ( okins height classes okins crown cover c A [fixed point	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/52 73/5	ressed S: sparse (20-50%) m - mid-high, 12-21 clumps; 0.2-20% - 4 tor 1cm] L) T2	M: mld-dense Dm - tail, 20-35r oppen woodland	(50-80%); <b>D</b> m - very tali , 20-50% - <b>v</b> E	bense (80-100%) 35m - extremely tail colland; 50-80% - open forest, 80-100% - closed forest CONDITION Type Severity (0 to 3) Fire (& height in m) Clearing O (historic - 3) Thinning/Ringbarking O (historic - 2) Enzing 41
G Herbarium RE di dominance: d- crown cover intr Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant: c - co-d ercept: 1: isolated ( okins height classes okins crown cover c A [fixed point	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/S2 13/S1 4	ressed S: sparse (20-50%) m - mid-high, 12-20 clumps; 0.2-20% - 4 tor 1cm] L) T2	M: mid-dense Om - tall, 20-35r oppen woodland, T1	(50-80%); D m - very tali , 20-50% - v E	Bense (80-100%) $35m - extremely tail$ odland; $50-80\% - open forest, 80-100\% - closed forest         CONDITION         Type         Severity (0 to 3)         Fire (& height in m)         Clearing         O         Thinning/Ringbarking         Chistoric - 3)         Srazing         Zing         Statis Flora   $
G Herbarium RE dd dominance: d- crown cover intu Walter and Hop Walter and Hop BASAL ARE. Species	efinitions dominant; c - co-d ercept: 1: isolated ( ixins height classes ixins crown cover c A [fixed point	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/S2 12/S1 4	ressed S: sparse (20-50%) m - mid-high, 12-2% clumps; 0.2-20% - 6 tor 1cm] L) T2	: M: mid-dense Om - tall, 20-35r open woodiand, T1	(50-80%); D m - very tali , 20-50% - w E	dense (80-100%) 35m - extremely tall odiand; 50-80% - open forest, 80-100% - closed forest CONDITION Type Severity (0 to 3) Fire (& height in m) Clearing O (historic - 3) Clearing O (historic - 2) Thinning/Ringbarking O (historic - 2) Grazing Z1 Exotic Flora $Q - 1$ (glc in gilga)
G Herbarium RE dd dominance: d - crown cover into Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant; e - co-d ercept: 1: isolated ( jokins height classes okins crown cover c A [fixed point	ominant; a - associated; s - supp (0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 lasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/52 13/5:	ressed S: sparse (20-50%) m - mid-high, 12-20 clumps; 0.2-20% - 0 tor 1cm] L T2	M: mid-dense Om - tail, 20-35r open woodland, T1	(50-80%); D m - very tall) , 20-50% - w E	dense (80-100%) $35m - extremely tall$ odiand; 50-80% - open forest, 80-100% - closed forest         CONDITION         Type         Severity (0 to 3)         Fire (& height in m)         Clearing         O       (historic - 3)         Chinning/Ringbarking       O         Srazing       41         Exotic Flora $0 = 1$ Canopy Dieback $<1$
G Herbarium RE dd dominance: d- crown cover into Walter and Hop Walter and Hop BASAL ARE Species	efinitions dominant: c - co-d ercept: 1: isolated ( iskins height classes okins crown cover c A [fixed point	0.01-0.4 ominant; a - associated; s - supp 0.2-2%); V: very sparse (2-20%), s: 1-3m - dwarf, 3-6m - low, 6-12 iasses: <0.2% - isolated trees or Bitterlich technique: fac \$1/52 IS/S: 4	ressed S: sparse (20-50%) m - mid-high, 12-21 clumps; 0.2-20% - o tor 1cm] L) T2	M: mid-dense Om - tail, 20-35r open woodland, T1	(50-80%); D m - very tall , 20-50% - v	Jense (80-100%) $35m - extremely tall$ odland; 50-80% - open forest, 80-100% - closed forest         CONDITION         Type         Severity (0 to 3)         Fire (& height in m)         Clearing         O         Thinning/Ringbarking         Q         Trazing         Exotic Flora         Canopy Dieback         Erosion         Paceruitment

Page 2 of 3

	Random mean	der	1./1	(please	tick type and	circle plot s	ize)
SITE NUMBER: EEM_OA_2	Plot		V	1x1m	10x10m	20x20m	(10x50m)
Species (cont'd)	Presence	Strata	Species			Presence	Strata
Acacia haropohylla	5-6	51					
Terminulia obibrigata	3	51					
Ehretia memberanitalla	+	51					
	-						
ELEOCHAVIS SP. (n-r)	5(4)4	G	Lifeform			Native	Exotic
(pol. E pallens)	0		Tree			2	
Dinelora deupiens	3		Shrub			1	2
Abutilon maluitolium			orass			6	2
Sesbannia cannabina			nero			10	5
Partlenium hysterophorus (g)	2					Heisha	Course
Mansilea drummondi	2		Stratum			Height	Lover
reschyromene indica	+-2						
Huernanthera auticulata	2		-			2.05	42.28
Cuperos sp (n-c)	+		52			2.05	16.20
Urcherachne tusca	+				1		
Maivastrom americanom	1		Crown Cover	Intercept (optiona	1)		1
Plus cline	1		Species	Strata/Height	Intercept	Range (m)	Cover (m)
Panisatum allar	4						1.6
Entronomica FAMOSUS	1		Lee re	leise of	0.3		
Dichanhipm Seviloum.	Ŧ				10		
Paspalidium carspitosim	1						
Crewig latitolia	+						
Chenopodium destortorum (a)	+						
Xauthium purgens P	+						
Cyperus concinus	2						
l'							
		-					
	-						
						-	-
	-						
Distribution of Evotic Flora	Abundance	Severity					
Declared Pests	, as an addinge						
Non-declared exotic flora				1			
Presence: Braun-Blanquet Technique (scale: + 1 throu	gh to 6)		1			© = colle	cted
Community Area (ba)	<1	1-<5	5-<20	20-<50	(>50)	DEH	Mapped:
Community Width (m): <35	35-<75	75-<150	150-300	not linear	variable	Yes	NO

\* pig seats + out, damage less so

						-		and the other diversion of			
LOGICAL EQUIVALENCE			DATE: 2	\$/08/	115		SITE: EE	-01	A-02	-	
-CONDITION PARAMETERS					1912				-		
DUNDCOVER: (ten 1 x 1m plots)	1	2	3	4	5	6	7	8	9	10	Mean
and Cover type	-							3			0.3
ve grass							7	1			
ve herbs & forbs	-		9		3	-		4			1.6
ve shrubs (<1m in height)						-					
I-native grass								1			0.1
i-native heros & sin dos											
atic Vegetation (nothing)									07 #		552
Jaile Vegetation (see regent)	85	95		6	32	62	86 3	0	84	100	00.5
natic vegetation (chief gam)							-	1			0.1
n-aquate seeses							-	1.0	G		21.9
	15	5	73 #	14	51	6	6	40	1	-	all
ak					1	-	A 4	42 \$	*	-	116.5
re ground			6	20 *		32	T	175	4	-	3.4
ther!			12		14	1009	4 100%	100%	100%	100%	100%
DTAL	100%	100%	100%	100%	100%	1007	00.00	100	0x20m	50	)x10m
ADGE TREES: (Eucalypts >30cm DBH and N	Ion-eucalypts	; >20cm)		Plot s	ize:	cize cla	sses (cm)	1		1	
				20	35-	40	45-	50-	55-	>60	(record
pecies	<20	20-25	25-	50-							
						+		-			
12					-					-	
						1		-			1
									-		
									-	-	
								-			
								_	-		
	-									-	
Fucal	unts: Avera	age DBH (thresh	nold)=	-	cm						
Eucary	vote: Aver	age DBH (thresh	hold)=	-	cm						
Non-eucar	ypts. Aver	NPC DOIN (				Hollo	ws:	a series of	Fal	llen Wo	oody
Species Habitat Notes (if applicable):				1.		Ini-A.	50 x 20ml		Ma	atorial	
+ Abundant algai in good condition	mlit dry)	A	racia	4 (2m)	1 1	PIOU:	JO X FOUNT		10.0500	aterian	
E le us Distantin .	Nig. V	very deep	cracia	(2m)	5	<10cm	n wide:		(ler	ngth of fa	allen woo diam and
hand over dom by aquatic u	leg. Pair	ed snipe	cracio	s (2m)	7	<10cn	o wide:		(ler log >0.	ngth of fa s >10cm .5m [Plot	allen woo diam and : 50 x 20
& Cround cover dom. bhaquatic u	leg. Paint	very deep ed snipe	GOr GOr	s (2m)	tal	(Piot: <10cm	o wide:		(ler log >0. <u>Co</u> r	ngth of fa s >10cm .5m [Plot unt Tally	allen woo diam and : 50 x 20
& Cround cover dorn. by aquatic u 4 Dense shrub cover.	reg. Paint	very deep ed snipe	GOr Sor	s (2m) namen	tal	(Plot: <10cn	o wide:		(ler log >0. <u>Co</u> 1.5	ngth of fa s >10cm .5m [Plot unt Tally , 2 , 3 ,	allen woo diam and 50 x 20
# Cround cover dorn. by aquatic u # Dense shrub cover. # Small diameter fallen timbe	veg. Paint v + leafl	very deep ed snipe Har	GOr Sor	s (2m) nameu nake	) tal	(Piot: <10cm	o wide:		(ler log >0. <u>Coi</u> 1.5	ngth of fa s >10cm .5m [Plot unt Tally , 2 , 3 , 1 , 1.5 ,	allen woo diam and $:: 50 \times 200$ $:: 1, 1 \le 0$ : 3, 2, 2
& Ground cover dorn. by aquatic u & Dense shrub cover. & Small diameter fallen timber abundant in patches.	reg. Paint	very deep ed snipe Har	GO S	s (2m) namen nake	) Hal	<10cn	n wide:		(ler log >0. [.5 [.5	ngth of fa s >10cm .5m [Plot .5m [Plot .7, 3, .7, 3, .1, 1.5, .3, 5, 5	allen woo diam and $50 \times 200$ 1, 1.5, 0 5, 3, 2, 2 z, 2, 1.3
& Ciround cover dorn. by aquatic u & Dense shrub cover. & Small diameter fallen timbe abundant in patches.	reg. Paint r + leafl	very deep ed snipe	GOI S	s (2m) nameu nake	) dal	<10cm	n wide:		(ler log >0. <u>Coi</u> 1.5 6,1	ngth of fa s >10cm .5m [Plot unt Tally 5 2 , 3 , 1 ,1 5 , 3 ,5 ,5	allen woo diam and $:: 50 \times 200$ :: 1, 1.5, 0 : 5, 3, 2, 2 : 2, 2, 1.5
& Cround cover dorn. by aquatic u & Dense shrub cover. & Small diameter fallen timbe abundant in patches.	r + kafl	very deep led snipe Har	601 S	s (2m) namen naike	) tal	<10cn	n wide:		(ler log >0. <u>Co</u> 1.5 (•, 1	ngth of fa s >10cm .5m [Plot unt Tally , 7 , 3 , 1 , 1.5 , , 3 , 5 , 5	allen woo diam and $:: 50 \times 200$ :: 1, 1.5, 0 : 5, 3, 2, 2 : 2, 2, 1.5
& Ground cover dorn. by aquatic v & Dense shrub cover. & Small diameter fallen timbe abundant in patches.	v + kafl	very deep led snipe Har	60rs	s (2m) namen nake	) Hal	<10cn	n wide:		(ler log >0. <u>Co</u> 1.5 6,1	ngth of fa s >10cm .5m [Plot <u>unt Tally</u> .7 , 3 , 1 ,1.5 , 3 ,5 ,5	allen woo diam and $50 \times 20$ $\frac{1}{2}$ 1, 1.5, 0 5, 3, 2, 1 2, 2, 1
& Ciround cover dorn. by aquatic v & Dense shrub cover. & Small diameter fallen timbe abundant in patches.	r + kafl	very deep led snipe Har	60rs	s (2m) nameu	) Hal	<10cn	n wide:		(ler log >0. [.5 6,1	ngth of fa s >10cm .5m [Plot unt Tally , 7 , 3 , 1 ,1 .5 , 3 ,5 ,5	allen woo diam ann 1: 50 x 20 1: 1: 1: 5, 0 5; 3; 2; 1 5; 3; 2; 1 5; 2; 1
& Cround cover dorn. by aquatic v & Dense shrub cover. & Small diameter fallen timbe abundant in patches.	r + kafl	very deep led snipe	60r S	s (2m) ramen nake	) Hal	<10cm	n wide:		(ler log >0. [.5 6,1	ngth of fa s >10cm .5m [Plot <u>unt Tally</u> , 7 , 3 , 1 ,1 <i>S</i> , 3 , <i>S</i> , 5	allen woo diam and t: 50 x 20 <u>t</u> 1,1 \$,0 5,3,2,7 z, 2, 1
& Ground cover dorn. by aquatic v & Dense shrub cover. & Small diameter fallen timbe abundant in patches.	veg. Pain v + kafl	very deep led snipe Har	60, s	s (2m) panen nake	) Hal	<10cn >10cn	n wide: O m wide: O AL:		(ler log >0. 1.5 6,1 1, 1	ngth of fa s >10cm unt Tally 7 2 , 3 , 1 ,1 5 , 3 ,5 ,5	allen woo diam and t: 50 x 20 <u>F</u> 1,1 \$,0 b,3,2,2 z, 2,1.2
& Cround cover dorn. by aquatic v & Dense shrub cover. & Small diameter fullen timbe abundant in patches.	v + kafl	very deep ed snipe	601 S	s (2m) nameu nake	Hal	<10cn >10cn	n wide: O n wide: O AL:		(ler log >0. [.5 6,1 1, 1	ottal: 500000 500000 500000 50000 50000 50000 50000 50000 50000	allen woo diam and 1: 50 x 20 1: 1 \$,0 5,3,2,2 2, 2, 1.2 /0:1 ha
* Cround cover dorn. by aquatic v * Dense shrub cover. # Small diameter fullen timbe abundant in patches. WOODY RECRUITMENT: 100%.	r + leafl	very deep ed snipe Har	GOI S	s (2m) raneu	) Hal	<10cn >10cn	n wide: O m wide: O AL: O		(ler log >0. [.5 6,1 1,1	ottal: 56 m	allen woo diam ant 1: 50 x 20 1: 1 5, 0 5 ; 3 ; 2 ; z ; 2 ; 1 : : /0.1 ha
& Cround cover dorn. by aquatic v & Dense shrub cover. & Small dometer fullen timbe abundant in patches. WOODY RECRUITMENT: 100%. TOTAL WEEDS: 2 (Parthenium hys	leg. Pain + kafl 1. Evdde	very deep ed snipe Har Har	601 S	s (2m) manueu nake	Hal	<10cn >10cn >10cn	n wide: O n wide: O AL: O		(ler log >0. [.5 6,1 1, 1	ngth of fa s >10cm S >10cm unt Tally 7 2 , 3 , 1 ,1.5 , 3 ,5 ,5 OTAL: 56m	allen woo diam and $1:50 \times 20$ $\frac{7}{2}$ $1, 1 \le 0$ 2, 3, 2, 7 2, 3, 2, 7 2, 3, 2, 7
Cround cover dorn. by aquatic v 4 Dense shrub cover. 4 Small diameter fullen timbe abundant in patches. WOODY RECRUITMENT: 100%. TOTAL WEEDS: 2 (Parthenium hys Size of Parth (ha)	leg. Pain + leafl	very deep ed snipe Har Har 5-25	60rs	s (2m) ramen nate	Hal	<10cn	n wide: 0 n wide: 0 AL: 0 101 - 200		(ler log >0. <u>Co</u> 1.5 6,1 1, 1	ottal: 56 m 57 ottal 57 ottal 57 ottal 57 ottal 56 m 520	allen woo diam ant :: 50 x 20 1, 1 \$, 0 5, 3, 2, i z, 2, 1 , 2, 2, 1 , 1 z, 2, 2 , 1 , 1 z, 2 , 2 , 1 z, 2 , 2 , 2 , 2 , 2 , 2 , 2 , 2 , 2 , 2
Cround cover dorn. by advatic i 4 Dense shrub cover. 4 Small diameter fallen timbe abundant in patches. WOODY RECRUITMENT: 100%. TOTAL WEEDS: 2 (Parthenium hys Size of Patch (ha)	leg. Pain + kafl 1. Evddd	very deep ed snipe Har (Pea). 5-25 0-10%	60, s	< (2m) manuar natec 26-1 >10-<	) Hal 00 50%	<10cn >10cn	AL: 0 101 - 200 50 - 75%		(ler log >0. [.5 [-, 1] [, 1] [, 1] [, 1] [, 1]	ottal: 5% or > 5% or >	allen woo diam and t: 50 x 20 <u>7</u> 1, 1 \$, 0 5, 3, 2, 7 z, 2, 1 z, 2, 1 /0.1 ha 0
& Cround cover dorn. by aquatic v & Dense shrub cover. & Small dometer fullen timbe abundant in patches. WOODY RECRUITMENT: 100%. TOTAL WEEDS: 2 (Parthenium hys Size of Patch (ha) <5 Connectivity	leg. Pain + kafl 1. Budde	very deep ed snipe Har For 5-25 0-10%	601 5	26-1 20-30-2	00 50% NV RV	>10cn >10cn	n wide: 0 n wide: 0 AL: 0 101 - 200 50 - 75%	0 6 RV	(ler log >0. [.5 6,1 1, 1 7 7	ottal: 56m 520 00 00 00 00 00 00 00 00 00 00 00 00 0	allen woo diam an 1: 50 × 20 1: 1 \$,0 5,3,2,7 2, 2, 1 2, 2, 1 0 /0.1 ha 0 .500 ha RV
& Cround cover dorn. by aquatic v & Dense shrub cover. & Small diameter fullen timbe abundant in patches. WOODY RECRUITMENT: 100%. TOTAL WEEDS: 2 (Parthenium hys Size of Patch (ha) <5 Connectivity Context	leg. Pain + leafl	very deep ed snipe (Har 5 - 25 0 - 10% <10% RV	60, s	26 - 1 20 - 300	) Hal 00 50% W RV	<10cm	n wide: 0 n wide: 0 AL: 0 101 - 200 50 - 75% 30 - 75%	) 6 RV 00	(ler log >0. [.5 6,1 1,1 1,1 7(	ottal: 5% or > 50% or > 5% or > 50% or > 50% or >	allen woo diam an: :: 50 x 20 1, 1 \$, 0 5, 3, 2, i z, 2, 1 z, 2, 1 , 2 , 2, 1 , 1 , 1 , 5, 0 , 2 , 2, i , 2 , 1 , 1 , 2 , 0 , 1 , 1 , 4 , 0 , 2 , 2 , 2 , 1 , 1 , 5 , 0 , 2 , 0 , 2 , 0 , 2 , 7 , 7 , 7 , 7 , 7 , 7 , 7 , 7 , 7 , 7
& Cround cover dorn. by aquatic v & Dense shrub cover. & Small diameter fullen timbe abundant in patches. WOODY RECRUITMENT: 100%. TOTAL WEEDS: 2 (Parthenium hys Size of Patch (ha) <5 Connectivity Context Distance to Water (m) 0-5	leg. Pain + kafl J. Evddde	very deep ed snipe Har 5 - 25 0 - 10% <10% RV 500 - 1000	GOI S	26-1 20-30 1000-	) Hal 00 50% 1% RV 3000	<pre>&gt;10cr &lt;10cn &gt;10cr TOT. 33</pre>	AL: 0 101 - 200 50 - 75% 000 - 50	0) 6 RV 00	(ler log >0. <u>Co</u> 1.5 6,1 7,1 7,1 7,1 7,1	ortAL: 5% or > >75% or (who in (who	allen woo diam an t: 50 x 20 7 1, 1 \$, 0 5, 3, 2, 7 z, 2, 1 2, 1

28.8.2015					
Ged an a					
04-04-2					
1	1				
A havp (2)	51 2.0	92.80 90.84	- 1.96		
A harp	2-4	2 85.24 82.81	\$ 2.36		
T. oblong.	2.0	]	-		
A.havp	2.2	77.11 76.48	0.63		
	1.2	75.49 74.82	6.61		
V	2.3	74.63 73.30	1.27		
A. harp (2)	2.2	72.47 70 41	205		
Loblong	23,		. 54		
Ahavp	1.7	65.90 6.5.38	0.52		
Ahavip (6)	1.8	64.36 60.28	4.08		
A.harp (1)	2.7	-52.03 43.14			
T. oblong	12-14	1.2 10 11 22	1 20	(+ 7 1)	2)
A.havp (5)	2.5	42.41 41.03	2.87	(1. 1001	2)
	1.0	2551 21 37	1.10		
Table (a)	22	27 11 31 17	1.71		
A have (7)	37	32.50 23.61	6.91		
(5)	2.5	27.27 12.40	2.87		
	1-87	15.47 4.48	10.00		
(3)	3.0				
a see to l					
			HI-		

p.4

COLOGICAL	EQUIVAL	ENCE		-	-	EEM_OA_12 Page 1 of 3	
Date: 30.	8.15	Collector	: CJH	+ MNW		SITE	
lime: 13	20	Job No.	1501	01	-		
Mapped RE:	11.3.	2			Lot o	n Plan :	
ield RE:	1-0	113.2					
Description:	20	poulned, 6	pen wl		-		
lope:	Aspect:	Landform	n (local):		Land	form (broad):	
° —	T	pla	10		bro	ad alluvial plain	
lope Shape:	flat	1					
Soils:	mid c	oramlye brow	In silty	clays		Soil Core Photo:	
itter: 5-10	Bare Soil:	10-20 Tim	ber: 5-10	Rock:	4	Groundcover: 60-80	
PLOTOS.	Photo No	7724 77	25 7726	+777	177	8 7772 7723	
-10103.	Direction	N	E S	W	g	reck 0m-273° 100m-93°	
NOTES: CC	mmunit	n mapped	by NRM	asig	Man	but markedly tragmented z	
regetat	ion E	tiny tose	mblance	of KV	lin	ted to a naviow band (<30m)	en isala
ON NW	Ja NE	of polygo	in. The	latter	15 1	agmented from KV of another type,	50 1000
						0	
					-		
PEMMANIT	V	N (V/NI)	Zone		Datu	. GDA94 WGS84	
Vegetative Str	ucture and Co	omposition	Waypoint		Easti	Northing:	-
Stratum	Median	Height range (m)	Intercept	Dominance		Species	1.
-						18	
E					-		
					-		
	-		1	- d	4	0001000	
FD	1		1 3	a	1	https://www.	
[EDL]	16	14-20		-n			
V							
			5	d	4	popula	
(T2)	10	8-12		a/5	P	bleitolius	
<u> </u>					-		
0			1 4	d	4	- hermici	- constr
(S1)	1.5	0.5-6	57	a	H-	Durto NUD C Gradice Couch LC	6 ROOM
-		(10	LOY in son	ap-	1	ern. Melloop & Collocation	- John
		40	what a loo	1. 400)			
		411	icket 2 100	in proof			
S2			15 0	dom En	nlitch	Mir, Ery austrole - cue?	
-		1					
			5	d	B	bladhi	
6	01	24.25	MI	ac	1°B	pertusa	
G	0.1	0.0-0.5		a	- 5	LOV	
					-		
Herbarium PE defe	itions				-		
dominance: d - dov	minant: c-co-dos	ninant: a - associated: s - sun	pressed				
crown cover interce	ept: 1: isolated (0.	2-2%); V: very sparse (2-20%)	, S: sparse (20-50%); M	1: mid-dense (50-80	%); D: dens	se (80-100%)	
Walter and Hopkins	s height classess: 1	-3m - dwarf, 3-6m - low, 6-1	2m - mid-high, 12-20m	- tall, 20-35m - ven	y tall, >35m	n - extremely tall	
Walter and Hopkins	s crown cover class	ses: <0.2% - isolated trees or	r clumps; 0.2-20% - ope	en woodland, 20-50	% - woodla	ne; 50-80% - open forest, 80-100% - closed forest	
BASAL AREA [	fixed point Bit	tterlich technique: fac	ctor 1cm]	101	CON	DITION	
Species		\$1/52 T3/S	1) (T2)	(T1) E		Type Severity (0 to 3)	
Zpopuli	rea	1	3	8	Fire	(& height in m)	
11					Clea	O(2-historic)	
'stag'					Thin	ning/Ringbarking Q(3-historic)	
U					Graz		
				+ +	EXO	any Dieback	(201
					Eroc	op Cramaining to	ico)
					Rec	nitment 2	1
						del	
			the second se				

Ш

#### ECOLOGICAL EQUIVALENCE Page 2 of 3 (please tick type and circle plot size), Random meander SITE NUMBER: EEM-0A-12 Plot V 1x1m 10x10m 20x20m ( 10x50m) Presence ecies Presence Strata Species (cont'd) Strata E populaça 6 51-7 Atal. hemiglaura Ehr. newboan. 4 51 2 SI 2 51-T2 Alec. oleif. Lifeform Native Exotic ree 2 Both. bladhi 3-5 hrub 2 × Boertusa rass 3-5 4 2 B. decipiens 2 lerb 2 2 2 + Malv. americ 2 Watth. indica tratum Height Cover Entero, ramosos. Chrysop, fallax Stylbsanthes Scalora 2 17.5 14-42 7 12.8 3.8 + 2.97 5.06 Urdchlog mosamb. × + yperus fylvus + Crown Cover Intercept (optional) Species Strata/Height Intercept Range (m) Cover (m) be 0 **Distribution of Exotic Flora** Abundance Severity **Declared** Pests Non-declared exotic flora © = collected Presence: Braun-Blanquet Technique (scale: +, 1 through to 6) 5-<20 20-<50 >50 DEHP Mapped: Community Area (ha): <1 1-<5 site only Community Width (m): <35 35-<75 75-<150 150-300 not linear variable No Yes

COLOGICAL EQUIVALENCE	-	_									Page 3 of	f 3
BICO-CONDITION PARAMETERS				DATE	30/08	12015		SITE: E	ern-c	A-12		
GR OUNDCOVER: (ten 1 x 1m plots)	-			-		65	-	1				
Ground Cover type	-	1	2	3	4	5	6	7	8	9	10	Mean
Native grass					-	3						0.6
Native herbs & forbs							1					
Nattive shrubs (<1m in height)												
Nom-native grass	26	,	54	42	38	28			-			37.6
Nor - native herbs & shrubs			-					1				
Aquatic Vegetation (floating)												
Aquatic Vegetation (submerged)				-				-				
Aquatic Vegetation (emergent)				1			-	-				
Norn-aquatic sedges								-		-		
Ferens		_		-								
Litter	11		9	5	6	8						7.8
ROCK												
Bar∈ground	63	H	37 3	51	56 #	61	-			-		53.6
(Other)	-						1		1000	10001		
TOTAL	1009	6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LA RGE TREES: (Eucalypts >30cm DBH and Non-	eucaly	pts >20	lcm)		Plot siz	ze:	(100	0x50m	100	x20m	50>	k10m
Spæcies				-	Tally	of DBH s	ize class	es (cm)				
	<	20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
E. 000			HAT UII	91		1		1				-
V. viminalis				1	"	1		-				
5400			""			-	-					
V. Mmmalls	51	3.0	10.32	12.16	184		51	5.06	-	-		
A.hemiglanca	51	1.7	17.99	18.93	0.94		TZ	3.8				
E.pop	51	4.8	24.80	26.98	2.18		TI	14.42				
Ε.ρορ	五	12.9	57.61	61-41	3.8							-
E. 20p (2)	T,	15.2	71.0	85.4	14.42							
A. heuriglance	51	2.4	77.03	78.0	1.04				10			
Eucalypts:	Aver	age DB	H (threshold	l)=	C	m		8	(24)			
Non-eucalypts:	Aver	age DB	H (threshold	()=	C	m		4	~			
Species Habitat Notes (if applicable): # Hollow only observed in larger blags # Moderate abundance of large oliamed # Area harvily grazed.	eutsu er fe	de p allen	lot. timber·			H [F <1	ollows rlot: 50 x L0cm wid	: 20m] de:		Faller Mate (length logs >1 >0.5m Count 1.5,2	rial: of fallen Ocm diar (Plot: 50 <u>Tally:</u> 36, 1	i woody m and x 20m])
						>1	LOCM WIG	de:				
WOODY RECRUITMENT: 100% (LOW a	bundle	mcl)				TO	OTAL:			TOTAL	alau	-
TOTAL WEEDS: 3 (B perfuse ; C. cilcar,	() Pa	wh							-	(0.5r	10.10	. In
Size of Patch (ha)	T	5 -	25	26	100		101 -	200		>2	200	
Connectivity		(0 - 1	10%)	>10	<50%		50 - 7	75%		>75% or	>500 ł	na
Context		<10%	6 RV	610-	80% RV	1	30 - 75	5% RV		>75	% RV	
Distance to Water (m) 0 - 500	-	500		1000							Complementaries	and the subscription
		500 -	1000	1000	- 3000		3000 -	5000		>5	000	

0.	RIE		1001	N MALIA		Page 1
are: )[	1.5	Collector:	- COL	a MINN	1	SITE: SITE:
imie: 14	40	JOD NO.			1.1	
Aa pped KE:	11-1	fr 11.10	11.1. 6		LOI	on Plan :
le d KE:	A-r	FHVK	1149	the sta	11	0.0.4
escription:	I-I-Ir	avpophula	realo	wiri sh	100	arta
lo pe:	Aspect:	Landform	(local): V		Lan	oform (broad):
6	T	Pla	10/		14	raad day plain
lo pe Shape:	flat					
oil s:	md -!	orown loan	y clay	3		JC 68m Soil Core Photo:
						Surface Soils Photo: 3742
itt er: 10 - 20	Bare Soil:	15-45 Timbe	r: 5	Rock: -	-	Groundcover: 30-50
TOS:	Photo No	7741 770	12 7743	7744	171	45 7746 7 7740.
HE TOOL	Direction	N E	S	W		Vc 9 100 0m - 344 100m - 104
NO TES: M	NOTE IN	tact than c	ireas to	514	5 (	> gilaal development
- Many	INKU (OD)	rected, deer	1 + with	very la	wal	cracks
- × P. 21	liave 1	inited to !!	nghest	points 4	0.	ren largely excluded
- Elec	charis	Swavds pres	ralent i	in places	b	more common to (D) of site
- catlle	pads	through (or	nonut	1 (pr	1	F149
	-			7	-	
REMINANT	Y	(N) Y/N?	Zone:	55K	Dat	m: GDA94 (WGS84)
Vegetative St	ructure and Co	mposition	Waypoint	: -	Eas	ng: Northing:
Stratum	Median	Height range (m)	Intercept	Dominance		Species
F						
E						
T1						
[EDL]						
1						
/						
T2						
			5	d		harpophylla
(\$1)	26	Dr 1	1	a3		6610nglata
12	2.0	0.6-4	15	G		carroni
			80-40/			
52						
52						
52						
52			5	d	~	aviable - see over
52				d		aviable - see over
S2 G	6.2	0.01-0.6	5	d	~	aviable - see over
S2 G	0.2	0.01-0.6	5	d	~	aviable - see over
S2 G	6.2	0.01-0.6	5			aviable - see over
S2 G	6.2.	0.01-0.6	5		~	aviable - see over
S2 G terbarium RE definit tominance: d - dom	6.2 Ions nant; c-co-domin	0.01 - 0.6 ant; a - associated; s - suppress	ed			aviable - see over
S2 G ierbarium RE definit kominance: d - dom rown cover intercep	6.2 lons inant; c.co-domir t: 1: isolated (0.2-2	0.01-0.6 ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf 3.6m - low 6.13-	ed midthigh 13-20-	mid-dense (50-80%)	; D: deny	aviable - see over (80-100%)
S2 G ierbarium RE definit kominance: d - dom rown cover intercep Walter and Hopkins I Walter and Hopkins	6 - 2 ions inant; c - co-domir t: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes	0 · 0 1 – 0 · (- ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - ; <0.2% - isolated tenes or other	ed warse (20-50%); M: r mid-high, 12-20m - 1 ps: 0,2-20% - orange	mid-dense (50-80%) tali, 20-35m - very tr woodiand 20-50%	; D: den all, >35r	aviable - see over (80-100%) extremely toll 1: 50-80% - open forest 80-100% - closed forest
G Ierbarium RE definit Iominance: d - dom rown cover intercep Walter and Hopkins I Walter and Hopkins o	6 - 2 lons inant; c - co-domir t: l: isolated (0.2-2 reight classess: 1-3 rown cover classes rown cover classes	ant; a - associated; s - suppress %); V: very sparse (2-20%), S: sj m - dwarf, 3-6m - low, 6-12m - ; <0.2% - isolated trees or clum	ed mid-high, 12-20m - 1 ps; 0.2-20% - open 1 cm]		; D: dem all, >35r woodia	aviable - See over (80-100%) extremely tall 15 50-80% - open forest, 80-100% - closed forest NTION
S2 G terbarium RE definit sominance: d - dom rown cover intercep Walter and Hopkins I Walter and Hopkins o BASAL AREA [fiz	ions inant; c - co-domin tt: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes ced point Bitte	ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - : <0.2% - isolated trees or clum erlich technique: factor s1/c2 = -2/c4	ed mid-high, 12-20m - 1 ps; 0.2-20% - open 1cm]	mld-dense (50-80%) tali, 20-35m - very ta woodiand, 20-50% -	; D: dem all, >35n woodla CON	aviable - See over (80-100%) extremely tall t; 50-80% - open forest, 80-100% - closed forest DITION
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins I Walter and Hopkins o BASAL AREA [fit Species	ions inant; c - co-domin t: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes (ed point Bitte	0.01-0.6 ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - : <0.2% - isolated trees or clum rrlich technique: factor \$4/52 T3451	ed mid-high, 12-20m - 1 ups; 0.2-20% - open 1cm] T2	mld-dense (50-80%) tali, 20-35m - very tr woodland, 20-50% - T1 E	; D: denn i; D: denn ii, 235rr woodia CON	aviable - See over         (80-100%)         extremely tail         d; 50-80% - open forest, 80-100% - closed forest         DITION         Type         Severity (0 to 3)
S2 G Herbarium RE definit dominance: d - dom crown cover intercepp Walter and Hopkins I Walter and Hopkins C BASAL AREA [fiz Species	6.2 ions inant; c.co-domin tt: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes ced point Bitto Augula	$0 \cdot 01 - 0 \cdot 6$ ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - 1 :: <0.2% - isolated trees or clum erlich technique: factor St/S2 T3/51	ed mid-high, 12-20m - 1 ps; 0.2-20% - open 1cm] T2	mld-dense (50-80%) tali, 20-35m - very tz woodland, 20-50% - T1 E	; D: denor i; D: denor woodla CON	aviable - See over         a
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins I Walter and Hopkins 0 BASAL AREA [fiz Species	6.2 ions inant; c - co-domir t: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes ced point Bitto 2hylla	0.01 - 0.6 ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - : <0.2% - isolated trees or clum erlich technique: factor S4/S2 T3451	ed arse (20-50%); M: r mid-high, 12-20m - 1 ps; 0.2-20% - open 1cm] T2	mld-dense (50-80%) tall, 20-35m - very tr woodland, 20-50% - T1 E	; D: derror all, >35r CON Fire Clea	aviable - See over (80-100%) extremely tall d; 50-80% - open forest, 80-100% - closed forest piTiON Type Severity (0 to 3) & height in m) O ng O (historic - 3)
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins 0 Walter and Hopkins 0 BASAL AREA [fin Species	6.2 ions inant; c - co-domir t: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes ked point Bitter 2hylla	ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - ; <0.2% - isolated trees or clum erlich technique: factor \$1/52 T3(51)	ed barse (20-50%); M: r mid-high, 12-20m - 1 ps; 0.2-20% - open 1cm] T2	mid-dense (50-80%) tali, 20-35m - very ta woodland, 20-50% -	; D: denu ; D: d	aviable - See over (80-100%) extremely tall b; 50-80% - open forest, 80-100% - closed forest p1TION Type Severity (0 to 3) & height in m) ng O (historic - 3 ing/Ringbarking 11
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins o BASAL AREA [fin Species Lav PO	6 - 2 lons inant; c - co-domir it: 1: isolated (0.2-2 height classess: 1-3 rown cover classes ked point Bitte hylla	ant; a - associated; s - suppress %); V: very sparse (2-20%), S: sy m - dwarf, 3-6m - low, 6-12m - :: <0.2% - isolated trees or clum erlich technique: factor \$1/52 T3451	ed warse (20-50%); M: r mid-high, 12-20m - 1 ps; 0.2-20% - open 1cm] T2	mid-dense (50-80%) tali, 20-35m - very ta woodiand, 20-50% - T1 E	; D: den all, >35r CON Fire Clea Thir Graz	aviable - See over (80-100%) extremely tall t; 50-80% - open forest, 80-100% - closed forest DITION Type Severity (0 to 3) & height in m) ng O (historic - 3 ing/Ringbarking O 11 Plane
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins I Walter and Hopkins o BASAL AREA [fii Species	lons inant; c - co-domir t: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes ked point Bitte 2hylla	0.01-0.6 ant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - :: <0.2% - isolated trees or clum erlich technique: factor S1/52 724/51	ed arse (20-50%); M: r mid-high, 12-20m - r ips; 0.2-20% - open 1cm] T2	mid-dense (50-80%) tali, 20-35m - very ta woodland, 20-50% - T1 E	; D: dens all,>35r woodla CON Fire Clea Thir Graz Exot	aviable - See over         bittom         aviable - See over         bittom         aviable - See over         bittom         bittom         bittom         aviable - See over         bittom
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins I Walter and Hopkins O BASAL AREA [fit Species	6-2 ions inant; c-co-domin t: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes ked point Bitte 2hylla	0.01-0.6 uant; a - associated; s - suppress %); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - : <0.2% - isolated trees or clum erlich technique: factor \$4/S2 T3/51	ed mid-high, 12-20m - 1 ups; 0.2-20% - open 1 T2	mid-dense (50-80%) tall, 20-35m - very ta woodiand, 20-50% - T1 E	; D: deror ; D: deror ill, >35r woodla CON Fire Clea Thir Graz Exot	$a_{1}a_{1}a_{2}b_{1}b_{2} - b_{2}b_{2}a_{2}a_{3}a_{4}a_{4}b_{2}b_{2}a_{4}a_{4}b_{2}b_{2}a_{4}a_{4}b_{2}b_{2}a_{4}a_{4}b_{2}b_{2}a_{4}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}a_{4}b_{2}b_{2}b_{2}b_{2}b_{2}b_{2}b_{2}b_{2$
S2 G Herbarium RE definit dominance: d - dom crown cover intercep Walter and Hopkins I Walter and Hopkins O BASAL AREA [fin Species	ions linant; c - co-domin tt: 1: isolated (0.2-2 reight classess: 1-3 rown cover classes keed point Bitto 2hylla	0.01-0.6 uant; a - associated; s - suppress 5%); V: very sparse (2-20%), S: s m - dwarf, 3-6m - low, 6-12m - : <0.2% - isolated trees or clum erlich technique: factor S4/S2 T3451	ed mid-high, 12-20m - 1 ups; 0.2-20% - open 1cm] T2		; D: denn ; D: denn il, >35r woodla CON Fire Clea Thin Graz Exot Cano Eros	aviable - see over $(80-100%)$ $extremely tail$ $(50-80% - open forest, 80-100% - closed forest$ $piTION$ $Type Severity (0 to 3)$ $8 height in m) O (historic - 3)$ $9 high O (historic - 3)$ $9 hig$

COLOGICAL EQUIVALENCE				(1)	41-1-4	Pag	ge 2 of 3
ST TE NUMBER: 55M 00 13	Random mea	inder		(please	tick type an	d circle plot	size)
	Piot	Strata	Species	14111	10/10/11	Preso	10x50m
sp. ecles (contra)	Fresence	Strata	pecies			Fresence	Strata
Accella narpopulgia	2	191					
1- Obionadice 1							
A dilla di Calina	4						
A. averaitonos		1					
Saindalon crebic	5		Lifeform			Native	Exotic
Decirlanoomene induce	3 6		Tree			2	
Elepchavis pallens	2-5 N		Shrub		المستح	2	
RESIDENTIA FAINTIALINA	2 1		Grass			4	1-
Satrong Man Mangus	2		Herb			9	2
Zucheliam cassoitozum	2-3						
Be poolella questralis	10.0		Stratum			Height	Cover
Coefus availis	+		T1				
Difference thus austr / com	+-7		T2				
Currentis avillaris	2 (0)		51			2.47	38.54
Parthenium hust portorus.	1 3		52				
Marsilea drumm.	2 6						
Hibiscus trionim	+-2 Y	1	Crown Cover	Intercept (optiona	1)		
(uperus 3D.	2		Species	Strata/Height	Intercept	Range (m)	Cover (m)
Leptochlog digitata	+						
CUPERUS CONCINIONS		1	see ru	reise p.3			
P. Chiave	+-3						
			-				
			-				
			-				
			-				
							-
			1				
	-						
Distribution of Exotic Flora	Abundance	Severity					
Declared Pests							
Non-declared exotic flora							
Dresence: Braun-Blanquet Technique (scale: + 1 thr	ough to 6)		-			© = collect	ed
Community Area (ha)	<1	1.45	5-<20	20-<50	(>50)	DEHP	Mapped:
Community Width (m):	25-75	75-(150	150-300	(not linear	variable	Yes	No
Community which (m).	00000	1 10-1100	100 500	( institucei )		100	( "

COLOGICAL EQUIVALENCE									1	age 3 o	f 3
BIO-CONDITION PARAMETERS			DATE	30/08/2015 SITE: EEM-0A-13							
GR OUNDCOVER: (ten 1 x 1m plots)	15								95	5	
Ground Cover type	1	2	3	4	5	6	7	8	9	10	Mean
Native grass	23	6	8		150			4			5.9
Nattive herbs & forbs									9		
Native shrubs (<1m in height)								6		4	1.0
Nor-native grass		-		48		28			18		94
Nom-native herbs & shrubs		-	6				3	4		2	1.5
Aquatic Vegetation (floating)			-								
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)							91 -	38			12.9
Norn-aquatic sedges											
Ferens											
Litter	27	88	+ 4	12	76 #	15	4	12	58 *	94.	39.0
Roc k											
Bar ∉ ground	50 +	6	12	40 =	6	57 =	2	36 #	24		29.3
(Other)										1-1	
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and Non	eucalypts >20	lcm)		Plot siz	e:	100>	(50m	(100)	(20m)	50)	10m
Spæcies			_	Tally o	of DBH si	ze classe	s (cm)	1			_
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
NIL			_								
			_								
		-									
											1. Com
Eucalypts:	Average DB	H (threshold	=(b	CI	m	-					
Non-eucalypts:	Average DB	H (threshold	i)=	Cr	m						-5
Species Habitat Notes (if applicable):					Н	ollows:			Fallen	Wood	y
					[P	lot: 50 x 2	20m]		Mater	ial:	
					<1	Ucm wide	e:		logs >10	of fallen Jcm diar	woody n and
						0			>0.5m [	Plot: 50	x 20m])
									Count T	ally:	~ ( )
									04,11,11	, -1	0.5,0
			0			Acm wide					
					-1		с.				
						0					
WOODY RECRUITMENT: /pp 2					TO	TAL:			TOTAL:		
TOTAL WEEDS: 4. (8. pertusa 19. cilia	ve ; bude	dah Rea	Ravel	mum)		0			7.0r	n/0.1n	4
Size of Patch (ha) <5	5-	25	26	100	1	101 - 2	200		>2	00	
Connectivity	0-1	0%	>10	<50%		50 - 7	5%		>75% or	>500 1	a
Context	-100	6 BV	>10-	80% RV	-	30 - 750	% RV		>750	6 RV	
	C107	1000	100-	2000		0000 -	0000		2137	o nv	
Distance to Water (m) 0 - 500	500 -	1000	1000	- 3000		5000 - 5	0000		>50	100	
Ecological Corridors	Not W	/ithin	Shar	ng a cor	nmon	Bounda	iry	Wit	hin (wh	ole of p	part)

EEM-0A-13

30.8.15

spepies	, stit	Hot	st	END	Cover
A barn (4)	51	2.5	0	3.50	3.50
1	Sho-	2.2	5.68	7.32	1.64
		2.0	13.20	14.36	116
		1.9	15.32	16.30	0,98
- (2)		23	18.74	20.67	1.93
1 - (5)		2.8	24-10	28.08	3.98
Table (2)	1123	2.0	37.20	39 18	1-98
Tobl		207	41.50	45.54	4.04
Aharo (2)		3.1	-	-	-
TODI		1.8	50.00	5131	1.31
Above (4)		2.8	54-37	60.18	5.81
(2)		1.9	61.57	64.35	2-78
-		2-9	64-64	65.48	0.84
- (2)		2.3	66.05	68.72	2.67
-		1.6	85.15	86.10	0.95
- (3)	HR	2.8	92.02	95.53	3.51
- (2)		3-2	196.63	98.05	1.40

Date: 23.1	27015	Collector:	CJH	I, MNW	12 8	SITE: CO. 1	EEM_OA_19
Time: 081	0	Job No.	150	bl (f	rei 15040)	5P42 (	
Mapped RE:	0-r	1			Lot on Plan :		and the second
Field RE:	1)-1	(1134)			11		
Description:	trage	manted 2 p	pourea	00lu	(J)		
Slope:	Aspect:	Landform (I	ocal):		Landform (broad):	6	
%	-	plain	-		Hoodplain	Dt Suttor	River
Slope Shape:	tlat.	1	A Company		1		
Soils:	mid bro	wn sandy lo	nua			Soil Core Photo:	-
	1	in the second se		1		Surface Soils Photo:	4054
Litter: 10-20	Bare Soil:	5 - 70 Timber:	40	Rock: -	- Groundco	over: 15-20	1
PHOTOS:	Photo No	4049 4000	4001	4002	40.22	4046	4041
	Direction	N E	S II	W	g/c rock	0m-247	100m - 61
NOTES: pad	tch. E	majure tre	<u>es To</u>	nd bit	disionting	1005 6 10	vge.
Interv	enirg.	spalls .	> n=r	A. 7-	1.5	1 0.00	0
COMM	Municy.	type extense	13 tor	11 2 02	402 of po	14 gan	and = 117-
Spp. 10	at write.	Strom Mu	NOY	11.2.75	201 COMM	Juniore all	grea c 11.2 1
		~~~	~				2
EMNANT	v	N VIND	Zone	551	Datum: GDA94	584	and the second se
Venetative Str	ucture and Co	mosition	Waypoint:	·	Easting: 117, 416	Northing: 71 7	1828
Stratum	Median	Height range (m)	Intercent	Dominance	Species 147.01	790 71 2	18.73
Stratum	weulan	neight range (m)	mercept	Commance	Sheries 144.81	- /1/ 2	1963
	( <u>-</u> )						
E							
			15				
			(	a	5 orounda		
TI	-		V 2	A.	- holo a		1000
[EDL]	15	13-19	10-151	a15	Clessell.	State and	
V			410-101	3	5 councild.		
			VE	d	L CONDAN	AC Sale	6
T2	a	8-12	5.01	a.	Al plaif &	DOD AL PHI	etter L
$\sim$			D-100.	5	T oblona	1 1 1	
				d	Chrudt	Lmitch	
6	2		V 2	CA-	901 austi	all. Leaven	1
(J)	5	1-6	57	015	Elphop, A c	pleit	
			- /		and the last state	- Company	A CONTRACTOR
and the state		the second second	1				
S2							
			(	d	+ P F J AP	the second second	
			)	0	Vele ORK	,	
(6)	01	0.01-03	1 1	4	. Ja. an		
$\bigcirc$							
			1				10000
Herbarium RF definit	tions						
dominance: d - domi	inant: c - co-domi	nant, a - associated: s - sunpress	ed				A AL PROPERTY
rown cover intercen	at: 1: isolated (0.2-	2%); V: very sparse (2-20%). St sr	arse (20-50%): M:	mid-dense (50-80%	); D: dense (80-100%)	Sector Sector	
Walter and Hopkins	height classess: 1-3	Im - dwarf, 3-6m - low, 6-12m - r	nid-high, <b>12-20m</b> -	tall, 20-35m - verv (	all, >35m - extremely toll		
Walter and Hopkins	crown cover classe	s: <0.2% - isolated trees or clum	ps; 0.2-20% - open	woodland, 20-50%	- woodland; 50-80% - open fores	t, 80-100% - closed forest	
BASAL AREA [fi	xed point Bitt	erlich technique: factor	1cm]		CONDITION		
Species		\$1/52 T3/51	(12)	(T1) E	Type	Severity	(0 to 3)
5 anoula	nn.		Y	6	Fire (& height in m)	0	
e kohan	(VIII)				Clearing	0	(2-hid)
1 11.000	ni i	1	1		Thinning/Ringbarking	0	(2-1-15+)
L CLAID	110				Grazing	2	a hand
"stein				1	Exotic Flora	2.2	(ali)
'stag				a sea a s		the c	
ctestel			5		Canopy Dieback		- Jic)
Ctessel Ac Cxc	1		5		Canopy Dieback Erosion		(yrc)
Stan Ctespel Ac Cxc	1		5		Canopy Dieback Erosion Recruitment		( syn)

FCOLOCICAL FOUNDALEN

SITE NUMBER:		Random mea	nder		(please tick type and circle plot size)					
SILE NUMBER: EEM-OA-IQ		Plot		x	<del>1x1m</del>	<del>10x10m</del>	20x20m	(10x50m)		
Species (cont'd)	1	Presence	Strata	Species			Presence	Strata		
E população		5	51-71							
(+ 352)		1.1.	71							
Ac salic		1	51-72							
Ar excelsa		4	51-72							
( brew		3-4	S							
Ly carron		23	51-17	Lifeform			Native	Exotic		
frem witch		2-3	SI	Tree			4			
				Shrub			3	10000		
and the second			-	Grass			5			
				Herb			3	1		
				Stratum			Height	Cover		
P cilliore		5	G	T1			16	27.78		
net cont		3		T2			11.5	16.63		
Sty Scalor.		2		S1			3.1	5.49		
AMStida 50.	Juliana	3		S2	and the second second					
Sida cordif.		1								
Ans ram		2		Crown Cover	Intercept (optiona	l)		-		
C. fallox		2		Species	Strata/Height	Intercept	Range (m)	Cover (m)		
Sidra vohlenal	and the second	1		Ableit	T2  1	0.00	2.51	2.51		
E VAMOSUS		1		2 000	(T) 15	3.80	9.95	6.15		
brun aust		1	V.	1661	TZ 10.5	12-40	20.30	7.90		
				2 pop	51 4	23-82	15.60	1.13		
A CONTRACTOR OF THE		-		2 pop	D H	35.20	41.31	14-11		
1				HC CKI	12 13	25.18	42.40	2.01		
				D. COVE	51 4	101-40	40.36	2-06		
				rc ex		44.04	60.07	7.0		
the second s				Ctth	0 16	61-00	09.40	1.02		
				200- 72			123.3	1		
								1.1.1.1.7		
								2.2		
	Sec. Sec.			0.3.3		1.37.3				
		11111								
			-	1 - 1 - 1						
			-							
					10-11-11-11					
	and the second									
						5				
Distribution of Exotic Flore	1	Abundance	Severity							
Declared Pests		-	-							
Non-declared exotic flora		a	5							
Presence: Braun-Blanquet Technique (	scale: + 1 throug	to 61			1		© = collect	ted		
				1			T			
Community Area (ha):	site only	<1	1-<5	5-<20	20-<50	>50	DEHP	Mapped:		

BIO-CONDITION PARAMETERS	1 1<	15 SITE: BYERWEN (SP 42)									
GROUNDCOVER: (ten 1 x 1m plots)	Contraction dec			20 10		82.93	EEL	4_06	1-19	of le	
Ground Cover type	1	2	3	4	65	6	7	8	9	10	Mean
Native grass											1200
Native herbs & forbs					-						
Native shrubs (<1m in height)											
Non-native grass	4	6	5	4	7				1	1	5.2
Non-native herbs & shrubs											
Aquatic Vegetation (floating)				1							
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)			1-1								
Non-aquatic sedges											
Ferns											
Litter	12	85	15	18	60						38
Rock											
Bare ground	81	9	80	78	33						56.2
(Other) Timphen	3		0-	10							A.6
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalvots >30cm DBH and No	n-eucalypts	>20cm)		Plot siz	le:	(100)	x50m)	100	k20m	50×	10m
Charles		22001.17	Marcol Ind	Tally of DBH size classe			s (cm)				
species	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
t malinea		1 22.5		11/97.5		11 95		11.05	Vene	67.38	· · · ·
E. popionea						00		10.0	3.1.0		
e breilouir					1n.s						
C itessions					0110						
Chan		b/		11							
						1					
L' carron is		1				1					
CORRECT											
0	111	11		1.						-	
HEXSELSE											
Eucalypts:	Average [	DBH (above thre	shold)=		cm	39.53					1000
Non-eucalypts:	Average (	BH (above thre	shold)=		cm	25 ZI		-			
Habitat Comments:		C ul	*		Гн	allows:	-		Faller	Wood	ły
Honval, around with potchy st	nallow	leat litts	24.		[P	lot: 50 x	20ml		Mate	rial:	ly .
Children Children Child	and the	ha com		te hal	1	Ocm wid	e:		(length	of fallen	woody
·low patchy distribution of that	Len The	new ,001.	E	IN MOI	1000				logs >1	Ocm diar	n and
· low abundance of hollows (no	ne in p	lot)				D			Count	Tally:	A 2011.11
1 1 ful but	achthe	1 20% 00	nor 1	tor					3,0.5	, 8, 3.	5,1.5
· Grass is primarily borner bo	pering	2 3011 (0	0.01						2,2.5		
. due to grazing provides in i	arevar	OUDV.			>1	Ocm wid	e;				
Very close to creek.							(		1. 1. 1.		
					-15	0					
									1.20		
and the form the March and the first sector					-30-5				ald -		
WOODY DECOULTMENT 4 12 4			A State Aller		тс	DTAL:			TOTAL	:	1000
WOODT RECROITIVIENT: 1 (10)104	604)				-	(	2		21	-0.0	
TOTAL WEEDS: 3 ( nr )					1.1				21		

Page 3 of 3

COLOGICAL	EQUIVAL	ENCE						Page 1 of
Date: 23.1	2.2015		Collector:	COH	4 MAN	M	CITE.	1.0
Time: TI	0		Job No.	1506	1 Con	15040)	SITE: 22M-0	A-20 (SP4
Mapped RE:	A-r					Lot on Plan :		
Field RE:	10-5	(11.3	2)					
Description:	E. D.	opuloe	a de	rowth	and the second second second			In the second
Slope:	Aspect:		Landform H	ocal):		Landform (broad	):	
% —	-		plain	×- Van	1 citl	1 floodela	in terrace by So	How Kiver to (N)
Slope Shape:	flat	40 5	lightlu	conve	X	Ouder	ow to back cut	10(6)
Soils:	Pale c	xamge	, Ubroa	wn sar	ndy li	XIM	Soll Core Photo: Surface Soils Photo:	4075
Litter:<10	Bare Soil:	50-6	) Timber:	-	Rock:	Gro	undcover: 30-410	
PHOTOS:	Photo No	407.	5 1	F 5	6	4071	- 4071	4072
notes: appr regrothe activ mod c	the ver	have over rozet	1 Hou 1 due coulic	histor to prox	ically Imity outd	to water	stick-raked	-7 even ag
REMNANT	Y		Y/N2	Zone:	567	Datum: GDA94	WGS84	
Vegetative Stru	ucture and Co.	mposition	1,14	Waypoint:	-	Easting: 104.80	Northing: -11	37770
Stratum	Median	Height	range (m)	Intercept	Dominance	Species IL	H-80784 - 71	. 3222 4
E								
T1 [EDL]								
т2								-
⇒(sı)	25	1-	5.(8)	5	 	E pop. C brews 2 teretic	ł	
S2								
G	0.]	0.01	-10-4	5 {	d alc a	Anstida 'see ou	500- Cr <sup>2</sup> 1	
Underland and the			-	1 1		1		
dominance: d - domi	inant: c - co-domis	nant: a - associ	iated: s - sunnress	ed	the second			and the second second
crown cover intercep	ot: I: isolated (0.2-	2%); V: very sp	arse (2-20%), S: sp	arse (20-50%); M:	mid-dense (50-80	%); D: dense (80-100%)		
Walter and Hopkins H	height classess: 1-3	8m - dwarf, 3-6	im - low, 6-12m - r	nid- <b>high, 12-20m</b> -	tall, 20-35m - ver	y tall, >35m - extremely tall		
Valter and Hopkins o	crown cover classe	s: <0.2% - isoli	ated trees or clum	ps; 0.2-20% - open	woodland, 20-50	% - woodland; 50- <b>80% - op</b> e	n forest, 80-100% - closed forest	
BASAL AREA [fi	xed point Bitt	erlich tech	nique: factor	1cm]		CONDITION		
Species		<u>\$1/52</u>	<b>73/</b> S1	T2	T1 E	Туре	Severity	(0 to 3)
/			-			Fire (& height in	m) ()	
2000			3		-	Clearing	0	(3 - hist)
		-	Contract of			Thinning/Ringba	rking O	11
11						Grazing	2.5	
11								111
						Exotic Flora	2	(glc)
						Exotic Flora Canopy Dieback	200	(glc)
						Exotic Flora Canopy Dieback Erosion	2009	(glic)

		Random mea	inder		(please	tick type an	d circle plot :	ize)
SITE NUMBER:	>	Plot		x	1x1m	<del>10×10m</del>	20x20m	10x50m
Species (cont'd)		Presence	Strata	Species			Presence	Strata
5 populara		6	51					
5. Leveticorais		1	1					
C brewster		3	J			-		
Ar exista		+	6-51					
				Lifeform			Native	Exotic
				Tree			4	
				Shrub			3	
P. ciliare		4	G	Grass			7	3
She scab		0	1	Herb	95 (2)			
A Aida manch		11						
Calley Jerich		1		Stratum			Height	Cover
C FALLAN		4		T1			rieigine	cover
PH. MANDA				12				
est brain		1 2		51			214	15 41
Hot and which		1-2		52			5.17	15.71
I VEI CONTOTIVI		2		54		-		
Dia Ionenae	- Herene and	1		Comme Com	Internet land	N		
B PEVA.				Crown Cover	Strate (Unight	l) Interest	Papao (m)	Course (m)
Evolv. abin.	and the second second	+		Species	Strata/Height	Intercept	Range (m)	Cover (m)
Ent ram					1 1 2			
Zornia 3p. (n-r)		+	N	sel b	ack of p-2			
	the second second							
			Carl Contract					
a contraction of the second								
	and an office							
	New York							
				-	Contraction of the second			
			-					
	and the second			1				
	-							
			-					
								-
					-			
	- Alter A							
Distribution of Section Flag	-	Abundana	Courselle					
Distribution of Exotic Flora		Abundance	Severity	-				
Veclareo Pests				-				
Non-declared exotic flora		1	1			and strength		
Presence: Braun-Blanquet Technique (sca	ale: +, 1 throug	gh to 6)	-	-		-	© = collect	ed
Community Area (ha):	site only	<1	1-<5	5-<20	20-<50	>50	DEHP	Mapped:
Community Width (m):	<35	35-<75	75-<150	150-300	not linear	variable	Yes	No

~60% polygon althis quality

ECOLOGICAL EQUIVALENCE			-				-			Page 3	UI S
BIO-CONDITION PARAMETERS	and all the set	na sine and	DATE:	23.12	, 15	_	SITE:	SYERW	IEN EEM-OA-		
GROUNDCOVER: (ten 1 x 1m plots)							1	1.1.5%		(SPL	13)
Ground Cover type	1	2	3	54.55	65	6	7	8	9	10	Mean
Native grass	g	6	90	-	1000	1000	22		13.8		4.4
Native herbs & forbs					221		4.8		14 2	1	
Native shrubs (<1m in height)					1081	0.1	19.0		1.1.5	-	1.000
Non-native grass	12	8	18	52	42	220	30.01		1.2	42	26.4
Non-native herbs & shrubs					015.6	12.62			And Sal		Dies
Aquatic Vegetation (floating)					1.2.32	1122					
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)					2	1	12.3		1.1.1		
Non-aquatic sedges	10.00				1993		618		100	14.08	
Ferns					1.3		200		100		
Litter	74	52	42	14	3						37
Rock								1			
Bare ground	6	30	32	32	55						31
(Other) Timber		4	0.04	2							1.2
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: /Fucalvots >30cm DBH and No	n-eucalvots	>20cm)	1000	Plot siz	ze:	(100	x50m )	100>	20m	50x	10m
Charles				Tally of DBH size			s (cm)				
Species	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
and the second											· · · ·
			-								1
						-					
		-									775.4
NIL			-								-
					-				1		-
									and the second		
and the second	-	-									
		-			-			-	-		
		-	-						-		-
Eucalypts:	Average D	BH (above thr	eshold)=		cm		2	-	-		24.2
Non-eucalypts:	Average D	BH (above thr	eshold)=		cm				-		_
Habitat Comments:					H	ollows:			Faller	Wood	ly
· Heavily aroud, all dom.	by eno	tic grass	ses u	th	[P	lot: 50 x	20m]		Mate	rial:	woodu
sound and inter	- 1	3				ucin wiu	e.		logs >1	.0cm diar	n and
Son & MATINES.						0			>0.5m	[Plot: 50	x 20m])
· No canopy cover									Count	Tally:	
LL CITUM C									0.5,	.5,3.5	,1.5
· MINIMAL ICAT LITTLEV OF TAIL	en timb	per, Litter	dom. 1	2 hay	rd >1	Ocm wid	e:				
· minimal latteral cover		011 0	rasses						1.1		
								1. 14			
						0			1 I		
								- 14 3			
						- 3					
WOODY DECOUITMENT.	1		-	-	то	TAL:			TOTAL	-	
TOTAL WEERS	1				-	0			7	Sm	
TOTAL WEEDS: 2 (GL)								-			

Page 3 of 3

EEM-1	JA-	20							
(SP43	)								
		11.	44	1 1	End	Harri			
specie	5	14.	5111.	51 -	eno.	Lat	-		
E pop		4	1	0	1.55	1.35			
		2.5		2.60	3.40	0.80			
E pop. (	* 3)	20		4.79	6.32	1.53			
E. pop. (	(4×2)	2.1		760	9.0	1.40			
E pop (	×5)	2.4		10.65	12.98	2.33			
e 000	1	3.2		96.40	47.30	0.90			
6 000		4.5		53.60	56.20	2.60			
E. pop		2.1		73.74	74.26	p.52			
		IUD.		75.80	11 64	1 22			
	1.01	40		78.10	17-11 20.L.	220	1		
1	(~2)	40		1040	00100	2-20	1		
Y		2.0	V	192-41	93.03	0.56			
		-	1000		-				
		1	1						
						1.22			
		-		1					
		2001	1056	1001	4001	annes.			
		010	100	1 100	1				
				(mos)	in the second	Jentra			
		126	1.12	1		132			
				1 in					
						-			
		5							
									A CONTRACTOR OF A CONTRACTOR O
						-	-		and a second

ULUGICAL	EQUIVAL	ENCE					Page 1 of
ate: 23.1	2 2015		Collector:	CJH	MNW		SITE:
ime: IOL	+5	S. Sand	Job No.	1506	( Cpreu	15040)	EZM-OA_21
Aapped RE:	11,2	1.2	Coheck	(DV)	1	Lot on Plan :	
ield RE:	1.3	.2		1			
escription:	2 K	phillippe	I MI		Carl Profit Andrews		
lope:	Aspect:		Landform (Id	( t - f		Landform (broad):	here it is a second sec
-	-	1	plain	(X bas	sin)	Libroad flor	paplain 1- backed ou
ope Shape:	tat	× U	onver	1		1	
oils:	pale bi	rown ;	sandy	claups			Soil Core Photo:
ittar 10, 10	Para Sail:	20-10	Timber	5	Back	Grounder	Surface Solis Photo: 40.16
itten 10-70	Photo No	1460	1 4047	4003	4094	14045	1097 1097
HOTOS:	Direction	N	E	S	w	8/c cock	0m - 203° 100m - 73°
OTES:	mmin	itu	in h	051N	(pot.	broad byer	hand divinage basin
or high	- ouder-	-low.	1- 600	Keut	flow	rath	
around	lover	a sdi	5 500	gest	patch "	holds mate	for extended periods
04	servers	whore	Drey.C	Ongr	inth	2 to dan	in SE
Lavige	Matrice	tree	5 (7-	- hollo	N bea	ring thout)	
0				1.	FEN		
IMNANT	(Y)	N	Y/N?	Zone:	50K	Easting: htt soort	Northing: 11 27/20
Stratum	Modian	Haight	range (m)	Intercent	Dominanca	Species 11 17	20076 - <u>21.92.620</u>
stratum	weulan	reight f	onge (m)	intercept	Dominance	species 144.3	-21-27697
É							
		Wenner .					
~	1/1-1			6,5	d	Epopulnea	
(11)	1L	12	10	0-41	as	C'dallach	, Enelanop
[EDL]	10	10	20	30-501			
v			-		1	60.0	
(T2)	10	d-	-17	1	d	6 Lope	pole
C	10	-1		5-101	42	C dallar	and
				Ċ	d	C brewste	A land
()	2	1	1 (-1)		a	2100	
SI	5	[-	4(1)	151			
-		-	-				
S2							
				(	d	Both Hadh	11
2				1	alc	Elanch 500	L.fizza
(G)	01	0.01	-0.5		G	Avistida	eo, HCONT.
					a3	*P ciliare.	11
		1	-				
barium RE definit	ions	and and		-			
ninance: d - domi	inant; <b>t</b> - co-domi	nant; a - associa	ated; s - suppresse	d			
vn cover intercep	nt: I: isolated [0.2-	2%]; V: very spa	arse (2-20%), S: spa	rse (20-50%), M: 1	mid-dense (50-80%	%), D: dense (80-100%)	
ter and Hopkins h	neight classess: 1-3	si x0 2% icolo	n - IOW, 6-12m - m	iu-nigh, 12-20m - 1	woodland 30-50	san, >55m - extremely tall	80-100% - closed forest
SAL AREA Ifin	xed point Ritt	erlich techr	nique: factor 1	cm]			, ee 2007e - closed forest
ecies	Act Point Bill	\$1/52	T2/S1	172	TI	Type	Severity (0 to 3)
e cies				10		Fire (& height in m)	
				5	18	Clearing	ĥ
. 000.				2		Thinning/Ringbarking	D (hat-12)
- pop	-						
5700p.				1		Grazing	3
stay dealar	ch			1	2 -	Grazing Exotic Flora	3 (01)
stay azalar	ch				2	Grazing Exotic Flora Canopy Dieback	1-2- (gh)
pop stag dixilar	ch				2	Grazing Exotic Flora Canopy Dieback Erosion	3 17 (gh) 0

	1	Random mea	nder		(please	tick type an	d circle plot :	size)
SITE NUMBER: EEM-0A-21		Plot		x	1×1m	10x10m	20x20m	(10x50m)
Species (cont'd)	ar Marania ana	Presence	Strata	Species			Presence	Strata
5 popular		6	SETI			-		
E dallach.		2	17-71					
Smillamoph		2	J					
C. Marial		4	51					
Aler oleif/elong			TZ		A Date of the second			
Atal Lemia J		4	SI	Lifeform			Native	Exotic
				Tree			5	
				Shrub		and an	1	
Bothrio blach.		3-5	G	Grass			5	1
5100ch 50.		1-5	1	Herb			3	1
Rescharge ind.		2		-				
Dineto Essea/Fusca		+-3		Stratum			Height	Cover
R pert		+3		T1			16.1	66.0
Evan elona		1		T2				
EUL OUT	-	1		S1				
Cuper 50 (n-r)	-	1		52				
sitta rohlenze.		1						
Them aven		1	1	Crown Cover	Intercept (optiona	1)		
1.56.91.	_	9		Species	Strata/Height	Intercept	Range (m)	Cover (m)
				SOON	11 17.6	10.00	12.56	(12.56)
				I I I	1 17.2	) -		-
					118.0	13.84	17.50	3.66
					117.6	21.68	27.80	6.12
				V	15.8	33.90	41-51	17.61
				Cdall	T2 12-1	45.43	50.40	4.97
				Epoply3)	FI 135	51.70	64.24	12:54
				11	14.8	67.70	71.83	4-13
				(x3)	1 160	72.88	82.19	9.31
				V (x2)	1500	89-10	00.001	19.90
- m/ , 1212-				Cbrlw	51 2.8	89.91	92.50	2.59
* V poor conditions	2. Or		E	Tobl	51 20	96.18	100.00	3.82
SURVEY				Corein	51 2.4	0'-	-	
. 7								
					1		-	
	-		-	Martine Contraction				
	-							
				1				
	-							
1								
						-		
		10		No.			1.0	124
Distribution of Exotic Flora		Abundance	Severity	ALL DECK		10 0	122-0	
Declared Pests		-	-					
Non-declared exotic flora		2	1-3			No.		
Presence: Braun-Blanquet Technique (scale	e: +, 1 throug	to 6)			~		© = collect	ed
Community Area (bal	site only	<1	1-55	5-<20	(20-50)	>50	DEHP	Mapped:
Community Width (m):	<35	35-<75	75-<150	150-300	(not linear	variable	Yes	No
community winding (m).		55 475	1,2,120	130.200	( inst initial )	Tanable	103	1.0

17.24

BIO-CONDITION PARAMETERS		and the second	DATE:	23.12	15	-	SITE:	BYERWE	en eer	4-0A:	21
GROUNDCOVER: (ten 1 x 1m plots)										(SP 44	)
Ground Cover type	1	2	3	4	65	6	7	8	9	10	Mean
Native grass				12							2.4
Native herbs & forbs				1							
Native shrubs (<1m in height)											
Non-native grass		15	63	9	45						26.4
Non-native herbs & shrubs			3	3	3				0		1.6
Aquatic Vegetation (floating)											-
Aquatic Vegetation (submerged)					12.1						
Aquatic Vegetation (emergent)											
Non-aquatic sedges											
Ferns		-									
Litter	85 *	40	28 8	70 4	46 12						53.8
Rock											
Bare ground	15	45		3	6	1 and					13.8
(Other) Timber			6	4		1.2.4	22				2.0
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and No	n-eucalypts >	20cm)		Plot si	ze:	(100:	x50m)	100:	x20m	50×	10m
Species				Tally	of DBH si	ze classe	s (cm)				-
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
б. рор		11 362. 5	Jung III	247.5	262.5	212.5	190	105	111	645	
dallactori					0						
tac			1	1	1	1	1				
nre isterij		1									
melenophloia		2	1	1							
						1		2.51			
						1.00				1.15	
		12.275									
			102								
Eucalypts:	Average DB	H (above three	eshold)=		cm	31 -	48				
Non-eucalypts:	Average DB	H (above three	eshold)=		cm	22.	5				
Habitat Comments: moderate abundance of hollow Patchy shallow leaf litter, moderate abundance of falle hollows, Area has sparse shrublayer Patchesof bare coil + taller no close to chock dam.	in hivin in timber and la ative gr	g + Olead - limited heavily asses pre	dourd graze escuet,	arrice d	H4 (P <1 1 1 ×1	ollows: lot: 50 x Ocm wid	20m] le: le:		Faller Mate (lengt) logs >: >0.5m <u>Count</u> 3,9, 3,6,1, 5,5,0 0,5,3	n Wood erial: h of fallen 1.0cm diar [Plot: 50 <u>Tally:</u> 0.5, 2.1 5, 1, 0, 5, 1, 0, 1, 2.5, 0.5	ly n and x 20m]) 5 ,4,4 6.5,2.5 5 ,4 7 ,3
											2
WOODY RECRUITMENT: 1 / #	Intera		Sec. 1		тс	TAL:			TOTAL	:	

1 17.6

TOTAL WEEDS:

2 (g/conly)

2 17.2

318.

4 17.6

×

Datas	12 200	Collector	1411	6 11 AL A		the second s
Time: 15	O C	Job No.	CH ISI	5/01 (0	ver isount	SITE: SEM_OU 25
Mapped RF:	1A-F	1.50 110.	1 101	and of	Lot on Plan :	Co (- o requi
ield RE:	0-5	(11311)				
Description:	Niv	1 ( con alley	matal	at rel	100. the - 5	rationed mature trees
lane:	Arnect	Landform	(local): Qluo		Landform (broad):	that i marke 1
%	Aspect:		incari: Pla	An a		a. basin . Andolai
-	['\ ]	1 OUEN	and civa	unage	1 WATAN OUR	tias radiu + thousan
lope Shape:	that	to convex	basin	U	1> poten	tially v. or channel
oils:			É 1			Soil Core Photo:
10 20			17	1	La la	Surface Soils Photo: 41+7
itter: (0-20	Bare Soil:	26 Timbe	$\frac{1}{1000}$	Rock:	Groundco	over: >+0
нотоз:	Photo No	416- 410	4164	4140	4111	4165 4166
	Direction			W	g/c rock	0m-240° 100m-110
OTES: UPVC	1 trage	VINACI E	Solatea		trees - r	slavar trees ly
0350CIA	tra O	C DURTHON	J Bas	In. I	namy 2600	pmin about v
equart	n ph	terrales	A pla	100 Ch	Over tion	(1153)
VLOVE	1 14	arzian an	and we	P PAS	PA 13.0	
MICH FED	ny -	grading p	TELANS	40 (J)	Store Carl	
MNANT	Y		Zone	55V	Datum: GDA94 ( WA	3584
leaetative Stru	icture and Cr	mposition	Waypoint:		Easting: 10.7. 18454	Northing: - 21 35747 E
Stratum	Median	Height range (m)	Intercent	Dominance	Species [117.]	1837171 25117
Justen		inengine range (ini)	intercept		sheres ( M1,	10010 / 71-21141 E
-				3		
E						
1 - T - T - C						
0		1	15	d	C+55ellar	15
(11)	10	10-17/22	V	alc	C. Clarkson	15
[EDC]	25	14 27 (30	57			
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(T2)	13	10-16	151	a/5	COAVE	
Ŭ	~	1	201. (			
-			()	d	C Clarkso	n
(S1)		41.5.5	VX	6	CRESEN	
	4	1-6	5 mil	a	2 popula	l.
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				1000		
S2						
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(G)	0.3	0.01-1	M.07	- the	- a cond	
$\bigcirc$						
-			1			
rbarium RE definitie	ons					
And the second second	nant; c - co-domi	nant; a - associated; s - suppres	sed			
minance: d - domir	t: I: isolated (0.2-	2%); V: very sparse (2-20%), 5:	parse (20-50%); M: r	mid-dense (50-80%	); D: dense (80-100%)	
minance: <b>d</b> - domir own cover intercept		3m - dwarf, 3-6m - low, 6-12m -	mid-high, 12-20m - t	tall, 20-35m - very	tall, >35m - extremely tall	
minance: <b>d</b> - domin own cover intercept alter and Hopkins he	eight classess: 1-	s: <0.2% - isolated trees or clu	nps; 0.2-20% - open :	woodland, 20-50%	- woodland; 50-80% - open fores	t, 80-100% - closed forest
minance: <b>d</b> - domin own cover intercept alter and Hopkins he alter and Hopkins cr	eight classess: 14 rown cover classe		r 1cm]	-	CONDITION	
minance: d - domin own cover intercept alter and Hopkins hr alter and Hopkins cr ASAL AREA [fix	eight classess: 14 rown cover classe t <b>ed point Bitt</b>	erlich technique: facto		T1) E	Түре	Severity (0 to 3)
minance: d - domin own cover intercept alter and Hopkins h alter and Hopkins or ASAL AREA [fix pecies	eight classess: 14 rown cover classe i <b>ed point Bitt</b>	erlich technique: facto \$1/52 T3/51	· (T2)			
own cover intercept (alter and Hopkins h (alter and Hopkins c (alter alter	eight classess: 14 rown cover classe (ed point Bitt	erlich technique: facto <u>\$1/52</u> <del>13/51</del>	. (12)	Y	Fire (& height in m)	0
own cover intercept alter and Hopkins hu alter and Hopkins cr ASAL AREA [fix pecies	eight classess: 1- rown cover classe ted point Bitt	erlich technique: facto <u>\$1/52</u> T3/51	(12)	Y	Fire (& height in m) Clearing	0 (3-hist)
minance: d - domin own cover intercept alter and Hopkins in alter and Hopkins or ASAL AREA [fix pecies 	eight classess: 1- rown cover classe (ed point Bitt	erlich technique: facto <u>\$1/52</u>	(12)	Y	Fire (& height in m) Clearing Thinning/Ringbarking	0 (3-hist)
own cover intercept alter and Hopkins hi alter and Hopkins or ASAL AREA [fix pecies 	eight classess: 1- rown cover classe ted point Bitt	erlich technique: facto \$1/52 Ta/51		Y	Fire (& height in m) Clearing Thinning/Ringbarking Grazing	0 (3-hist) 0 "
ominance: d - domin own cover intercept laiter and Hopkins fu (alter and Hopkins of ASAL AREA [fix pecies 	rown cover classe red point Bitt	erlich technique: facto \$1/52 T3/51		Y	Fire (& height in m) Clearing Thinning/Ringbarking GrazIng Exotic Flora	0 (3-hist) 1-2 (alc)
ominance: d - domin rown cover intercept laiter and Hopkins hr (alter and Hopkins or ASAL AREA [fix pecies 	rown cover classe ted point Bitt	erlich technique: facto \$1/52 F3/51		Ý	Fire (& height in m) Clearing Thinning/Ringbarking Grazing Exotic Flora Canopy Dieback	$ \begin{array}{c} 0 & (3-\text{hist}) \\ 0 & (1-2) \\ 1-2 & (g c) \\ 21 & (g c) \end{array} $
ominance: <b>d</b> - domin rown cover intercept (alter and Hopkins In (alter and Hopkins cr <b>ASAL AREA [fix</b> pecies <u>CAW</u>	rown cover classes: 1- rown cover classe (ed point Bitt	erlich technique: facto \$1/52 73/51		Ý	Fire (& height in m) Clearing Thinning/Ringbarking GrazIng Exotic Flora Canopy Dieback Erosion	$ \begin{array}{c} 0 \\ 0 \\ -1-2 \\ -1-2 \\ -2 \\ -21 \\ 0 \end{array} $

		Random mea	nder		(please	tick type an	d circle plot :	size)
SITE NUMBER: EEML OA -2	25	Plot	*	x	1x1m	<del>10×10m</del>	<del>20x20m</del>	(10x50m)
Species (cont'd)		Presence	Strata	Species			Presence	Strata
5. populaea.		3	51	1				
C Eldirks.		4-5	SI-TI					
Ctessell.		4-5	51-11		and the state			
C. brewist.		2.3	51					-
			5	-			1000	
· · ·			St.	Lifeform			Native	Exotic
			1.530	Iree			3	~
				Grass			(	3
				Warb	-		2	-
0 11 11 11 1		AT	1	TICID		Constant of	-	
both blacki		2.5	4	<b>C</b> 11		. 1	11.1.1.1	-
both decip/cload	ur	<u>0</u> -4		Stratum	1 measur		Height	Cover
Hala (evida.		21			= action	10	20	8.527
There are a		2.4		51	- Colinaia	ic .	215	1751
have avent	- 22	1-2		52			2.40	4.10/1
P (illiane		1-11			and the second second			-
1) Ille ist		2		Crown Cover	Intercent (ontiona	0		
Cure (ulu		1		Species	Strata/Height	Intercept	Range (m)	Cover (m)
FINDER CHANDSIS		1						
Uso MOSAMD.		2		50 m	N 0 0.2	5		
					or or pro			
ŧř							1	
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		1 1 1						
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				X				
							-6.5.3	1201724
					5			
			-					
Distribution of Exotic Flora		Abundance	Severity					and a second
Declared Pests							-	-
Non-declared exotic flora								
Presence: Braun-Blanquet Technique (s	cale: +, 1 throug	(h to 6)	1	-	1		© = collect	ted
Community Area (ha):	site only	<1	1-<5	5-<20	20-<50	>50	DEHP	Mapped:
Community Width (m):	<35	35-<75	75-<150	150-300	not linear	variable	Yes	No

#### ECOLOGICAL FOUNTAL

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	GROUNDCOVER: then 1 x 1m platel	Coloring and the second		DATE:	23.1	2.13	1	anc. /	TERME	2 2	01_0	440
Name         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>	Ground Cover type	1	2	3	4	15	6	7	8	9	10	Mean
Autor Instance         +         12         72         1         72         1           Marker Instak & Stoto         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -	Native grass	-	-	-		110					10	11 (
tative shrubs (chin in height)       46       90       42       55       1       1         tormstrue herds & thrubs       46       90       42       55       1       1       1         squark Vegetation (floating)       1       1       1       1       1       1       1         squark Vegetation (floating)       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	lative herbs & forbs	+	12			76						11.10
Inn-native grass         46         30         rg         42         55         1         1           Ion-native herbs & shrinds         Ion-native herbs & shrinds </td <td>lative shrubs (&lt;1m in height)</td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td></td>	lative shrubs (<1m in height)			-			1					
Domentive herbs & shrubs         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100 <td>on-native grass</td> <td>41</td> <td>80 #</td> <td>10</td> <td>42</td> <td>58</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>118 9</td>	on-native grass	41	80 #	10	42	58						118 9
qualit Vegetation (submerged)	on-native herbs & shrubs	76	00	10	10	00						40.1
guards Vegetation (energent)	quatic Vegetation (floating)											
Built Vegetation (emergent)         Image of the second secon	quatic Vegetation (submerged)											
on-aquatic sedges         Image 2         Image 2 <thimage 2<="" th="">         Image 2         <thimage 2<="" th=""></thimage></thimage>	uatic Vegetation (emergent)											
stris       strist       stris       strist       strist	on-aquatic sedges											
Ear         Addition	erns											
cck         sc s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2         s 2	itter											
are ground         50         9         9         9         9         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100	lock					12.3						
Other/ OTAL         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%	are ground	50 *	8	82 #	58 **							20.6
OTAL         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100%         100% <th< td=""><td>Other)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1.0</td></th<>	Other)											1.0
ARGE TREES:         (Eucalypts > 30cm DBH and Non-eucalypts > 20cm)         Plot size:         100x20m         S0x10           pecies	OTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Tally of DBH size classes (cm)         Tally of DBH size classes (cm)         <20       20-25       25-30-35       30-40-45-50       55-360 frei         <20       20-25       25-30-35       40-45-50       55-360 frei         Drewster ii            70-0          Drewster ii	ARGE TREES: (Eucalypts >30cm DBH and No	on-eucalypts >	20cm)	instration in	Plot siz	:e:	100	<50m	100	x20m	50>	:10m
$\frac{\sqrt{20}}{\sqrt{20}} \frac{20 \cdot 25}{25} \frac{25}{30} \frac{35}{40} \frac{45}{40} \frac{45}{50} \frac{55}{50} \frac{56}{50} 5$	pecies				Tally o	of DBH si	ze classe	s (cm)				
Index Ks       70.0         Drewsterii       70.0         Drewsterii       70.0         Drewsterii       70.0         Drewsterii       70.0         Eucalypts:       Average DBH (above threshold)=         Non-eucalypts:       Average DBH (above threshold)=         Non-eucalypts:       Average DBH (above threshold)=         Bibitat Comments:       Parzed, indives graces intact and provide some         Pactors heaving grazed, indives graces intact and provide some       Plot: 50 × 20m]         Stabitat Comments:       Pallen Woody         Rew large trices induct index graces intact and provide some       Plot: 50 × 20m]         Stabitat Comments:       Pallen Woody         Mithink all ground tunker, all small diametar       0         VOODY RECRUITMENT:       3 (C. clarke ; E. pop; C. Hoss)         OTAL WEEDS:       2 (gr.)		<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
Drewsterii       Image: Stream of the stream o	rlarks					1					70.0	1.0
brewsterii       Image: Second S		38					1.					
Eucalypts:       Average DBH (above threshold)=       Top. 0       cm         Iabitat Comments:       Average DBH (above threshold)=       35       cm         Babitat Comments:       Average DBH (above threshold)=       35       cm         Paichas heavel (y grazed ) notive graces intact and provide some [Plots 50 x20m]       Average DBH (above threshold)=       35         Paichas heavel (y grazed ) notive graces intact and provide some [Plots 50 x20m]       Average DBH (above threshold)=       30       Som wide:         O       Som wide:       O       Som vide:       0       Som (Dits 50 x Count Tally:         VOODY RECRUITMENT:       3 (C. clavite ; E. pop; C. 4655)       ToTAL:       0       ToTAL:         OTAL WEEDS:       2 (grace)       -       -       5, 5 M	brewsterij					1						
Eucalypts:     Average DBH (above threshold)=     TO. O     Cm       Bithat Comments:     Non-eucalypts:     Average DBH (above threshold)=     35     Cm       Bithat Comments:     Bithas heavily grazzed individe grasses intact and provide some free lows intact and provide some free lows intact and provide some free lows intact and provide some free lows.     Fallen Woody Material:       Bithas heavily grazzed individe grasses intact and provide some free lows intact and provide some free lows.     Fallen Woody Material:       Bithas heavily grazzed individe grasses intact and provide some free lows.     Fallen Woody Material:       Bithas heavily grazzed individe grasses intact and provide some free lows.     Fallen Woody Material:       Bithas heavily grazzed individes grasses intact and provide some free lows.     Fallen Woody Material:       Bithas heavily grazzed individes grasses intact and provide some free lows.     Fallen Woody Material:       Bithas heavily grazzed individes grasses intact and provide some free lows.     D       Bithas divide:     D       Bit			1								1.	
Eucalypts:       Average DBH (above threshold)=       Image: Top (above threshold)= <thimage: (above="" threshold)="&lt;/th" top="">       Image: To</thimage:>									1.5	1		
Eucalypts:       Average DBH (above threshold)=       TO, O       Cm         Non-eucalypts:       Average DBH (above threshold)=       35       Cm         Tabitat Comments:       Non-eucalypts:       Average DBH (above threshold)=       35       Cm         Tabitat Comments:       Pachas heavely graced matures graces intact and provide some       Hollows:       Fallen Woody         Pachas heavely graced matures graces intact and provide some       Plot: 50 × 20m]       Count Taily:         Some wide:       0       Some Wide:       Dos mellot: 50 × 20m]         Minimum al ground hunder, all small diameter       0       Count Taily:       2.5, o.5, o.5         >10cm wide:       0       0       Count Taily:       2.5, o.5, o.5         VOODY RECRUITMENT:       3 (C.clark ; E.pop; C.tcs)       TOTAL:       0       ToTAL:         OTAL WEEDS:       2 (gir)       2 (gir)       5, Sm       5, Sm												
Eucalypts:       Average DBH (above threshold)=       70.0       cm         Non-eucalypts:       Average DBH (above threshold)=       35       cm         abitat Comments:       Matrial:       Pollows:       Pallen Woody         Battat Comments:       Pathas heavily grazed individe grasses intact and provide some       Pollows:       Pallen Woody         Battat Comments:       Pathas heavily grazed individe grasses intact and provide some       Pollows:       Pallen Woody         Minum al ground tumber , all small diameter       0       Some Wide:       2.5,0.5,0.5         >10cm wide:       0       2.5,0.5,0.5       0.5         >10cm wide:       0       0       10cm wide:       0         0       Total:       0       5,5m       5,5m         0       Total:       0       5,5m					2.74							
Eucalypts:       Average DBH (above threshold)=       TO. 0       Cm         Non-eucalypts:       Average DBH (above threshold)=       35       Cm         abitat Comments:       Average DBH (above threshold)=       35       Cm         Babitat Contracts:       Patchas heavel y grazed in optimes graces intact and provide some [Plot: S0 x 20m]       Fallen Woody         Material:       (length of fallen wide:       10cm wide:       10cm wide:       0         Few large trees intact and ground timber , all small diameter       0       2.5, 0.5, 0.5       0.5         Non-eucalypts:       3.0 cm       2.5, 0.5, 0.5       0.5       0         /OODY RECRUITMENT:       3 (C. clark ; F. pop; C. tress)       TOTAL:       0       TOTAL:         OTAL WEEDS:       2 (gr.)       5, 5 m       5, 5 m					61.E.S.			- 5	122		1.5	
Eucalypts:       Average DBH (above threshold)=       To. O       cm         Non-eucalypts:       Average DBH (above threshold)=       35       cm         Habitat Comments:       Hollows:       Fallen Woody         Babitat Comments:       Hollows:       Fallen Woody         Material:       (length of fallen wide:       10cm wide:       10cm wide:         Itabitat Comments:       Fallen Woody       Material:       (length of fallen wide:         Pays large trees       None with hollows       South Hollows       0         With mail ground tunker, all small diameter       0       Count Tally:       2.5,0.5,0.5         >10cm wide:       0       0       0       0         VOODY RECRUITMENT:       3 (C.clavik ; E.pop; C.tos)       TOTAL:       0       5,5 m         OTAL WEEDS:       2 (g.f.)       0       5,5 m       5,5 m					-	17.2						
Eucalypts:       Average DBH (above threshold)=       To cm         Non-eucalypts:       Average DBH (above threshold)=       35       cm         tabitat Comments:       Hollows:       Fallen Woody         Batch as heavily grazed individe grasses intact and provide some [Plot: S0 x 20m]       Hollows:       Fallen Woody         Material:       (length of allen wide:       Identication of allen wide:       Ide										12		
Non-eucalypts:     Average DBH (above threshold)=     35     cm       Habitat Comments:     Hollows:     Fallen Woody       Patches heavily grazed indives graves intact and provide some (length of fallen wide:     [Plot: 50 x 20m]       Takeval cover,     Fallen Woody       Few large trees none with hollows     0       Minnimal ground timber, all small diameter     0       VOODY RECRUITMENT:     3 (C. clark ; E. pop; C. tess)       OTAL WEEDS:     2 (g/g)	Eucalypts:	Average DB	H (above three	shold)=	70.1	) cm						1
abitat Comments:     Fallen Woody       Batches heavily grazed inatives grages intact and provide some [Plot: 50 x 20m]     Some Material:     Material:       Interval cover.     Few large trees none with hollows     0     Some Plot: 50 x 20m]       Minnimed ground timber, all small diameter     0     Some Plot: 50 x 20m]     Some Plot: 50 x 20m]       VOODY RECRUITMENT:     3 (C. clark ; F. pop; C. toss)     0     Some Plot: 50 x 20m]       OTAL WEEDS:     2 (g/r)     5, 5 m	Non-eucalypts:	Average D8	H (above three	shold)=	35	cm						
VOODY RECRUITMENT:     3 (C. clavik; F. pop; C. toss)     TOTAL:     TOTAL:	abitat Comments:					H	ollows:			Faller	Wood	ly
VOODY RECRUITMENT: $3(C. clavit; E. pop; C. + css)$ TOTAL: 0 TOTAL: 0 $5, S_M$	Ratches heavily grazed inative interval cover. Few large trees none with minimal ground timber, al	hollows Ismall a	intact an. diameter	d prov	ide so	те (Р <1	lot: 50 x 2 Ocm wid D	20m] e:		Mate (length logs >1 >0.5m <u>Count</u> 2.5, c	rial: of fallen Ocm diar (Plot: 50 <u>Tally:</u> 0.5, 0.	woody n and x 20m]) ミ、ጊ
WOODY RECRUITMENT: $3(C.clavić; E.pop; C.tos)$ TOTAL:     TOTAL:       TOTAL WEEDS: $2(gl_{f})$ $5, S_{M}$						>1	Ocm wid	e:				
NOODY RECRUITMENT: 3(C. clavic; E. pop; C. toss) TOTAL: TOTAL WEEDS: 2(g/r) 5, SM							0		Ē			
VOODY RECRUITMENT: $3(C, clavik; E, pop; C, toss)$ TOTAL:TOTAL:rotal weeds: $2(g/r)$ $5, Sm$												
NOODY RECRUITMENT: $3(c.clark; E.pop; c.toss)$ TOTAL:TOTAL:OTAL WEEDS: $2(g/c)$ $5, Sm$												
OTAL WEEDS: 2(g/c) 5.5M	NOODY RECRUITMENT: 3 (C. clavie	L; E.000	; C. tuss)	)		т	DTAL:			TOTAL	:	
0,7	TOTAL WEEDS: 2( g) c)									0	, 5 M	
(101) (2) 91.50 62.78 8.52 T1 20 POP 3.10 41.75 59.27 2.48 T1 20	CIAVIL (20) 91 50 82.78	8.52		Τl	20							

C -1855,	7.2]		
2 Pop 5	4.2	8.40 6.63	1.71
É.pop	A.0	3.70 0.60	3.10

Date: 23	12.2015	5	Collector:	CJ	1 a MNU	(h) SITE				
Time: 15.	60		Job No.	1506	21 (p)	ev. 15040)	STH. OI	1_26		
Mapped RE:	N-1		2 1			Lot on Plan :		1		
Field RE:	n-r	(1)	3.4)							
Description:	mykei	a con	IPULX,	estally	of will					
Slope:	Aspect:		Landform (	ocal): 🔾		Landform (broad):				
%	/		ST							
Slope Shape:	7	- 95	per El	ENLOA	-25					
Soile	1		1				Soil Core Photo:			
Sons.	· /		~			and the second second	Surface Soils Photo:	4179		
Litter: 10	Bare Soil:	10-21	) Timber	: 5	Rock:	- Groundcover: 65-75				
BUIDTOS.	Photo No	417	4 417!	5 476	4177	4178	4173	4180		
PHOTOS:	Direction	Ň	E	S	w	g/c rock	0m - 233°	100m - 53°		
NOTES: Lea 12 nati 13 merce 51 rege	wily of vess of everation	ver v Inter vge	th hised if the trees foor	tout pr	the E flow F but t per	alc oly Basins) Marledly turbed by	discontinu Zattle gruz	ida cordito qos ing		
REMNANT	v	N	Y/N2	Zone:	SEV	Datum: GDA94 (W	5584			
Vegetative Stru	icture and Composition			Waypoint:	-	Easting: 147, 793 (C	Northing: -21.3	5018		
Stratum	Median	Height	range (m)	Intercept	Dominance	Species 107	10317 -21-2	5045		
E							.0 1			
	24	18-	-27	V 5-10/	as	E cirebra E cirebra C Clarks	, ,			
(12)	14	10-	- 16	25/10/	a	E crebra E crebra C clarke	i. ?			
(SI)	4	1-	-7	× 25%	a	C 1055 , CO	uata			
<b>S</b> 2	-				<u></u>	2149 				
6	0-05	0.0	1-0.6	-1	a	1 See mer				
and the second		-	-	1 + 1						
Herbarium RE definition	ions									
dominance: d - domin	inant; c - co-domi	nant; a - assoc	nated; s - suppress	eo		1. Di danan (00.4003/1				
rown cover intercept	It isolated (0.2-	( very sp	oarse (2-20%), St sj	mid high 10 00-	tall 20 25-	(), writerise (80-100%)				
Nalter and Healthan	regin classess: 1-:	an dwarr, 3-0	lated trees or elem	ins: 0 2-20% - open	woodland 20.50%	• woodland: 50-80% - open form	t. 80-100% - closed forest			
and one noplans c	ved point Ritt	erlich tech	inique: factor	1cm]			and and and a set of the t			
SACAL ABEA IN	xea point Bitt	eriich tech	Tactor		(T) E	Tune	Emmeit - I	0 to 3)		
BASAL AREA (fix		3±/52	+5/51	10	C E	Time 18 beinho in mi	Severity (			
BASAL AREA [fi) Species	_	free providences			and the second second	rire (& neight in m)	O O			
BASAL AREA (fi)						Clearing	A	11da i		
BASALAREA (fi) Species						Clearing	2 -	historic		
BASALAREA [fix Species C_tessell Z crebac	n					Clearing Thinning/Ringbarking	2-3	historic "		
BASALAREA [fi> Species Clessell Ecrebra						Clearing Thinning/Ringbarking Grazing	2-3	historic "		
BASALAREA [fi) Species (_tessell 2 crebre	~					Clearing Thinning/Ringbarking Grazing Exotic Flora	2-3 3 2(3)	historic " (q(c)		
BASAL AREA [fi) Species C_tessell E_crebre	~					Clearing Thinning/Ringbarking Grazing Exotic Flora Canopy Dieback	$\begin{array}{c} 2 - 3 \\ 2 - 3 \\ 3 \\ 2 \\ 3 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ - 1 \\ -$	historic " (g(c)		
BASAL AREA [fi) Species (_tessell Z crebra	~					Clearing Thinning/Ringbarking Grazing Exotic Flora Canopy Dieback Erosion	2-3 3 2(3) 1 0	historic " Gle)		

Page 1 of 3

E.
		Random meander			(ple	ase tick type an	e and circle plot size)		
SITE NUMBER:		Plot	/	x	1x1m	10x10m	20x20m	10x50m	
Species (cont'd)		Presence	Strata	Species			Presence	Strata	
CHESSELLANIS		5	51-71						
9 cor loca		34	12-11						
CURENST		11	51						
Covota		1	1	-					
Alal hernia		1							
Eight and I		4	1	Lifeform			Native	Exotic	
Cryphy ant?			- 4/	Tree			2-		
9				Shrub			4		
P in line		6	C	Grass			2	1	
Hal wal		7	1	Herh			1	1	
rut (Dit		12		THET			T	1	
wouth ind.		1 2 2							
Sida cord		2.0		Stratum			Height	Cover	
Sty Scab	the section	2		T1	meas	ored	26.6	15 40	
Avist lerich		4		T2 T	estr	note-plot	24	.5-107	
Enter Sam				SIL TZ			13.5	21.03	
Cyp tulv.				32.51		and the second	1.95	2.43	
Sidia Tohlenar.		2	V						
				Crown Cover	Intercept (opti	onal)			
				Species	Strata/Heigi	nt Intercept	t Range (m)	Cover (m)	
				Cless	F2 12	0.00	6.15	6:15	
				CHESS	(T) 561	24.70	40.10	05.40	
				Chris	31 14	34 82	35.15	0.35	
		7		Zuch	T2 15	70.0Z	84.90	14.88	
				(Cbreil)	51 2.5	73.98	7608	2.10	
				10					
the second s									
	1000			P					
		1							
					1				
	- 10-2 T								
							The second		
		-						15	
*									
							1.5		
	19.00								
					3.4				
Distribution of Exotic Flora	1.1.1	Abundance	Severity			-			
Declared Pests									
Non-declared exotic flora	1								
Procence: Braun Blanquet Technique /s	cale: + 1 throw	ab to 6)					(C) = collect	l	
Community Acres (he)	cale. r, i unou		1.1	E .00	20.00	( sra)	G = collect	Mannad	
community Area (haj:	site only	<1	1-<5	5-<20	20-550	250	DEHP	Mappeo:	
community Width (m):	<35	35-<75	/5-<150	150-300	not linear	) variable	Yes	I NO	

	Sector Sector				and the second			-	- and the second	I upe o	013
BIO-CONDITION PARAMETERS			DATE:	23.1	215		SITE: 7	SYERNJE	n Z	21-0	NA 26
GROUNDCOVER: (ten 1 x 1m plots)				1.11							
Ground Cover type	1	2	3	4	65	6	7	8	9	10	Mean
Native grass				-		-					
Native herbs & forbs	1		1	2	2						1.2
Native shrubs (<1m in height)											
Non-native grass	2.6	46	18	g	6						20.8
Non-native herbs & shrubs											
Aquatic Vegetation (floating)											
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)											
Non-aquatic sedges		1 1412									
Ferns											
Litter	42	18	16	12	z						19.2
Rock											1
Bare ground	31 #	24	65 #	78 \$	84 *						56.4
(Other) Timber	1. C. C. C. C.	12									2-4
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and No	GE TREES: (Eucalypts >30cm DBH and Non-eucalypts >20cm)						(50m)	100	<b>x</b> 20m	50)	(10m
Species		of DBH si	ze classe:	s (cm)							
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
E. Credra						1		1			
c by Ewster i	111			1			1			2	
itaa				1	1	1		'			
tess.	See. 1							115		20).1	98.5
				1							
											No.
					1000						
								and the second sec	-		
Eucalypts:	Average DBH	(above three	shold)=	60.	1 cm						-
Eucalypts: Non-eucalypts:	Average DBH Average DBH	l (above thre: l (above thres	shold)= shold)=	60.7	1 cm cm						

WOODY RECRUITMENT: 41

3 (310)

TOTAL WEEDS:

TOTAL:

10:0 (1)

TOTAL:

OLOGICAL	EQUIVAL	ENCE					Page 1 of
ite: 23.1	2.2015	Collector:	(D)	1, MNIN		SITE: Contract	
ne: 16	20	Job No.	1501	al (pri	Y. 15040)	-AO-M25	-27
apped RE:	11.3.	2 Ccheck	Vg. N	nappin)	Lot on Plan :		
d RE:	11.3	.2	11 .	il		and the second second second	
scription:	20	pulped, iv	anlan	1 on a	HUVIUM		The last statement of the second
pe:	Aspect:	Landform (I	ocal):		Landform (broad):	3 ( - 11	0.
	-	plain		and the second	floorplain	2) of Sutton	Kiver
pe Shape:	tlat					-	
s:	Mid P	rown U= lov	ange)	sandy	clay loan	Soil Core Photo:	11104
	Bar 6 1		15	- Dente	- 10 1	Surface Soils Photo:	418-1
r:60	Bare Soil:	5 Timber	2 1114/1	Rock:	Groundcove		1,188
DTOS:	Direction	4102 (10 C	2 444	400	410 D		4100
TES NO	a tine M	Interit PA	Rio - Citi	ed cc	Bre lock		100111-
La not	Clab	red hist	(no )	v. lav	ae mative	trees) bot	well-an
einve	Vis C	Not 30,115)	Che u	- 100	January L	many on	year of
ccasi	ional	tree fall	last o	100cars	natural		and the second
				E mil	-		
INANT	$(\mathbf{r})$	N Y/N?	Zone:	JOK	Datum: GDA94 WGS	B4	
getative Stru	icture and Co	mposition	Waypoint:		Lasting: (41.78212	Northing: -2-344	
tratum	Median	Height range (m)	Intercept	Dominance	Species 14+,+	012+· -21· 348	06
							-
E							
-							
0			- (	d	2 populne	n	
11	16	10-11-	01	a_			0.1.5
	10		30-40%	- 25	ecrebia, C	tessell (both	a) edge)
			-	d	40.0		0
T2		a 15	V)	9	408		3.50
-	0	4-12	251				
			(	d	C brewst		
(SI)	-15		VY	a	Epop. A. 0	Leifolius	
C	4	1-8	151	5	C' dallach	ana	
			L				
101						1	
S2							
			5	d	Anistida sep	-	
()	0-1	0.01-0 h	1 < 1	a	'see over"	1	
6	VA	T	2				- and all
arium RE deficiti	ans		1				
inance: d - domi	nant; ¢ - co-domi	nant; a - associated; s - suppresse	ed		and the second second	and the second second second	States -
n cover intercept	t: 1: isolated (0.2-	2%]; V: very sparse (2-20%), S: sp	arse (20-50%); M:	mid-dense (50-80%	); D: dense (80-100%)	and the second	
er and Hopkins h	eight classess: 1-	m - dwarf, 3-6m - low, 6-12m - r	nid-high, 12-20m -	tall, 20-35m - very t	all, >35m - extremely tall		
er and Hopkins c	rown cover classe	s: <0.2% - Isolated trees or clum	ps; 0.2 20% open	woodland, 20-50%	woodland; SO-80% open forest, 8	0 100% - closed forest	
and the second se	ed point Bitt	erlich technique: factor	1cm]	17751	CONDITION		
SAL AREA [fix		\$1/S2 T3/S1	(T2	(T1) E	Туре	Severity (0 to	3)
SAL AREA (fix		and the second se			Fire (& height in m)	0	
SAL AREA [fix ecies					and the second sec		
SAL AREA [fix ecies			1	13	Clearing	0 (	(hist?)
SAL AREA [fix ecies = PDP			1	13	Clearing Thinning/Ringbarking	0 (	hist ?)
sal area (fix ecies = PDP Hay			1	13	Clearing Thinning/Ringbarking Grazing		hist?)
ecies - POP Hay			1	13	Clearing Thinning/Ringbarking Grazing Exotic Flora		hist?)
ecies POP			1	13	Clearing Thinning/Ringbarking Grazing Exotic Flora Canopy Dieback Frosion	00-700	hist?)
SAL AREA [fix icies - PDP - Aay			1	13	Clearing Thinning/Ringbarking Grazing Exotic Flora Canopy Dieback Erosion Recruitment		hist?)

	Random meander			(please tic	k type and	d circle plot s	ize)
SITE NUMBER: 22M_04-24 (2/50)	Plot		X	1x1m 1	10×10m	<del>20x20m</del>	10x50m
Species (cont'd)	Presence	Strata	Species			Presence	Strata
Epopulnea	6	51-71					
C'd'allach	1	51					
Chrew 5th	3-4		-		_		
Coyata	2.3		1.3.5.7				
A. deil			-			and the	
Eryth aust	1		Lifeform			Native	Exotic
Attel henring	+		Tree			3	~
Psyde allt	+		Shrub			6	-
May conn	1	V	Grass			5	4
1			Herb			4	1
							-
			Stratum			Height	Cover
			T1			14.3	45.77
Arist jericho.	3-4	G	T2		-	11.0	5.41
Heterope cont	3-4		51			2.35	3.54
pothrio dan	2		52				
potr allip/dond	0				- and the second		
Sida rotlevill	2		Crown Cover	Intercept (optional)			
Penn. ciliare	2-4		Species	Strata/Height	Intercept	Range (m)	Cover (m)
Doth pert			7.000	1 10.010	1,00	3.10	1200
CUP TOIL	+		UXZ CD	14 9	1.14	13.02	2.00 a 12
Shi sala	+	1	(***)	1557	4:1	24.44	3.56
AND SCOLO	1			0,5 4	136	100	SINI
Dean Maria	2	V		605	0.62	56 20	5 38
A AM MONO	~	1		13.7 16	3118	68.57	5.00
		1		1/ 180/7	1-05	84.10	17.05
				TA INO 8	51.15	86.54	5.41
			Cavat	51 17 1	53.60	14.15	0.55
			En aud	51 3 9	571	98.70	2.99
			J				
		and the second				Lange of the second sec	
			-		-		
		-	1				
			N S T 1				
	1						
		-	in a second				
			No.				
Distribution of Exotic Flora	Abundance	Severity			-		
Declared Pests							
Non-declared exotic flora							
Presence: Braun-Blanquet Technique (scale: +, 1 throug	gh to 6)	0				© = collect	ed
Community Area (ha): site only	<1	(1-<5)	5-<20	20-<50	>50	DEHP	Mapped:
Community Width (m): <35	35-<75	75-<150	150-300	(not linear)	ariable	Yes	No

	and the second second	Sum Starperson				-		-	-	Page 3	013
BIO-CONDITION PARAMETERS			DATE:	23.1	2.15		SITE:	Fren	Ion 2	2871-	-04.
GROUNDCOVER: (ten 1 x 1m plots)			1.		1.5		1 7			10	L Manu
Native grace	1	2	3	4	65	0	· /	8	9	10	iviean
Native borbe & forbe	6	28	25	6	46				Constants of		14.6
Native rieros & foros				-					k		
Non-institue grace					10	-	-				11. 0
Non-notive grass	18		6	8	42		-				14.8
Agentic Versitation (fleation)									-	-	-
Aquatic Vegetation (noating)	-					-	-	-			1.1.1.1
Aquatic Vegetation (submerged)											
Aquatic vegetation (emergent)					-		-				
Non-aquatic sedges								1.000			
Ferns		H		4	14		-				
Litter	42 #	54	57*	68	44 *				-		53.0
ROCK											1000
Bare ground	28	K6	12	18	6						16.4
(Other) Timbly	6										1-2
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and No	n-eucalypts >	20cm)	1	Plot siz	e:	(100:	x50m)	100;	(20m	50x	10m
Species				Tally o	of DBH s	ze classe	s (cm)				
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
E populnes	(1))	10	HAT III	un I	(1)	"					
											1
. brewstern	1	•									
itag			'		-	10.0	1				
C clarkson			/	-		31			1231		
E. CYLLOVG		1 2 2 3						-			
Net days			1				N	ale ale	- Andrew		2
			1								
	1 AM										
Eucalypts:	Average DB	H (above thre	shold)=	35.8	.cm						
Non-eucalypts:	Average DB	H (above thre	shold)=	22.	5 cm						
Habitat Comments: glc:mix of Nature exdic, only a cover. No Hollows, low abundance of littler is shellow r patchy. some termite mounds.	exotic gro fallon t	azcol, goa unbev	d pate	hy late	24a} [P <1	ollows: lat: 50 x : Ocm wid	20m] e:		Faller Mate (length logs >1 >0.5m <u>Count</u> 2	n Wood rial: of fallen Ocm diar (Plot: 50 <u>Fally:</u>	woody n and x 20m])
					>1	Ocm wid	e:				
						0					
WOODY RECRUITMENT: 2 (c. clav	ks ; C.0	uall.)			т	TAL:	0		TOTAL		
TOTAL WEEDS: 1-2 (9/2).					-				2		

COLOGICAL	EQUIVAL	ENCE						Page 1 o
Date: 23.	12 2015	5 c	ollector:	CJH	MNL	)	1	SITE: 46 1 AN 20
ime: 17	05	Je	ob No.	11506	1 (0	rev 1504	0	22M. UH - 28
Aapped RE:	N-M	711-2			1	Lot on Plan :		and the second se
ield RE:	N-1	(11.5.9			01		. 1	
escription:	ire (15	pulth.	(	255ell 4	E CREE	ra shruk	pland	E ENTERAL CHESS
lope:	Aspect:	L	andform (In	ocal):		Landform (br	oad):	0
6 42%	NW		mid to	DOPESSI	ope	9.u.	.vise	е.
lope Shape:	(mu	ex		11		0		
oils:	mid o	range	sand	3.				Soil Core Photo:
itter: 10-15	Bare Soil:	10-30	Timber:	5	Rock:	~	Groundco	ver: 50 + 75)
HOTOS:	Photo No	4192		2 4	. 5	AQ6		4191 4198
	Direction	N	E	S	W	g/c	røćk	0m-170° 100m-350
IOTES: di	SLONTIN	10005	rean	owith,	SOILER	but C	4003	is entitle know
1> Kn	01 51	5 alo	OUR	£100d	picing	T- guer	FLOW	basin to (D+W)
- SP	of Ita	50m to	or O	VET FIEL	in ich	nd torn	<u> </u>	La bacilla y aplon
de l'	1 all	TROP (	- Joe	1 all	CALLA	and of	ant a	AND MISITU A NOIDH
91ml	OSA DE	lot loc	Wille-	ed Di	it of	Patrick	OUE	~
MNANT	Y		Y/N?	Zone:	55K	Datum: GDA	94 (WG	(584)
egetative Stru	ucture and Co	mposition		Waypoint:	-	Easting: (4	7.1700	Northing: -21.2505%
Stratum	Median	Height ran	nge (m)	Intercept	Dominance	e Species	147	1. 17904 , -21, 35153
								1.1.7
F		FR r						
			_					and succession of the second second
0-				V	d	Ctess	ell	and the second second
TEDIT	24	19.	20	1	a15	- Cel	arts	9120
	24	10-	20	25%	.5	200	pop,	Elreb.
<u> </u>				1		1	-	
T2								and a start of the
	1.1							
				11	d	C19	el	
(m)				V	a	E. (1	Clora	Celarksonsidina
<sup>o</sup>		1-8	3	Bio		C br	ewst	TI
	1.11.16			0.0	015	Alpe	x Lelsa	Ac excel
				1				
S2		18.2				-		
	24. 11						-	· · · · · · · · · · · · · · · · · · ·
		11-20-00		(	1	Hati	ont	
				)	a	See	OURS'	
G	0.4	0.01-	-0.5	MY				
		12						
Sec. 1								
barium RE definit	ions					A Sugar		and the second
ninance: d - domi	inant; c - co-domi	inant; a - associate	d; s - suppresse	ed	The second			
wn cover intercep	ot: 1: isolated (0.2-	2%); V: very sparse	e (2-20%), 5: sp	arse (20-50%); M:	mid-dense (SO-80	%); D: dense (80-100%)		and the second second second second
ter and Hopkins I	height classess: 1-	3m - dwarf, 3-6m -	low, 6-12m - n	nid-high, 12-20m -	tall, 20-35m - ver	y tall, >35m • extremely	tall	90 1000/ almost fac
SAL APEA 14:	ved noine Bie	terlich technic	ule: factor	ps; u.z-20% - open 1cm1	woodand, 20-50	CONDITION	- open torest	s, ou-suras - closed tofest
AGAL AREA [TD	Aeu point bit	s1/s2	Tales lactor	T2	(T1) F	Tuno		Severity (0 to 3)
lecies	-	<del>3±/32</del>	+4/31	12		Fire (& height	tinm	
	and the second second		15		1	Clearing	c in my	2 (hist)
Jectall			-		-	Thinning /Pin	abarking	S (m))
teshell				A DECEMBER OF				7 11
testell			-			Grazing	Rostwing	3 11
-tressell Crebia			1			Grazing Exotic Flora	Roarving	1-2 (H2
tehell Crebra						Grazing Exotic Flora Canopy Dieba	ack	(1)2
- tessell Crebra						Grazing Exotic Flora Canopy Dieb: Erosion	ack	1-2 (1)2 1 0
tressell Cressia	\					Grazing Exotic Flora Canopy Dieba Erosion Recruitment	ack	3 II 1-2 (1)2 1 0 3

×

		Random mea	nder		(please	e tick type an	d circle plot :	t size)	
SITE NUMBER: SEM -OA	-29	Plot		x	1x1m	10x10m	<del>20x20m</del>		
Species (cont'd)		Presence	Strata	Species			Presence	Strata	
Ctessellans		5	51-71				3		
E. crelora		4	51-(11)	1.1.1.1			04		
Chrwsteri		3	51						
Alph excelsa		+	1						
foudr other	-	1							
Ad exielsa		3	J	Lifeform			Native	Exotic	
the second s				Tree			3	-	
Het cont.		4-5	G	Shrub			5	-	
Anst lench		3		Grass			6	2	
BOOKP		2-3		Herb	Sec. Sec.	- 2-1	6	-	
p. cluare		2-3							
Watth intra		2		Stratum			Height	Cover	
Sida rohlenal		2	Y	TI	Measured	_	30	6.46	
Grew latif			G-51	R(TI) e	stimate p	1d	24	5-10%	
Cfallax		2	C	(\$1)	1	in tax in	6.7	7.13	
Rostell adjsc.		1	T	52			-		
Chamae about		+				100			
Avist ram		1		Crown Cover	Intercept (optiona	al)		222	
Concurrice media		2		Species	Strata/Height	Intercept	Range (m)	Cover (m)	
SANGOOD - MIAL		1				12.5			
Both decipo	- 24	2		see k	inthin of	p. 3			
Pet allo		2	51		1				
Ano anon.		1	51			121755			
1.40		T							
					1				
					V			2	
	NE R								
	Sta								
	The second								
	la maria	1.5							
					1 A.S.				
			LE ZOL						
						-			
							1931	3	
						1.	1		
							22.2.1		
	-								
						1275.884			
Distribution of Exotic Flora		Abundance	Severity					1999 A	
Declared Pests								1.1.1.1	
Non-declared exotic flora						1.0			
Presence: Braun-Blanquet Technique (se	cale: +, 1 throug	gh to 6)					© = collect	ed	
Community Area (ha):	site only	<1	1-<5	(5-<20)	20-<50	>50	DEHP	Mapped:	
Community Width (m):	<35	35-<75	75-<150	150-300	not linear	variable	Yes	No	

			-	-	-					Page 3 (	5 10
BIO-CONDITION PARAMETERS		. The second	DATE:	23.12	.15		SITE: 1	BYERWE	al E	EN-DE	-28
GROUNDCOVER: (ten 1 x 1m plots)			1				1		1		
Ground Cover type	1	2	3	4	65	6	7	8	9	10	Mean
Native grass	22	15	12		28			1			15.6
Native herbs & forbs	2	5	2								1.8
Native shrubs (<1m in height)						-	-				-
Non-native grass		4	16	52	15						18:00
Non-native herbs & shrubs								1			
Aquatic Vegetation (floating)											
Aquatic Vegetation (submerged)								1			
Aquatic Vegetation (emergent)											
Non-aquatic sedges											
Ferns											
Litter	15	22	-	26	32.						19.0
Rock											
Bare ground	61 #	50 \$	70 *	22 #	25#				Citicana and		15.6
(Other)											-
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and No	n-eucalypts >2	Ocm)		Plot siz	e:	600	x50m	100	x20m	50x	10m
Species	-			Tally	of DBH si	ize classe	es (cm)	1		1	
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (r	ecord
C trac	1-1-1-1-1-1									25.5	
									2.0		1000
						1					ic lug i
										1.00	
											8.2
the second s											
							DA1	1100	lina		
							1011	pien	anna	1	
				10.00	1			14.7			
Eucalypts:	Average DBH	(above thre	shold)=	85L	cm			1		1	
Non-eucalypts:	Average DBH	(above thre	shald)=		cm	-	Alexandre	-	-	-	
	- HereBe Ber			-	Lu	allaure			L Caller	Weed	
• Few large trees and vlow ab • gre dow by natives, less grazi covers	undarce ed and p	of hollo rouidu s	iws ione (	ectera	[P <1	lot: 50 x Ocm wid	20m] le:		Mate (length logs >1 >0.5m <u>Count</u>	erial: h of fallen LOcm dian (Plot: 50 : Tally:	woody n and x 20m])
e Law abundance or tallion the	C Briders								3, Z,	1.5,4,	\$,10
o termite mounds.									6,6,	05,1	
. littler sparse + shallow.			22		>1	Ocm wid	le:		1		
									ii.		
						С	2		1		
WOODY RECRUITMENT: 3					тс	DTAL:		in the state	TOTAL	3	
TOTAL WEEDS: 1-2. (9/6)						t	2			43m	6.3
cicultura 5.8 63.42 62.74	6.66		1962								1000
tess 5.6 61.60 59.47	2.13										
tess 1.27- 34.22 19.90	4.32										
1455 4.0											

4.0			
(n)-		0.00	( III
(20)	6.46	0.00	(1.40

c.tess

ate:	<u>.</u>		Collector:	CJH	M	JW		CITE	inter dentas.
me:			Job No.		1			SHE:	
Aapped RE:	ner	194	1			Lot on Plan	:	1 10 10	
ield RE:	D-C	(1).	341						
Description:	Co	clarke	5003	C+55	¥2 9	creb, E	Eteret	- rearowth	
ilope: %	Aspect:		Landform (lo	ocal):		Landform	broad):	0	
Slope Shape:		Y Sin	illow to	5 82M.	-0A_	25			
Soils:								Soil Core Photo:	(12)2
itter 10-15	Bare Soil:	5	Timber:	-	Rock:	-	Groundco	ver: 80-9	35
	Photo No	4107	+ 4208	47.09	4210	47.11		4725	4206
HOTOS:	Direction	N	E	S	W	g/c	canopy	0m- 30°	100m-210°
Some	V. Tare	ped h	bles i	n rec	Irow	n			-
REMNANT	Y	(N)	Y/N?	Zone:	554	Datum: Gl	DA94 4	14584	
Vegetative Stru	icture and Co	mposition		Waypoint:		Easting:   L	17.77649	Northing: - 2	21.30733
Stratum	Median	Height	range (m)	Intercept	Dominan	ce Specie	25 14	-2	1.35 68
(n)	23.	19-	26	V }	als	Cte Etc	60165 25 eb E	teret	
T1 T2									
T2 T3									
(S1)	4	1-	8	KG-15K	d a 0/5	Cd Ctr Ztr	ark 55 2 cretic,	zpop.	
Ş2									
G	0.2	0.0	1-0-6	M-0	d	tile i	2101 -	variable	
terbarium RE definit Jominance: d - dom	ions inant, c - co-domi	nant, a - associ	ated; s - suppresse	id.					
rown cover intercep Valter and Hopkins I Walter and Hopkins (	it: 1: isolated (0.2- height classess: 1-3 crown cover classe	2%); V: very sp 8m - dwarf, 3+6 (s: <0.2% - (so);	arse (2-20%), St sp m - low, 6-12m - n ated trees or clum)	arse (20-50%); M:r nid-high, 12-20m - t ns; 0-2-20% - open	nd-dense (50- tall, <b>20-35m</b> s woodland, 20-	au%); D: dense (80-10 ery tall, >35m extrem 50% - woodland; 50 8	om) nely tall 0% open fores	t, 80 100% - closed forest	
BASAL AREA [fi	xed point Bitt	erlich tech	nique: factor :	1cm]		CONDITIO	N		
Species		S1/S2	<b>S1</b>	T2	(11)	E Ty	pe	Severity (	0 to 3)
<u>, 1 1</u>						Fire (& hei	ght in m)	0	
1 411	5.				1	Clearing		3	nist
- Clark		and the second se				Thinning/F	ingbarking	0	OVET.
= clark = thet						c .		2	11.2,
e teret						Grazing		2	11.2,
e thref	,					Grazing Exotic Flor	a aback	1-2 (	.glc)
e Kret	,					Grazing Exotic Flor Canopy Die	a eback	2 1-2 ( 41	g(c)

e

2)

	Random meander				(please	e tick type an	d circle plot s	ize)
SITE NUMBER: GEN-OA-	-29	Plot		х	1x1m	<del>10x10m</del>	<del>20x20m</del>	10x50m
Species (cont'd)	1	Presence	Strata	Species			Presence	Strata
Celarks		5	SETI					
Clos		3						
C dallach.		2	J					and
Ectebra		2.3	31(-71)					
C. brewst.		3	SI					
Acaria 30.		+	51	Lifeform			Native	Exotic
<u> </u>				Tree			4	-
				Shrub			2	-
Bblackbi		3-5	4	Grass		-	5	
Avist jeach		3		Herb			3	
Arist 50 (n-r).		1						
Tricovare -92.		1		Stratum			Height	Cover
5. Scalbra		2		T1	1 tree		26	840
Walth India		2		T2				
Clycine Sp.		1		<b>S1</b>	1 shrub		34	1.34
Both decip/clond		2		S2				
Eul. aur.		1						
P cilian.		1-3	V	Crown Cover	Intercept (optiona	al)		
				Species	Strata/Height	Intercept	Range (m)	Cover (m)
								-
			1	see i	ottom of	03		
						1		
			+					
	Service of the servic					1		
				NT BOARD		10-05-01		
	_						- mark	
		-	Participa de				-	
								12.21
	- man	-					Contraction of the	
								-
						-	1.57	
						Construction of the		
			-					
		100 15 1					1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	
						Cast and	m (25)	
	1						1000	(Color)
	1							
			1 Section					
Distribution of Exotic Flora	11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1	Abundance	Severity					
Declared Pests								
Non-declared exotic flora								
Presence: Braun-Blanquet Technique (	scale: +, 1 throug	gh to 6)					© = collect	ed
Community Area (ha):	site only	<1	1-<5	5-<20	20-<50	>50	DEHP	Mapped:
Community Width (m):	<35	35-<75	75-<150	150-300	not linear	variable	Yes	No
		and the second second second second		No. of Concession, Name	Statistics of the second second second	And the owner of the owner owne		down

## ECOLOGICAL FOLLIVALEN

GROUNDCOVER: (top 1 x 1 m plots)			DATE:	45 1	6.13		SILE:	SYERW	EN !	27.17-	01-0
Ground Cover type	1	2	3	4	65	6	7	8	9	10	Mean
Native grass		10	-	0.7	20				-		2.1.
Native herbs & forbs	17	10	8	26	SA						21.4
Native shrubs (<1m in height)										-	
Non-native grass		AT #	1.7 #	100	68 -						51
Non-native herbs & shrubs		91	06	60	QU.						214
Aquatic Vegetation (floating)											
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)											
Non-aquatic sedges		-				-					
Ferns											
Litter	1.7	0	18	19				-	-		12.11
Rock	1 (	7	10	10							12325
Bare ground	,										1.0
(Other)	6	6	12			-					4.8
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
		20)		Plot siz	10°	100	(50m)	100	x20m	50	(10m
ARGE TREES: (Eucalypts >30cm DBH and No	in-eucarypts >	20(11)		Tally	of DBH si	ze classe	s (cm)				
species	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
A 1 1										1.5	1
u da Ksonjama	122					-				0.	
		1									
Concernant of the second second									-		
							-		-		
						-					
				-							
Furalvate:	Average DB	H /ahove thre	shold)=	15	D (m						
Non-euralynts:	Average DB	H (above thre	shold)=	60	cm		CIT	rel	-	-	-
	Average bb	in fabore time	Shoul				-	-	L Faller		h.
Habitat Comments:	de serrae	lateral.	cover			ot: 50 x	20m]		Mate	n wood rial:	y
e Patchy long miles 0					<1	Ocm wid	e:		(length	n of faller	woody
Very few large trees, no hellow	US								logs >1	Ocm dia	m and
Low abund. fallen timber									Count	Tally:	x 20mj)
little sparse and mostly have	ed off go	955				0			2,0	5,3,1	2,1,1
	0										
					1	0cm wid	A.				
					1	ocini wila					
					10						
						0					
									100		
			-	and the	т	TAL:	-		TOTAL		-
TOTAL WEEDC		-	-	-	_	0				19.5	
TOTAL WEEDS: 1-2 (g/c)	-	in the second	-			-	-	- All	1 1		
pop 3.8 37.60 88.26	1.34										
clark (26.0 75.30 66.90	(8.40)								1		

51

	LLCOWA	LEINCE						ttm		Da	Daga a sta
Date: 30.	8.15	(	Collector:	CJH	+ MNW		-	a land the second			rage 1 or 3
Time: 68	55	J	ob No.	1 150	240		(All all all all all all all all all all	and the second			Contraction of the
Mapped RE:	D-1					Lot on Plan :		Contraction of the			
Field RE:	A-r	(11.3.	2)								
Desecription:	frac	mented	2.0	populae	E WI	to open	wl				
Slope:	Aspect:	L	andform (k	ocal):		Landform (br	ad):	and the boundary of the	State of the local division of the local div		
%	-	- 11	plain			allusia	ala	0	10.	War (	
Slorge Shape:	flat		( IOAII )			1 Migvitte	pia	AN	UC TO	for tre	2K
0101	mleh	100 10 60	india (	lau				Soil Core	Dhata	-	
Soils:	par a	rewn au	widy i	y				Soll Core	Photo:		
litter: 10	Bare Soil:	10-20	Timber	5-10	Rock:	- 1.		Surrace S	oils Photo:	75	
dife. 10	Photo No	FIL-51	1657	17153	TIEL		srounaco	ver:	60-	10	
PHOPTOS:	Direction	N	E	(0+	2 +604			+1	244	763	0
NOTES by	Direction	f clark	L -	3	W	g/c	FOCK	0m - 6	200	100m -	105
NOTES: MIL	HOLY C	of alling	INA AT	MININA	Tradi	y eviden	t	Stump	3 pull	ed time	Der
cpin . St	ada t	contra 1.	FILOIX	phear J	MIS.		- 1	1.1.2	1		
- ATTISE!	his	min- ma	AUT 4	O WUT	Vel R	Lovery &	Not C	listrib	ution 9	alus	ity yar
and and	1 1	and e	VDT-	Dier a	racen	1 lat 1	1.		211		
Grand	, day	adad	and	24 5	n swall	indiet 1	all	Mto .	20+10v (	rak	~
COULT I	- un		(VIND)	7	Ven +	entis to	14 - V	MUR r	Ca (s)	m - 70	16)
New planting Sta		(N)	T/N?	Zone:	0	Datum: GDA9	4 WGS	84	0		
vegetutive stru	ture una co	mposition		waypoint:		Easting:		Northing:			
Stratum	Median	Height rang	ge (m)	Intercept	Dominance	Species			1		
E	and the set		A CONTRACT								-
						6					
				3	d	2000	ulaea	1	man Station	4	
(EDL)	16	111 - I	a			1 1					
[]		T	7 (	10 - 251					- in the second		
				6		-					
TO	in l	0 10		1	d	2 - 11	spin	la .		Carlos -	
	10	8-12	<	5-10%	a 5	HCaEI	a 50	allana			
					I	-	0.00				
51				1	~ (	E POPU	inea.	1	112201		-
	1.5	0.5-	7	BINY 1	ad	C ore	WOTU	1-1-20	uncina	Cova	da.
			1	2 10 1	014	Adal h	hulla	( d	inter 1	1	
					Ma	Fice. N	aving.	T G ST	nara 1	tr. exce	120- 8 mi
					have a second second	and the second sec					
52											
52							er elster				
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52				5	d	* B. pert	ISA.				
52 G	0.05	0.01-	0.4	{	d	* B. perti	ISA, Rr'				
S2 G	0.05	0.01-	0.4		d o	× B. perfi '2000	ISA, Re'				
52 G	0.05	0.01-1	0.4		d Ø	* B. perfi	ISA. Na				
S2 G	0.05	0.01-1	D· 4		d	* b. perfi 'see o	ISA, Na				
S2 G	0.05 s	0 · 0   -	D. 4		d	* b. pert	ISA, NGC'				
S2 G erbarium RE definition miloance: d - domina pawn cover intercept:	0-05 s nt; c-co-domina ; isolated (0.2-29	0 · 0   -   nt; a - associated; s 0; V: very sparse (2	D. 4 - suppressed	{	d D Id-dense (50-80%)	* 0. pert	ISA Ha				
G erbarium RE definition minance: d - domina own cover intercept: alter and Hopkins heis	0 · 05 s t; c · co-domina : isolated (0.2-29 tht classess: 2-3m	0 + 0	D- 4 -suppressed -20%), S: sparse r, 6-12m - mid-	: (20-50%); M: m high, 12-20m - ta	d	<ul> <li>B. perfi</li> <li>200 0</li> <li>b: dense (80-100%)</li> <li>b: dense (80-100%)</li> </ul>	ISA RC'				
S2 G arbarium RE definition miniance: d - domina swn cover intercept: alter and Hopkins heig alter and Hopkins cross	0-05 s : isolated (0.2-2% ht classes: 1-3m m cover classes:	O + O	D-4 - suppressed -20%), S: sparse r, 6-12m - mid- ses or clumps: (	e (20-50%); M: m high, 12-20m - ta 12-20% - open w	d 0. id-dense (50-80%); II, 20-35m - very ta oodiand, 20-50%	<ul> <li>D. perfi</li> <li>22200</li> <li>22000</li> <li>22000</li> <li>22000</li> <li>22000</li> <li>22000</li> <li>22000</li> <li>22000</li>     &lt;</ul>	ISA RC'	0-100% - elses	forest		
S2 G rbarium RE definition minance: d - domina wwn.cover intercept: alter and Hopkins felg alter and Hopkins crow	0-05 s nt; c-co-domina : isolated (0.2-2% ht classes: 2-3m m cover classes: 1 point Bitter	O + O   nt; a - associated; s G: V: very sparse (2: 1- dwarf, 3-6m - low <0.2% - isolated tra-	D- 4 - suppressed -20%), S: sparse y, S-12m - mid- ses or clumps; t; factor 1 cc	e (20-50%); M: m high, 12-20% - open w n]	d 0 id-dense (50-80%); II, 20-35m - very ta oodland, 20-50% ~	<ul> <li>D. perfilience</li> <li>222200</li> <li>D: dense (80-100%)</li> <li>II, &gt;35m - extremely tai</li> <li>wpodland; 50-80% - or</li> <li>CONDITION</li> </ul>	ISA RC' sen forest, &	9-100% - closed	forest		
S2 G erbarium RE definition minance: d - domina own cover intercept: atter and Hopkins rep alter and Hopkins crow ASAL AREA [fixed pecies	D-05 5 nt; C-co-domina 1: isolated (0.2-2% ht classes: 1-3m on cover classes: 1 point Bitter	0 · 0   nt; a - associated; x 6): V: very sparse (2 - dwarf, 3-6m - low <0.2% - isolated try flich technique \$1/\$2	D- 4 - suppressed -20%), S: sparse v, 6-12m - mid- tes or clumps; 4 :: factor 1cr 12((S1))	e (20-50%); M: m high, 12-20% - ta 12-20% - open w n]	d 0. id-dense (50-80%); il. 20-35m - very ta oodiand, 20-50% - T1		ISA RC' sen forest, 8	0-100% - closed	forest		
S2 G erbarium RE definition ominance: d - domina own cover intercept: alter and Hopkins crow ASAL AREA [fixed pecies	D-05 s nt; c-co-domina I: isolated (0.2-29 tht classess: 2-3m vn cover classes: 1 point Bitter	0 · 0   nt; a - associated; s 6); V: very sparse (2: - dwarf, 3-6m - low <0.2% - isolated tra flich technique S1/S2 1 1	2.4 - suppressed -20%), S: sparse y, 6-12m - mid- tes or clumps; 4 :: factor 1cr -24(S1)	e (20-50%); M: m high, 12-20% - open w n] (T2)	d (d-dense (50-80%); II. 20-35m - very ta oodiand, 20-50% - T1 II.	b. perfil 222 0	ISA, RC'	9-100% - closed	forest Severity (0	to 3)	
S2 G erbarium RE definition ominance: d - domina own cover intercept: falter and Hopkins crow ASAL AREA [fixed pecies COO QUILLO	D-05 s nt; c-co-domina i: isolated (0.2-22) tht classess: 2-3m vn cover classes: d point Bitter	0 · 0   - nt; a - associated; s 6): V: very sparse (2: 1- dwarf, 3-6m - low <0.2% - isolated tra rich technique \$1/52 ] 1	- suppressed - suppressed - 20%), S: sparse y, 6-12m - mid- ces or clumps; 4 2: factor 1cr 	e (20-50%); M: m high, 12-20% - ba h2-20% - open w n] (T2) []	d (d-dense (50-80%)) (d-dense (50-80%)) (d-	<ul> <li>b. perfilience</li> <li>b. perfilience<td>n)</td><td>9-100% - dosed</td><td>forest Severity (0</td><td>to 3)</td><td></td></li></ul>	n)	9-100% - dosed	forest Severity (0	to 3)	
S2 G erbarium RE definition ominance: d - domina own cover intercept: falter and Hopkins row ASAL AREA [fixed pecies	0.05 s nt; c - co-domina i: isolated (0.2-29 th classes: 1-3m on cover classes: 1 point Bitter	0 - 0   - nt; a - associated; s (); V: very sparse (2 i - dwarf, 3-6m - low s0.2% - isolated tre s1/52 3 1		e (20-50%); M: m high, 12-20m - ta 12-20% - open w n] (T2) []	d 0. id-dense (50-80%); il. 20-35m - very ta oodland, 20-50% - T1 II II II	b. perfi 200 - perfi 200 - or 200 - or	ISA Har'	9-100% - closed	forest Severity (0	to 3)	-2)
S2 G erbarium RE definition iminiance: d - domina own cover intercept: alter and Hopkins row ASAL AREA [fixed pecies populated Stag	0-05 s nt; c-co-domina i: isolated (0.2-29 ht classess: 2-3m on cover classes; d point Bitter	o · O   - nt; a - associated; s G; V: very sparse (2 - dwarf, 3-6m - low - d0.2% - isolated tre - flich technique - s1/S2	0-4 -suppressed -20%), S: sparse y, 6-12m - mid- ses or clumps; t: factor 1cr (a/s1)	e (20-50%); M: m high, 12-20m - ta 12-20% - open w n] (T2) [1] ] [1] ]	d 0. Id-dense (50-80%); Il. 20-35m - very ta oodland, 20-50% - T1 II: II: II: II: II: II: II: II: II: II	D: dense (80-100%) II, >35m - extremely tai wpodland; 50-80% - or CONDITION Type Fire (& height in Clearing Thinning/Ringba	n) arking	9-100% - closed	forest Severity (0 O O U U U	to 3)	-2)-3)
S2 G erbarium RE definition ominance: d - domina own cover intercept: fatter and Hopkins eron ASAL AREA [fixed pecies populated Stag	0-05 s nt; c-co-domina i: isolated (0.2-29 tht classess: 2-3m en cover classes: d point Bitter	0 · 0   - Int; a - associated; s 6); V: very sparse (2 - dwarf, 3-6m - low <0.2% - isolated tra flich technique \$1/52 3 	0-4 -suppressed -20%), S: sparse y, S-12m - mid- ees or clumps; t :: factor 1cr Fa(S1)	e (20-50%); M: m high, 12-20m - ta h2-20% - open w n] (T2) [1] ] [1]	d 0. id-dense (50-80%); il. 20-35m - very ta oodland, 20-50% ~ T1 II: II: II: II: II: II: II: II: II: II	b. perfi 200 0 200	n) m) mking	9-100% - closed	forest Severity (0 O O U U U U U	to 3)	2
S2 G erbarium RE definition ominance: d - domina own cover intercept: latter and Hopkins crow ASAL AREA [fixed pecies population Stag	D-05 s nt: c-co-domina i: isolated (0.2-29 ht classes: 2-3m on cover classes: d point Bitter	0 - 0   - Int; a - associated; x 6): V: very sparse (2 - dwarf, 3-6m - low <0.2% - isolated tra flich technique S1/S2 I 	D-4 -suppressed -20%), S: sparse v, 6-12m - mid- ces or clumps; u :: factor 1cr Factor 1cr Factor 1cr	e (20-50%); M: m high, 12-20m - ta 1,2-20% - open w n] (T2) [1] [1] [1]	d 0. id-dense (50-80%); II, 20-35m - very ta oodland, 20-50% - T1 III III III	D: dense (80-100%) II, >35m - extremely tai wpodland; 50-80% - or CONDITION Type Fire (& height in Clearing Thinning/Ringb: Grazing Exotic Flora	n)	0-100% - closed	forest Severity (0 O O U U U U U U U U U U U U U U U U U	to 3) vistoric ustoric	-2) -3)
S2 G erbarium RE definition ominance: d - domina own cover intercept: latter and Hopkins help alter and Hopkins crow ASAL AREA [fixed pecies populate Stag	D-05 s nt; C-00-domina i: isolated (0.2-29 ht classes: 1-3m en cover classes: d point Bitter	0 · 0   -   Int; a - associated; s 6): V: very sparse (2 t - dwarf, 3-6m - low <0.2% - isolated tra- flich technique \$3/52 ] 	D-4 suppressed -20%), S: sparse v, 6-12m - mid- ces or clumps; 4 :: factor 1cr :a(S1)	e (20-50%); M: m high, 12-20% - open w n] (T2) [	d 0 id-dense (50-80%); il, 20-35m - very ta oodland, 20-50% - T1 H	b. perfilic b. perfilic b. perfilic b. perfilic b. perfilic b. perfilic center constant	ISA HC' sen forest, &	9-100% - closed	forest Severity (0 0 () 0 () 2 -3 ( 0 )	to 3) vistoric gkl	- <u>2</u> - <u>3</u> )
S2 G erbarium RE definition ominance: d - domina own cover intercept: fatter and Hopkins heig fatter and Hopkins crow ASAL AREA [fixed pecies pecies ASAL AREA [fixed pecies	D-05 s nt; c-co-domina i: isolated (0.2-29 ht classes: 2-3m en cover classes: d point Bitter	0 + 0   Int; a - associated; s 6): V: very sparse (2 t- dwarf, 3-6m - low <0.2% - isolated tra- dich technique \$1/52 3 1	D- 4 	e (20-50%); M: m high, 12-20% - open w n] (T2) [ ] ]     ]	d 0 10-dense (50-80%); 11, 20-35m - very ta oodland, 20-50% - T1) 12 14 14 14 14 14 14 14 14 14 14	D. performation     D. performation     D. performation     Solution     Solution     Solution     Type     Fire (& height in     Clearing     Thinning/Ringba     Grazing     Exotic Flora     Canopy Dieback     Erosion	ISA HC' sen forest, &	9-100% - closed	forest Severity (0 0 () 2 () 2 - 3 () 0 - 3	to 3) vistoric ustoric	-2) -3)

AND AND AREA		Random me	ander	1	(plea	se tick type a	nd circle plat	size)
SITE NUMBER: EEM-DA	-9	Plot	-1-13	1	1x1m	10x10m	20x20m	10x500
Species (cont'd)	V	Presence	Strata	Species		-	Presence	Strata
E. populnea		6	51-71					
C. brewsteri		3	51					1
At hemiglauca		1	1		Sin I		-	
E claubsonsiana		+						
Acacia exceled		+	V					
Covata	10-110	+	G-51	Lifeform			Native	Exotic
Psydrax olut		+	.51	Tree			4	
				Shrub			3	
	and a shore			Grass			5	3
				Herb			3	
B. pertusa		5	G		100000000			
H. contortus.		3		Stratum			Height	Cover
Both. decipiens	S. Sandan and	3		T1				corer
Estalia curea		2		T2				
lennisatum ciliare	AN IN	2-3		S1	The second second			
Chrysoppion Sallax	entrane i a la	2		S2		Constant -		Contraction of the
Brunbrielth austral	3	1			Contraction of the	ŕ		
Urochlar mosambiu	ensis	+		Crown Cover	Intercept (option	al)		
Sida rholemae		2		Species	Strata/Height	Intercept	Range (m)	Cover (m)
ENTRUS raimosus		1						cover (m)
Cyperus fullous		1		Sel 03				
1								
								1.1
a second second second second								
			and the second second second					
		1 B.						
	- Strateger	Kunssen						
	and the second s			6				
istribution of Exotic Flora		Abundance	Severity					
eclared Pests								
on-declared exotic flora								
resence: Braun-Blanquet Technique (s	cale: +, 1 through	gh to 6)					© = collected	
		and the second se						
ommunity Area (ha):	site only	<1	1-<5	5-<20	20-<50	>50	DEHP M	nned.

ECOLOGICAL EQUIVALENCE										Page 3 o	f3
BIO-CONDITION PARAMETERS			DATE:	30/08/	1201:	5	SITE:	EEM_0	A-\$9		
GROUNDCOVER: (ten 1 x 1m plots)					65			- Inte			
Ground Cover type	1	2	3	4	5	6	7	8	9	10	Mean
Native grass	4										0.8
Native herbs & forbs							1 212			1	
Native shrubs (<1m in height)											
Non-native grass	78	58	38	82	27						56.6
Non-native herbs & shrubs		3									
Aquatic Vegetation (floating)											
Aquatic Vegetation (submerged)			N.								
Aquatic Vegetation (emergent)											
Non-aquatic sedges											
Ferns											
Litter	18 #	12	9	12	50	*					20.2
Rock						-					
Bare ground		30 #	53 #	6	16						21.0
(Other) Timber					6						
TOTAL	100%	100%	100%	100%	1009	6 100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and Non-	eucalypts >20	cm)		Plot siz	ze:	(10	0x50m	100	x20m	50)	(10m
Species				Tally	of DBH	size class	es (cm)				
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (	record
Epopulnea		HH-+++11	1441	1/1							
- poporter											
staa		4			11	1					
		1000									
Eucalypts:	Average DB	H (threshold	}=	c	m	-		9100	12)		-
Non-eucalypts:	Average DB	H (threshold	)=	C	m			ilia)	9		
Species Habitat Notes (if applicable):					T	Hollows			Faller	Wood	ły
# Hollows minimal and only obcom	ed in sta	gs				[Plot: 50 x	20m]		Mate	rial:	
A Moderate Jarcer diameter filler to	uper with	h hollow	<			<10cm wi	de:		(length	of faller	woody
s rice and in get a land of the in	internal card								>0.5m	[Plot: 50	x 20m])
* Heavily grazed.						4	r		Count	Tally:	1
									5,0.	5,1,2.	>,(,5
									1. 2,1.3	14	
					1	>10cm wi	de:				
						C	,				
											*
					-	TOTAL:			TOTAL		
WOODY RECRUITMENT: 1007.					-	4			21 4	- 101	40
TOTAL WEEDS: 2 (P. aliant ; B. pw	tusa)									5m [0]	19.
Size of Patch (ha) <5	5-	25	26	- 100	T	101 -	200		>2	200	
Connectivity	0 - 1	10%	>10	<50%	(	50-	75%	:	>75% oi	r >500	ha
Context	<109	% RV	>10 -	30% RV		>30 - 7	5% RV		>75	% RV	)
Distance to Water (m) 0 - 500	500 -	1000	1000	- 3000	-	3000 -	5000		>5	000	
Ecological Corridors	Not W	Shari	ng a co	mmoi	n Bound	Boundary W			Within (whole of part)		

Decuts	St	Hat	st	. Fad	Carllel	1 _					
E.DOD	T.	120	0	7.4	1.4		Τ.	25 42	,	T	- 16 4-00
2,000	Ta	13.4	19.96	26.85	6.89		-	20.70		To	
.000	51	1.8	48.33	48.87	0.26		11	9 387	-	5	
-pop (2)	TI	16.4	74.66	84.04	9.38		51	0.267.		-	
. pop (2)	T2	11.2	86.24	90.89	465						
pop	Tz	10.5	92.16	99.10	6.49						
											hermonia a bernar bernar
											and the second second second
				- 1							

ECOLOGICAL	EQUIVAL	ENCE										Page 1 of	3
Date: 30	2-9-2	1015	Collect	or:	CJH	11	1NW			SITE.	66.1 -	1	1
Time: 10	15	0	Job No		1 151	040				Sille.	an_c	04-10	
Mapped RE:	11.2	12						Lot on Plan	:				
Field RE:	5	2.1			11 -	-	11	-00					-
Slope:	Acnost	1011UW	Landfo		all Or	ra		) V  .		and the other designation			
%	Aspect:		Landro	rm (lo	cal):			Landform (I	broad):	10 0	015	11 (1	
Slope Shape:	flat	_	pia	in		-		allin	al pla	1010	y of J	UTTORCK	
Siepe Silape.	Ocila	laca		u A	da					Soil Core	Photo:		1
Soils:	pare	oron	ma	ma	y cia	)				Surface S	Soils Photo:		
Litter: 20	Bare Soil:	10-20	Tin	nber:	65	Ro	ock:	-	Groundco	over:	55-65	State Street Street	1
PHOTOS:	Photo No												
	Direction	N		E	S		W	g/c	rock	0m - 1	150	100m - 195"	
NOTES:	Jative	ly in	tact	15	ut th	201	hou	town	and (	W) ei	day du	e to '	-
hitton	du -	Gar	na	ch	unside	le:	1	in day	alent	pade	löck		
yv uav v e	ary or	Jergro	alach	1			-						
	m												
REMNANT	(Y)	4	Y/N	2	Zone:	55	K	Datum: GD	A94 (U	19584	>		
Vegetative Stru	icture and Co	mposition			Waypoint	-		Easting:		Northing	;		
Stratum	Median	Height	range (m	)	Intercept	Dom	inance	Specie	5				
						0	~	2.00	2011/20	(			
E	16	14-	10		1	- 4							
1	/	. 1	. 1		40 /								
A					(	1 1		400	outren	1			1
TI	1.0		-12			5		Acde	ia es	celsa	hea	roni	
[EDL] /	11	4-	15		5-151	-					1		
			-						-	-			
T2													
	-			-			t				and the second se		1
					(		t	E.M	itchel	lii			
(51)			~			0	λ	Acaci	a exi	elsa,	Laguio	zau, E pope	hea
$\sim$	4	1-	8		15		215	610	Signet	<del>na</del>		11.	
					20-102.	-							
				-									
52													
						-							
				-	(		1	xA	ne dis				
						-	a	Red	PCINS	In X	() MDS	ambiconcis	
G	0-1	0-01	-0-1	i	1			Them	eda tv	igindro	Aridi	de son H	contor
				1					102-2		1	117	
	Section of the section of the			0000	1		ACE STATE						
Herbarium RE definiti	ons					-							
crown cover intercen	nant; c - co-domi	2%): V: very co	arse (2-20%	) Street	se (20-50%)	mid.der	e (50.90m)	Di dente 180 100	941				
Walter and Hopkins h	eight classess: 1-	3m - dwarf, 3-6	m - low, 6-1	2m - mia	d-high, 12-20m -	tail, 20-3	5m - very t	all, >35m - extreme	ly tall				
Walter and Hopkins c	rown cover classe	es: <0.2% - isola	ated trees o	r clumps	; 0.2-20% - oper	woodlan	d, 20-50%	woodland; 50-80	% - open forest	, 80-100% - clo	sed forest		
BASAL AREA [fix	ed point Bitt	erlich tech	nique: fa	ctor 1	cm]	100		CONDITION					
Species		<del>\$1</del> /\$2	<del>13/</del> 5	1	(T2)	(11)	E	Тур	e		Severity (0	to 3)	
2 popula	a				5	11	-	Fire (& heig	ht in m)		0		
istand					2	T	-	Clearing Thinning (D)	ngharking		0	(21-1-)	
Sings			1	-	2			Grazing	ngparking		2	L: historic)	
Ac. ex	10/50				1			Exotic Flora			22	Cult	
	10-502						1	Canopy Diel	back		ZI	gui	
								Erosion			0		
								Recruitment	t		2		
-				-					1000				

SITE NUMBER		Random me	ander			(pleas	e tick type a	nd circle plot	size)
EM-OA	-15	Plot		x	1	×1m	10x10m	20x20m	10x50m
Species (cont'd)		Presence	Strata	Species			Sec. 19	Presence	Strata
E. populapa		24.77	SI-TI			1.0.1			
Acdicia excelsa			51-71		-			1.2	
Atalaya Leniglo	wa		51			1000			
Sremophila mate	helli		51		11				
Lovata			CSI						
				Lifeform				Native	Exotic
	Section 1			Tree			-	2	-
				Shrub				3	-
				Grass				6	8
Walteria indica		1	G	Herb				T	11
Permisetum cilian	0	3-4							
Bothriochlog opri	sa	4-5		Stratum				Height	Cover
Bothriochlon decir	iens	2-2		T1				Madi	11/275
unorhiba mosamb	Censis	2		T2				10.4	4(2)
Heteropping 10, to	tus	1		S1				117	2117
Acistida Sp.		1		52			-	44	2-42
Sida rholeinae		2							
Chryspopping falla	X	2		Crown Cover	Intercent	(optional	1)		
Enterordoop ram	6505.	1		Species	Strata	/Height	Intercent	Range (m)	Cover (m)
Estalia aurea				Enal 12	-+1	15:0	0.00		1.21
Eyperus fuluus		+		telob re	TI	111	TEF	22 11	12.40
Brunoniella australi	5				-77	157	77 10	21-46	4.40
Malvastrum americi	anum				TI	168	39 75	117 70	1.15
Achyranthes asper	19	+			17	9.1	20.17	44-10	2 14
Syanthillium dir	ercum	+			TI	116.6	11-27	17 18	505
halactia terrifi	ara	+			5	47	28.16	90.59	(7.4.7-
				V	TI	10	03.47	100.00	6-58
							1		
						1			
						-			
	-								
					_				
					_				
					-				
intelligence of Francis Pic									
adapad Dasta		Abundance	Severity						
eclared Pests		-	-						
on-declared exotic flora		4	1-5	·					
resence: Braun-Blanquet Technique (s	cale: +, 1 throug	h to 6)			6	~		© = collecter	d
ommunity Area (ha):	site only	<1	1-<5	5-<20	/ 20-<	50	>50	DEHP M	apped:

BIO-CONDITION PARAMETERS			DATE:	30/	8/201	5	SITE:	44M	-DA-	15	
GROUNDCOVER: (ten 1 x 1m plots)	Section Section			in the second	Sec. 1						
Ground Cover type	1	2	3	4	5	6	7	8	9	10	Mean
Native grass	2	1		4		1.20					1.11
Native herbs & forbs			-	1							0.7
Native shrubs (<1m in height)											10.2
Non-native grass	33	417	H	37	40						141
Non-native herbs & shrubs		1-1-	10		10						41.6
Aquatic Vegetation (floating)											
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)											
Non-aquatic sedges	-							-			
Ferns											
Litter	20	71	11	1.50	252						0.1
Rock		31	126	1B	28			-			24:6
Bare ground	1.7		1.4	1	1.0						
(Other)	45	21	18	40	52						30.9
TIMOR	100%	5	100%	1000	10000	4.0001					1-4
	10076	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and No	n-eucalypts	>20cm)	The states	Plot siz	ze:	100	(50m)	100)	(20m	<del>50x</del>	10m
Species		1 22 25		Tally	of DBH siz	e classe	s (cm)				
	<20	20-25	25-	30-	35-	40-	45-	50-	55-	>60 (r	record
2 populnea			1	Jut	111	1	6				
							(9)				
Ac. exietsa		1					C				
						1.00					
										1	
								10 10			
Eucalypts:	Average DE	3H (threshold)=	1	18 cr	n		18	316	1		
Non-eucalypts:	Average DE	BH (threshold)=	2	O Cr	n		10	4			
				-	Но	llows:		-	Fallen	Wood	,
					[Plo	ot: 50 x 2	0m]		Mater	ial:	
					<10	cm wide			(length	of fallen	woody
					4				logs >10	cm diam	and
					17				Count T	ally:	20mj)
									4.5 1.5	519	57
									3.75	2 1.7	55
					>10	cm wide			1.5	_,	7
					1	cill wide			1.1		
					11						
WOODY RECOUNTMENT					TOT	AI -			TOTAL		
			_			AL.			IUTAL:	0.0	
TOTAL WEEDS: >50%, cover						)			2	9.0	

EKITH	ay .	0.12						
ate: 25	172.4	015	Collector:	CJ	H+M	NW	SITE:	
me:	847		Job No.					And Care and
apped RE:	N-1	- 1 .	1			Lot on Plan :		
eld RE:	p-1		14912	11.4.4	1 AL	1.(a. ). 11		
escription:	tra	amer	MPA VC	rirowt	h 17.h	av noonylla ;	- 2 populner	t open st
ope:	Aspect:	0	Landform (lo	cal):		Landform (broad):		- 1
-	-		plan			broad de	in plain	
ope Shape:	flat				, ,		1	
ils:	pale C	range	sands.	@ 50	rtace l	veneer t	Soil Core Photo:	-
	dourk	L bide	own cl	and he	ereath.	Minor Gilgar	Surface Soils Photo:	4232
ter: 40-50	Bare Soil:	20-41	Timber:	-	Rock:	- Groundco	ver: 0-30	)
HOTOS:	Photo No	421	F 410	8 4224	4230	4231		
	Direction	N	E	S	W	g/c canopy		1
DTES: UN	usual	Consi	whity	>h	istoric	ally cleare	of + apparen	tly succe
thinked	1 1/or	aller	ca or	er the	Hears	= = una	intain 'as to	) Mistor
regera	Alont	ypes)	ROUNT	ana	distr.	Dution	and Encoder	· ··· · · · ·
- p pa	Ting	Seria	ball	UN CI	cate!	notorically 1	out a popula	a now pro
CO	CYDY ILes	your	hatch	hictori	calle	epinanel a	Mosilie of 1	NIL 7 +
MNANT	Y		Y/N?	Zone:	KER	Datum: GDA94	14580	
getative Str	ucture and Co	mposition	.,	Waypoint:	J.J.L	Easting: 147-767-51	Northing: -71.2	2040
Stratum	Median	Height	range (m)	Intercept	Dominance	Species	12 1	
					d	9 0000200	Carroni	
E (FI)			12	I			1	
C(I)	10	8-	-12	121				
				ZLK				
T1 T2								
T2 T3								
				(	d	Aracia hav	pophulla 5	populada
(Fr)		7	7	V-5 1	alc	L. Carroni	1151	11
SI	4	2-	+	ETic	a	At. Lemii	ilauch T. obl	ongla
		-		2-101			) 1	J
				((10))	d	Covata		
(S2)	1.7	25	- 7	V 1	a	Atalaya he	miglauca, Lo	carronil
0	1-0	0.)	1	5-151			0	
	-					XP aline		
				1	de	Galacia	Tiplaca KR	nartisa
G	07	0.0	IDX	1	42	Hantort	Scaroll	1 wa
0	VL	00	1-0-)			The construction of the		
barium RE definit	ions							
nance: <b>d</b> - dom	inant; c - co-domi	inant; a - assoc	lated; s - suppresse	d				AND
vn cover intercep	ot: I: isolated (0.2-	2%); V: very sp	oarse (2-20%), <b>S</b> : spa	arse (20-50%); M: (	mid-dense (50-80%	); D: dense (80-100%)		
er and Hopkins	height classess: 1-	3m - dwarf, 3-6	5m - low, 6-12m - m	id-high, <b>12-20m</b> -	tall, <b>20-35m</b> - very '	tall, >35m - extremely tall		
er and Hopkins	crown cover classe	es: <0.2% - Isol	ated trees or clump	os; 0.2-20% - open	woodland, 20-50%	- woodland; 50-80% - open forest	, 80-100% - closed forest	
SAL AREA [fi	xed point Bitt	terlich tech	nique: factor 1	[cm]		CONDITION		- 21
ecies		S1/S2	\$1	T2	T1 E	Туре	Severity (0 to	0 3)
it						Fire (& height in m)	0	1:1:1
111						Clearing Discharting	005	-historich
						Grazing	013	-historic)
						Evotic Flora	7 (-	10
						Canopy Dieback	249	(c)
						Erosion	0	
						Recruitment	Z	

edl

Mapped RE: Field RE: Description: Slope: % Slope Shape: Soils: Litter: PHOTOS: NOTES:	Aspect: Bare Soil: Photo No Direction	as p	andform (le	ocal):		Lot on Plan	: proad):		
Field RE: Description: Slope: % Slope Shape: Soils: Litter: PHOTOS: NOTES:	Aspect:	as p	andform (lo	ocal):		Landform (I	proad):		
Description: Slope: Slope Shape: Soils: Litter: PHOTOS: NOTES:	Aspect: Bare Soil: Photo No Direction	CIS P	andform (lo	ocal):		Landform (I	proad):		
Slope: Soils: Litter: PHOTOS: NOTES:	Aspect: Bare Soil: Photo No Direction	as p	andform (lo	ocal):		Landform (I	proad):		
6 Solope Shape: Soils: Sitter: PHOTOS: NOTES:	Bare Soil: Photo No Direction	as p	er t	25			and the second		
Nope Shape: Noils: Nitter: NOTOS: NOTES:	Bare Soil: Photo No Direction	asp	er t	25					
itter: HOTOS:	Bare Soil: Photo No Direction	us p		-			2		
Soils: .itter: PHOTOS: NOTES:	Bare Soil: Photo No Direction	1.0-2	1					Soil Core Photo:	-
Litter: PHOTOS:	Bare Soil: Photo No Direction	1 4 2 - 2	1					Surface Soils Photo:	4378
	Photo No Direction	1 1 2 - 2	Timber:		Rock:		Groundcov	ver:	1 1900
	Direction	111/53	(1734	11725	4736	11322			
NOTES:		TT N	E	S	W	g/c	capopy		
	)								
the second se									
	(	95	Dart	25					
	7		per						
					2				
REMNANT	Y	(N)	Y/N?	Zone:	55K	Datum: GD	A94 (L)	4584	
Vegetative Struct	ture and Co	mposition		Waypoint:		Easting: 10	+7.7714	Northing: _ ZI	.36705
Stratum	Median	Height rar	nge (m)	Intercept	Dominance	Specie	s		
	-			-	d	Ea	poulneu	Larroni	A Larpo
E/TI	0	0 1	2	1	als	1	1	/	4
	7	0-1	3	12.	1				
				ZIA					
T1 T2									And States
							_		
			-				2		
T2 T3									
		The second second		-	4	6.00	a de a	A heread	
6				VZ	d	2.00	punea	H Nay OVON	yerry Lill
( \$1 )	4	2-			a	Htala	aya n	Thanca	4
	4			5-10%	as	2 mut	delling	1 oblong	ala
					1	1	ta	0	
					a	Cove	C.		
(52)	1	0.5-	2	1. 2. 1	ap	Jui	71		
			~	10-50/					
				Ċ	1	RQ (1	linve		
					a	9 ray	MOSUS	, ×B Dert	154
G	DI I	0.01	02	]	014	8000	50,105	un	
	0.	0.01-	0.2		- H	- Cure	- Prover	1	
				(					

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COLOGICAL	EQUIVA	LENCE							Page 1 of 3
Date: 3(	2.8020	015	Collector:	CTH	1 + M	NW		SITE GC .	1 10
ime:	2.10	2 0	Job No.	151	040			SILE. COM_(	)A-16
Aapped RE:	11.	5.2				Lot on Plan	1:		
ield RE:	11	5.2		H					
escription:	2-	0000	inea	willa	n alli	willing			
lope:	Aspect:		Landform (	local):		Landform (	broad):	11.0	
· ·	-		plair	2		lalluv	ial th	oodalain (N	) of Suttor
lope Shape:	tla	t	4					1 0	
oils:	pale	brav	n-brau	nge so	unds.			Soil Core Photo:	-
itter: 20	Bare Soil:	10-7	Timber	: <5	Rock:	-	Groundcov	<b>ver:</b> 50 - 70	2
HOTOS:	Photo No Direction	N	F	s	W	alc	rock	m 29D°	100- 4000-
OTES: MO	derate	lu in	to it	E Vavd	e fore	26 100	I	1 100 6000	Hannie
-inner 1	retting	Jeur	dont	· ung	~	Co year	Tach	mover sam	- INT MICH
- gle	Inal	hed	ly al	rgraze	ed.				
							-		
EMNANT		H	¥/N?	Zone:	55K	Datum: GD	DA94 (W	(4584)	
regetative Stru	icture and C	omposition		Waypoint:	-	Easting:		Northing:	
Stratum	Median	Height	range (m)	Intercept	Dominan	ce Specie	S		
				5	a	E.po	pulned	L	
E	717	111-	10	(1.0)	a				
/		1	1	40%					
-					1	En	10.100	1	
(T1)			.2	V	A	Ach	lia e	XIQISA AL	hemidauto
[EDL]	11	9-	-15	E IS	10	- He card	and the	111-	Junea
		1		2-131				Standing Projection	~
T2							Sector Sector		and the second second
								· · · · · · · · · · · · · · · · · · ·	
	125-014			1,1 (	d	2 rem	iphil6	mitchellu	0
(51)	11		d	V L	d	Ataka	ina 1	remiglance	A COLLA EV
$\cup$	4	1-	8	122	a15	Law	whit	C 1051am	tha.
				<51,			1		
52									
				(	d	× Both	wipelale	Da Alertisa	
	~ 1			1,2	a	×U-MO	Sampli	ensis The	neda trianda
G	0-1	0.	01-04	M	als	Aristid	a sop.	B. decimen	S H. contort
			1		all	×P. ali	and		1
	Concernation of the		-	11					
barium RE definiti	ons								
minance: d - domin	nant; c-co-dom	inant; a - associ	ated; s - suppress	ed					
wn cover intercep	t: I: isolated (0.2	-2%); V: very spi	arse (2-20%), S: sp	parse (20-50%); M:	mid-dense (50-8	0%); D: dense (80-100	)%)		
iter and Hopkins h	rown course ale	- dwarf, 3-6	m - low, 6-12m - r	nid-high, 12-20m -	tall, 20-35m - ve	ry tall, >35m - extrem	ely tall		
SAL AREA IT	red point Bit	terlich tech	nique: factor	1cm]	woodland, 20-5	CONDITION	ne - open torest, i	su-100% - closed forest	
ecies	eu point bit	S1/S2	T2/S1	T2	(T1) F	CONDITION		Council to 10	1 +0 21
Accula	ia	JEJJL	10/01	F	E E	Fire (8 hei	(ht in m)	Severity (C	10 5)
- paper o	0.0			1	10	Clearing	inc in my	0	
stans				1	1	Thipping/Pi	ingbarking	00	1
J						Grazing	Bodi Killg	2	
Ar. ex	10/50			7		Exotic Flora		22	(alc)
Abenai	alasa					Canopy Die	back	2-2	gut
	J	3. AT				Erosion		0	
						Recruitmen	t		
		the second se	the state of the second data where the	and the second division of the second divisio					

SITE NUMBER:		Random mea	nder	6	(please	e tick type an	d circle plot s	ize)
STE NOWBER. ELM-OA-I	6	Plot		(x)	1x1m	10x10m	20x20m	10x50m
Species (cont'd)		Presence	Strata	Species			Presence	Strata
E. populnea		6	51-TI					
Acadia excelsa		3	h				1.1	
Eremophila mitchel	111	3	51					
Atalyga Munigla	via	2	SIG-TI					
Lovata 0		3	G-51					
V. Viminalis		+	51	Lifeform		142	Native	Exotic
				Tree			2	-
				Shrub			4	
0-11-1-1-1-			-	Grass			4	3
pothno anda pertusa		4-5	19	Herb			X	2
Borniounlies deup	ens	3						
Waltheria 100100	-	-3		Stratum			Height	Cover
Chrysolugon tallax		2		11			1+0)	20.94
Aust de la contract		4		S1			11.0	1-95
Hetermon contrad	215	2		52			20	100
E Denie filme		2						
Sita rialesee		2		Crown Cover	Intercent (ontiona	1)		
Drochlige Mosampila		7-2		Species	Strata/Height	Intercept	Range (m)	Cover (m)
Themade triantia	(2,1)	2		6 000	TITO	0.00	R 51	9.5L
Brunoniella australi	3	T		1 hab	51 3.5	1.51 M	1-72	0.71
Achirantles aspera		1			12 12-1	7.46	\$ 15	0.69
Cialatica tenvitlara	Carrow 1	1		Enjitch	51 3.0	12.11	12.58	D.44
Malvastron american	num	2		5000	T2 114	31.33	34.92	3.59
Parthenium hysteroph	0/05	t		. 1	TI 19.5	40-88	53.50	12-62
Cilycine tabacina		+			TI 16-2	62.16	71.32	g.16
Triantberg triquetra		+		1 V	T2 10-4	71.75	74.80	3.05
Eportes australis		+		Abenin	51 4-3	84-24	85.30	1.15
			V	SPON	TI 17-3	88.68	97.28	8.60
		L						
	-							-
						-	-	
				-				
				-				
Distribution of Exotic Flora		Abundance	Severity					
Declared Pests		-	-					
Non-declared exotic flora		4	1-5					
Presence: Braun-Blanquet Technique (sca	le: +, 1 throug	to 6)			0		© = collecte	ed
Community Area (ha):	site only	<1	1-<5	5-<20	20-<50	>50	DEHP	Mapped:
Community Width (m):	<35	35-<75	75-<150	150-300	not linear	variable	Yes	No
		and the second se	Concession in the local division in the loca	An and a second s	1			

			DATE	2-	101-	101		61			1	
				30,	1010	(01)	SITE: 29			M-OA-16		
Ground Cover type	1	1 2	1 2		E	6	17			10	-	
Native grass	-	2	3	4	5	0	· ·	8	9	10	Mean	
Native herbs & forbs	E		1	3	2		1				1-8	
Native shrubs (<1m in height)		-		L							0-6	
Non-native grass	1.0	27	0	110	2	-					an li	
Non-native herbs & shrubs	44	3+	51	52	50						38.4	
Aquatic Vegetation (floating)		F									0.4	
Aquatic Vegetation (submerged)												
Aquatic Vegetation (emergent)												
Non-aquatic sedges		-										
Ferns												
Litter		2/		07	1							
Rock	14	26	18	25	50						19.4	
Bare ground	1.2	2.1	10	1.0	100	-						
(Other)	45	34	128	40	38	-					30.70	
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	10004	
LARCE TREES. /S Labor DRU	10076	10076	100%	Diet eis	100%	100%	100%	100%	100%	100%	100%	
LARGE TREES. (Eucalypts >30cm DBH and No	n-eucalypts	>20cm)	and the second	Tally	of DBH s	ize classe	c local	100	(ZUM	<del></del>	<del>10m</del>	
Species	<20	20-25	25-	30-	35-	40-	45-	50-	55.	>60 /	record	
6 000 000							40-		35-	2001		
- 2- populación			1	HHT	11	1	/	2				
Anna existent		1						a)				
Acada Duesa		1					6	1				
and the second												
				-								
					-							
Eucalyots:	Average DI	BH (threshold)=	2	0 0	m		1	01			-	
Non-eucalypts:	Average Di	BH (threshold)=	1		m		1	sino	ïL			
		an (an adnora)	20			- 11						
					H In	Ollows:	0m1		Fallen	Wood	Y	
					<1	Ocm wide	e:		(length	of fallen	woody	
					1	III			logs >10	Ocm dian	n and	
						41			>0.5m	Plot: 50	x 20mJ)	
									3.8,1.	4.1.6.2	1,25,	
									0.5,1	5, 2-5	4.1-2	
					>1	Ocm wide	a:		2.21	7,2		
									· ·			
					1'			1	1.191			
WOODY DECOULTMENT, LOOP					TO	TOTAL:				TOTAL:		
TOTAL WEEDS		/ 1	1		-	- 6				765		
101AL WEEDS: 750/0 (00)	er. li	regetati	W)			0		-	1	0-)		

265m/ha

ECOLOGICAL	EQUIVALENCE

COLOGICA	L EQUIVAL	ENCE				and the second second	A	Page 1 of
Date: 23	12.2015		Collector:	CSH	MNW		SITE: 55M	010 71
lime:	410		Job No.	150	261 (	Wey 15040	) - 2012	04-44
Mapped RE:	n-r	(1) 5	23			Lot on Plan :		
Field RE:	0-1	(11.5)	10/	1021	Dend	an lola ad		- Participant - Participant
Description:	ICAT?	TIAITY	2000	mea.	open si	WUNDAND		
Slope:	Aspect:		Landform (Ic	cal):		Landform (broad):	1	1
n ind	N		Iower	Deves		J. g.u.	IOW THE T- P	an
Slope Shape:	+12	1	1		14	0		1
Soils:	parle	orang	fe broi	wn Sar	105		Soll Core Photo:	1.51
Litter: 10-2	Bare Soil:	5	Timber	10.25	Rock:	Grou	ndcover:	1 15
	Photo No	Thiga	4150	11151	USP.	1152	1118	4155
PHOTOS:	Direction	N	E	S	W	g/c ro	ock 0m- 255°	100m - 175°
NOTES: PA	en-and	d stl	TOWT	I TCO	Here	many ster	15 M-1	1
- Opt t	omple	tely v	stic	K-ra	Kedt	(findber	prev in plot	)
variat	le re	want	n cou	er hi	t eno	van to	satisfy Q	Bol nels.
		U				0	0 -	
			and the second					
		Carl	W/hits	7	EEV		(WICCOM)	
EMNANT	Y and Ce	monsition	Y/N?	Vavaointe	DOL	Fasting: ALL 200	WG584	25780
Stratum	Madian	Height	ange (m)	Intercent	Dominanco	Species 107	14/1/J 21	25/05
Stratum	wedian	neight h	ange (m)	intercept	bonnance	species 144	- 11-101 - 21.	2010
E						and we want the		
					_			
S West								
T1		1						
TEDL	March 1							
т2				and the second				
12	1.1.5							
			TELES	(	d	E looula	01	
6.76			-	V	a	- hopens		
SI	4	3-	t.	5-10/	a 5	Ac excels	Sa	
			A STATE		1	6		
~	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.				d	2 populat	A	
( s2)	1	0.5	-2	15, 1	ac	C Drews	KI.	
0				- Sr.	a	1		State State
				Č	d	tro) (t		
	1.44.8				alc	Aristida	500	
G	0.3	0.01	-04	M	a	See DUC	x	
		0.01						
						EUCX -	and the second second second	
erbarium RE defin	tions						A State of the second	
ominance: <b>d</b> - dor	ninant; c - co-dom	inant; a - associa	ted; s - suppressed	1				
own cover interce	pt: 1: isolated (0.2	2%); V: very spa	rse (2-20%), 5: spa	rse (20-50%); M:	mid-dense (50-80%	6); D: dense (80-100%)	and the second second	
alter and Hopkins	height classess: 1-	3m - dwarf, 3-6n	1 - low, 5-12m - m	a-high, 12-20m	tail, 20-35m - very	tall, >35m - extremely tall	forest 80 100% stored forest	
	ived point Bit	arlich toch	ique: factor 1	s; 0.2-20% - open	woodland, 20-50%	CONDITION	iorest, 80-100% - closed torest	
nacies	ixeu point Bit	s1/s2	Tale1	TO	T1 5	Type	Causelles	(0 to 3)
Pecies		Jan		12		Fire (& height in m	Severity	)
5 00011	WO/I	3 89	1101			Clearing		13
- rupu	1214	1.1 199	1			Thinning/Ringbark	ing 7	- 2
1819 B						Grazing	1	
1						Exotic Flora	1	
						Canopy Dieback	Λ	a
						Erosion	C	)
						Recruitment	A	>
		1.55						

	Random meander		nder		(please tick type and circle plot size)						
SITE NUMBER: EEM-OD-24		Plot		x	<del>1x1m</del>	<del>10×10m</del>	<del>20x20m</del>	(10x50m)			
Species (cont'd)		Presence	Strata	Species			Presence	Strata			
5 UC DODWARD		5-6	52-51								
Acada exista		3	G-51								
Cassia brewsteri	and a sugar	3-4	52	Summer of the							
Acaria indiferce		4	51								
Ength aust		1									
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Distribution of Exotic Flora		Abundance	Severity								
Declared Pests						1.7.20					
Non-declared exotic flora											
Presence: Braun-Blanquet Technique (	scale: +, 1 throug	to 6)					© = collect	ed			
	score: ", = anoug										
Community Area (ha):	site only	<1	1-<5	5-<20	20-<50	(>50)	DEHP	Mapped:			

BIO-CONDITION PARAMETERS			DATE: 23.12.15 SITE: BYERWEN EFM_01								A-24
GROUNDCOVER: (ten 1 x 1m plots)									(	SP47	1
Ground Cover type	1	2	3	4	65	6	7	8	9	10	Mean
Native grass		18	75	62	48						40.G
Native herbs & forbs		2		- Ch		-					0.8
Native shrubs (<1m in height)					2						0.0
Non-native grass	64	74		28	36						404
Non-native herbs & shrubs											10.1
Aquatic Vegetation (floating)											
Aquatic Vegetation (submerged)											
Aquatic Vegetation (emergent)					1						22
Non-aquatic sedges			-								
Ferns								1			
Litter	3		21	* 01	14	*					96
Rock				10		1			-		1.0
Bare ground	24 #						1.12				48
(Other) Timber	9	6	4								28
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
LARGE TREES: (Eucalypts >30cm DBH and No	n-eucalypts >	20cm)		Plot siz	e:	100	x50m	100>	:20m	50x	10m
Species			of DBH si	ize classe	s (cm)			-			
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Eucalypts:	Average DB	l H (above thre	shold)=		cm	-					
Non-eucalypts:	Average DB	H (above thre	shold)=		cm	-			-	1	
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Page 3 of 3

## **APPENDIX C: CURRICULA VITAE OF SUITABLY QUALIFIED EXPERTS**

Please refer to pdf file supplied separately.





# **CURRICULUM VITAE**

## **MEREDITH WATHERSTON**

Principal Ecologist

## Education

Bachelor of Science (Australian Environmental Studies), Griffith University (1996)

## **Professional Affiliations**

Environment Institute of Australia and New Zealand: Member Ecological Society of Australia: Member

## **Professional Development**

Certified Environmental Practitioner Regional Ecosystem Framework Training BioCondition Training

## **Skills and Expertise**

Meredith is a Principal Ecologist with more than 13 years' experience in the consulting industry. She has experience in assessing ecological impacts of a range of mining, gas and infrastructure projects throughout Queensland. Meredith's primary skills and experience are in botanical surveys, vegetation survey and mapping, ecological impact assessment, permits and approvals and offset identification. She has developed a strong knowledge of relevant State and Commonwealth legislation and understands the challenges navigating an approval pathway can present.

Meredith has been responsible for the project management and environmental assessment of small and large mining and infrastructure project and has performed the task of ecology technical lead for numerous environmental impact assessments.

As a manager of multidisciplinary environmental assessment teams, Meredith has gained understanding of and experience with a suite of environmental aspects of environmental impact assessment, including surface and groundwater assessment, noise and air assessment, aquatic ecology, community consultation and visual amenity. As such Meredith is able to offer an integrated approach when assessing ecological impacts and management.

Meredith has a field ecology background, whereby she has employed and is familiar with a range of flora and fauna survey techniques, industry best practice and animal welfare and ethical standards.

#### **Professional History**

2013 – present:	Principal Ecologist, Ecological Survey & Management
2003 - 2003	Environmental Officer, Commonwealth Department of
	Defence (Secondment), Parsons Brinckerhoff Pty Ltd,
	Queensland
2001 - 2013:	Ecologist/Senior Ecologist, Parsons Brinckerhoff Pty Ltd, Queensland
2000 - 2001:	Graduate Ecologist, Jaeger Environmental Pty Ltd

## Coal Seam Gas

 Future Gas Supply Area Project (withdrawn), Central Queensland, Santos Limited. Technical ecology lead for the preparation of the terrestrial ecological impact assessment for the environmental impact statement (EIS). Prepared IAS and coordinated and reviewed development of terrestrial ecology technical reports and chapters ready for public comment before the project was withdrawn under the *Environmental Protection Act 1994* and incorporated into the new Santos GLNG Gas Field Development Project.

## Mining Projects

- Terrestrial Flora and Fauna Assessment, Isaac Plains East. Prepared the ecological assessment report for an expansion of the existing Isaac Plains Mine near Moranbah. The assessment identified threatened species occurring within the study area and assessed potential impacts to these species against Queensland and Commonwealth assessment guidelines.
- Woolgar Gold Project Baseline Terrestrial Vegetation Report, Gulf Plains, north Queensland, Strategic Minerals Corporation Pty Ltd. Prepared the baseline vegetation assessment report and assessment of potential habitat for flora and fauna.
- Terrestrial Flora and Fauna Assessment, G200s Grosvenor Mine. Contributed to and reviewed the terrestrial flora and fauna assessment of an additional series of longwall panels at the existing Grosvenor Mine near Moranbah. The project involved assessment of field findings against Queensland and Commonwealth assessment guidelines, including the assessment of potential offset liability.
- Cannington Open Pit Project Preliminary Biodiversity Offsets Assessment, western Queensland, South 32. Prepared the desktop assessment of potential state and Commonwealth offset liabilities in Cannington Mine lease areas.
- Zamia Creek Offsets Management Area Baseline Monitoring, Central Queensland, Cockatoo Coal. Assisted in the baseline monitoring survey and prepared the baseline monitoring report for the offset management area.
- Byerwen Mine Offsets Assessment, Central Queensland, QCoal. Assessed impact and offset areas against Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy and calculator and Queensland Government Biodiversity Offsets Policy (QBOP) to develop an offset area that achieved efficiencies between both policies, minimising offsets required under the QBOP.
- Drake Mine Offsets Assessment, Central Queensland, QCoal. Assessed impact and offset areas against Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy and calculator and Queensland Government Biodiversity Offsets Policy (QBOP) to delineate an offset area that met both policies and achieved a manageable outcome for QCoal.
- Baralaba Mine Species Management Plans, Central Queensland, Cockatoo Coal. Prepared fauna management plans for approval by Queensland and Commonwealth Governments.
- Hail Creek Mine Transition Project Terrestrial Ecology Assessment, Central Queensland, Resource Strategies for Rio Tinto Coal Australia. Prepared technical impact assessment report, including habitat mapping, EPBC Act significance assessments and calculation of offset liability. Project included assessment of underground and surface impacts, from subsidence, tension cracking and vegetation clearing.



- Oaky Creek Fairhill Project Terrestrial Ecology Assessment, Central Queensland, Hansen Bailey for Glencore. Prepared the ecological assessment report, habitat mapping and significance assessment for the proposed trial pit for the project. A number of matters of NES were relevant to the project, including Brigalow and Dichanthium species.
- T9 West Terrestrial Ecology Baseline Assessment, Tiaro, South-east Queensland, Paragon Coal Limited. Assisted with the field flora and fauna season survey programs. Prepared the seasonal baseline assessment report as part of feasibility assessment of the proposed site.
- Moranbah South Project Matters of National Environmental Significance (NES) Report, Moranbah, Central Queensland, Hansen Bailey. Contributed to the Matters of NES report for the Environmental Impact Statement for the project. *Dichanthium queenslandicum*, *D. setosum* and the Koala were species requiring particular assessment for the project.
- Ornamental Snake Management Procedure, central Queensland, AngloAmerica. Prepared the Standard Task Instruction including risk mitigation and management activities required to reduce potential impacts to the Ornamental Snake during exploration activities.
- Hail Creek Mine Highwall Dump EPBC Act due diligence assessment, Central Queensland, Rio Tinto Coal Australia Pty Ltd. Undertook an assessment of the potential EPBC Act constraints to developing a highway dump at Hail Creek Mine.
- Hail Creek Mine Species Management Plan (SMP), Central Queensland, Rio Tinto Coal Australia Pty Ltd. Prepared the SMP for the current and future operations of the Hail Creek Mine that was approved by the Department of Environment and Heritage Protection. It covered native species protected under the Nature Conservation Act that may be impacted as part of any potential mine activities.
- Bluff Terrestrial Flora and Fauna Impact Assessment, Bluff, Central Queensland, McCollum Environmental Management Services. Assessed with the dry season flora survey and prepared the impact assessment report for the project that involved a number of matters of state and national environmental significance. Impact assessment included significance assessments under the EPBC Act and mitigation measures to minimise significance of residual impacts to the Koala.
- Middlemount Coal Project, Middlemount, Central Queensland, Midddlemount Coal. Prepared Commonwealth referral of the project.
- Rolleston accommodation village, Rolleston, Central Queensland, Xstrata. Reviewed ecological assessment to support development application.
- Wandoan Coal Mine construction camp and accommodation village, Wandoan, Central Queensland, Xstrata. Desktop ecological assessment to support development applications.
- Callide Mine Targeted Surveys, Central Queensland, Anglo Coal (Callide Management). Project manager and conducted targeted flora and fauna surveys concentrating on Commonwealth-listed species at Callide Mine in Callide Range. Study outcomes aided in determining management focus for Callide Management and in compliance with Commonwealth referral conditions.
- Kunioon Project, South-east Queensland, Tarong Energy Corporation. Was a key team member in preparation of technical flora reports to be included as part of environmental impact statement. Extensive field work and a rigorous review process were undertaken. State and Commonwealth flora species were assessed in relation to potential impacts of project.



- Callide Fire Management Plan, Biloela, Central Queensland, Anglo Coal (Callide Management). Project managed the preparation of a fire management plan for the mine, including field work and specialist input.
- Biodiversity Action Plan (BAP), Dawson Mine, Central Queensland, Anglo Coal (Dawson Management). Project manager and provided technical input and project management for preparation of strategy document for Dawson Management to enable them to understand the mine's biodiversity values, and to identify biodiversity issues that if not managed present an environmental or social risk and therefore a financial or reputational risk. As with Callide Mine BAP, biodiversity management units (BMUs) were identified that provide areas of focus for future management.
- Callide Mine Plans (2006), Biloela, Central Queensland, Anglo Coal (Callide Management) Pty. Ltd. Project manager and prepared three plans to manage Commonwealth matters within the Mt Murchison Nature Refuge. The Bluff SEVT area and to study the Commonwealth listed Quassia bidwillii within Callide Mine. Plans were prepared as part of Commonwealth referral conditions of The Bluff mining lease and were sent to the Department of Environment and Water Resources for review and approval.
- Biodiversity Action Plan (BAP), Callide Mine, Biloela, Central Queensland, Anglo Coal (Callide Mine). Identified biodiversity values of mine, established practical biodiversity management units (BMUs), determined biodiversity issues in these units and assessed risk of not managing issues. Developed action plans and specific strategies for each BMU that had high-risk issues.
- Tannum Sands Vegetation Clearing Development Application, Tannum Sands, Central Queensland, Boral Resources (Qld.) Pty. Ltd. Project manager and prepared relevant IDAS application and vegetation clearing code assessment. Submitted to Department of Natural Resources and Mines (NRM) and maintained ongoing communications with NRM and the client to achieve satisfactory agency and client outcomes.
- Redbank Asphalt Plant MCU Development Application, South-east Queensland, Boral Resources (Qld) Pty Ltd. Undertook vegetation assessment of site as part of due diligence process to identify potential state or Commonwealth protected matters as part of the development application package.
- Callide Mine Trap Gully Flora and Fauna Survey, Biloela, Central Queensland, Anglo Coal (Callide Mine). Project manager and undertook flora survey of two mining lease application areas as part of proposed mine expansion. Identified flora species occurring within the areas, validated remnant vegetation mapping, identified communities of Commonwealth significance, and assessed impacts of proposed mine expansion. Referral of project to Department of Environment and Heritage was also prepared as part of study.
- Glen Wilga Flora Survey, Chinchilla, Central Queensland, Tarong Energy Corporation. Completed flora survey of proposed coal mine site over early and late summer. Identified flora species occurring at site, validated and remapped remnant and other native vegetation communities to identify matters of Commonwealth significance, and searched for rare and threatened flora species.
- Callide Mine Semi-evergreen Vine Thicket (SEVT) Referral 'The Bluff', Callide Mine, Biloela, Central Queensland, Anglo Coal. Undertook detailed flora survey of SEVT at new mining lease at Callide Mine for preliminary information request as part of referral of project to Department of Environment and Heritage. Rare and threatened species were identified in this detailed technical study.
- Tannum Sands Vegetation Validation Study, Tannum Sands, Central Queensland, Boral. Project manager and identified and mapped regional



ecosystems within proposed disturbance areas in order to validate current regional ecosystem mapping and recommend suitability of site for map modification applications and future vegetation clearing approvals.

- Dawson Mine Central Vegetation Survey and Mapping, Moura, Central Queensland, Anglo Coal. Undertook vegetation survey and mapping to identify and map regional ecosystems with regard to future mining activities.
- West Rolleston Background Environmental Work, Rolleston, Central Queensland, Macarthur Coal. Undertook flora surveys and vegetation validation and mapping across 2,400 ha in conjunction with Queensland Herbarium to standard suitable for future map modification application if required. Assisted in summer fauna survey.
- Curragh Mine East Dump Site Review of Commonwealth Environmental Matters, Blackwater, Central Queensland, Curragh Queensland Mining. Undertook vegetation validation assessment and made recommendations with regard to mapping.
- Strategic Hydrological Study of Cape Cleveland Fine Sand Resource, Thuringowa Shire, North Queensland, Environmental Protection Agency. Identified impacts on flora and fauna of Bowling Green Bay National Park and Ramsar wetland resulting from potential hydrological changes caused by sand mining of adjacent dunal systems.
- Twin Hills Gold Project Initial Advice Statement, Central Queensland, Base Metals of Australia NL. Prepared preliminary impact assessment for proposed gold mine. Assessment involved aerial photograph interpretation, database and literature review, and identification of potential impacts of mine on existing environment.
- Property Vegetation Management Plan for Burton Coppabella Mine Pipeline, Coppabella, Central Queensland, Australian Premium Coals. Prepared permit application package for vegetation clearing along pipeline corridor, including property vegetation management plans (PVMPs). PVMPs assessed existing vegetation communities and provided recommendations for sensitive management of vegetation clearing.
- Environmental Management Overview Strategy for Monto Coal Project, Mulgildie, Central Queensland, Monto Coal. Undertook flora and fauna assessment, including Anabat recording and frog identification. Reported on existing environment, assessed potential impacts and provided recommendations to minimise impacts of proposed project.
- Ecological Assessment of Kilburne North-east Boundary Hill and Dunn Creek

   Hut Corridor, Callide Mine, Central Queensland, Callide Coal. Undertook flora and fauna surveys of 4,000-ha mining lease to determine main ecological values of site, potential impacts to these values and possibilities for management of preservation of these values. Survey included Elliot trapping, spotlighting, Anabat recording, harp trapping, direct searching and pitfall trapping.
- Lake Lindsay Flora and Fauna Survey Report, Middlemount, Central Queensland, Anglo Coal. Survey involved all standard survey techniques, including Elliot traps, pitfall traps, cage traps, harp traps, spotlighting, call playback and Anabat recording. Site's dominant ecological feature was wetland that provided habitat for federally listed migratory bird species. Referral to Department of Environment and Heritage was undertaken.



## **Transport Infrastructure Projects**

- Redcliffe Aerodrome Marine Plant Assessment, South-east Queensland, Wood & Grieve Engineers. Undertook marine plant mapping and a fish habitat assessment of a proposed taxiway extension at the Redcliffe Aerodrome.
- Baralaba Haul Route project, Central Queensland, Cockatoo Coal Pty Ltd. Performed Project Management and technical roles for Queensland and Commonwealth ecological permits and approvals for the project, including Referral, Clearing Permits, Species Management Plans.
- Baralaba Train Load Out Facility, Moura, Central Queensland, Cockatoo Coal Pty Ltd. Prepared Commonwealth and State management plans and approval applications for the project. Management required measures to minimise the significance of impacts to the EPBC Act listed Vulnerable Ornamental Snake and NC Act listed Endangered Solanum species.
- Eton Range Realignment Project Fauna Assessment, Mackay, Central Queensland, Department of Transport and Main Roads. Prepared the Fauna Assessment Report that considered impacts of a proposed realignment of the Peak Downs Highway crossing of Eton Range. The assessment found Koalas to be a key constraint for the project.
- Cloncurry Load Out Facility, Cloncurry, North Queensland, Minerals and Metals Group (MMG). Provided review and management of the technical components of the terrestrial and aquatic ecology, noise and air assessments for the proposed site. Managed the preparation of the Environmental Management Plan for the project to support an environmental authority amendment application.
- Springfield Road Rehabilitation, Springfield, South-east Queensland, Department of Transport and Main Roads. Undertook an ecological risk assessment of landslip rehabilitation works impacting state and Commonwealth listed plants and animals.
- Miva Road Vegetation and Habitat Assessment, Gympie, South-east Queensland, Department of Transport and Main Roads. Undertook field assessment and provided technical review of existing environment, impacts and mitigation reporting of proposed road widening works.
- Pialba-Burrum Heads Roads/Maryborough-Hervey Bay Road Intersection Upgrade Vegetation Assessment, Hervey Bay, South-east Queensland, Department of Transport and Main Roads. Undertook field assessment and provided technical of existing environment, impacts and mitigation reporting of proposed intersection upgrade.
- Northern Interchange Connections, Sunshine Coast, South-east Queensland, Department of Transport and Main Roads. Assessed significance of impacts on Commonwealth listed plants and animals and prepared referral documentation under the Environment Protection and Biodiversity Conservation Act.
- Multi-modal Transport Project, Sunshine Coast, South-east Queensland, Department of Transport and Main Roads. Prepared Species Management Plan (SMP) to support applications under the Nature Conservation Act.
- Multi-modal Transport Project, Sunshine Coast, South-east Queensland, Department of Main Roads. Managed ecological impact assessment of Stage 2 of the project, including technical review of specialist reports.
- Dixon Road to Stringybark Road Link Options Assessment, Buderim, Sunshine Coast, South-east Queensland, Maroochy Shire Council. Undertook a vegetation and flora survey of the study area to identify all flora constraints and develop possible road link options that ranged from high to low ecological



impacts. Assessed and compared each of the options to identify a preferred alignment with regard to flora and fauna values. Attended public display of the project to get community and stakeholder feedback about the project and assessment process.

- Kirkwood Road Concept Design Information Review Report, Tweed, New South Wales, Tweed Shire Council. Undertook ecological constraints study of two proposed road alignment options. Attended community information gathering workshop.
- Banora Point Bypass, Banora Point, New South Wales, Roads and Traffic Authority. Undertook vegetation assessment of road proposed project area and downstream wetland areas to determine potential direct and indirect impacts of road project. Developed design and construction management strategies to avoid ecologically significant areas.
- Tugun Bypass Project, Tugun, South-east Queensland, Department of Main Roads. Reviewed ecological values of Department of Main Roads compensatory habitat packages in New South Wales.
- Gold Coast Light Rail Feasibility Study, Gold Coast, South-east Queensland, Queensland Transport and Gold Coast City Council. Undertook ecological, air and noise feasibility assessment of proposed project. Project traversed recreational, natural, commercial and residential areas.
- Tugun Bypass Stage 1 and 2 Referral, Tugun, South-east Queensland, Department of Main Roads. Prepared referral for Stages 1 and 2 (NSW) of proposed Tugun Bypass to Environment Australia owing to location of proposal on Commonwealth land and presence of number of federally listed threatened species that might be affected by proposal.
- Boyne Valley Infrastructure Relocation Study, Gladstone, Central Queensland, Gladstone Area Water Board. Undertook botanical survey of proposed rail and road corridors for relocation of existing road and railway line for expansion of the Awoonga Dam. Assisted in fauna survey using standard techniques such as spotlighting, active searching, call playback and Anabat recording.
- Tugun Bypass Species Impact Statements and Environmental Impact Statements, Tugun, South-east Queensland, Department of Main Roads. Undertook vegetation and habitat assessment for proposed Boyd Street interchange review of environmental factors. Contributed to review and updating of vegetation assessments and ecological data for these documents, in accordance with Threatened Species Conservation Act. Prepared plans for federally listed species potentially impacted by proposed project.
- Ecological Assessment for Bonville Project Consistency Report, Pacific Highway, Coffs Harbour, New South Wales, New South Wales Roads and Traffic Authority. Conducted vegetation identification along proposed upgrading length of Pacific Highway to determine whether route refinement was consistent with previous approval and conditions.
- Environmental Audit, Springfield Road Project, Springfield, South-east Queensland, Ipswich City Council. Undertook one of five audits of road projects. Audit report addressed consistency of on-ground landscaping works and revegetation using landscaping plans.

#### **Power Projects**

• SunSouth 132 kV Power Project Initial Assessment Report, Sunshine Coast, South-east Queensland, ENERGEX Limited. Reviewed and compiled the terrestrial ecology chapter of the report, including assessment of significance of impacts to Commonwealth matters of national environmental significance.



- Darling Downs Power Station 2 Project, Braemar, Central Queensland, Origin Energy. Managed the ecological components of the development assessment and prepared the referral for the project under the Commonwealth Environment Protection and Biodiversity Conservation Act. Collaborated with EcoFund to identify suitable offset site under the Queensland Vegetation Management Act.
- Columboola to Wandoan South 275kV Transmission Line and Wandoan South Substation Project, Columboola, Central Queensland, Powerlink Queensland. Managed the ecological components of this environmental impact statement, including specialist sub-consultants and assessment of significance of impacts to Threatened species and communities.
- Braemar to Kumbarilla Park 275kV Transmission Line Project, Braemar, Central Queensland, Powerlink Queensland. Managed the ecological components of this project including specialist sub-consultants. Reviewed technical reports and prepared relevant chapters of the environmental impact statement. Provided advice to the client on the implications of referral of the project under Commonwealth legislation.
- Woolooga to Eerwah Vale Transmission Line and Eerwah Vale Substation Project, South-east Queensland, Powerlink Queensland. Project-managed the route selection, community consultation and environmental impact assessment process for new transmission line and substation for northern Sunshine Coast region. This was a highly controversial project that required innovative technical, community consultation, and engagement and management methods.
- Nebo to Pioneer Valley Environmental Work Plans (EWPs), Central Queensland, Powerlink Queensland. Project manager and prepared broad EWPs for the proposed transmission line and assessed potential for sodic soils to be a construction issue for the project.
- Middle Ridge to Greenbank Environmental Work Plans (EWPs), South-east Queensland, Powerlink Queensland. Prepared a series of EWPs for the construction of the transmission line that involved identifying sensitive areas and mitigation measures to protect those areas, sediment and erosion controls for access track and pad construction, lay-down areas and weed management.
- Mowbray Transmission Line Project Options Analysis, Launceston, Tasmania, Transend Networks. Identified a number of potential above- and below-ground transmission line route options and substation sites. Assessed the social and ecological constraints of each route option and substation site by identifying potential impacts to specifically developed criteria. Project included considering many unquantifiable aspects as well as a sensitivity analysis of the assessment methodology.
- Spring Gully to Braemar Transmission Line Project, Central Queensland, Powerlink Queensland. Was technical lead and reviewer for flora surveys undertaken as part of environmental impact statement (EIS). Undertook targeted surveys of Commonwealth matters throughout project area, including assessment and mapping of brigalow communities and of listed 'vulnerable' shrub Philotheca sporadica.
- Middle Ridge to Greenbank Targeted Studies, South-east Queensland, Powerlink Queensland. Project managed the flora and fauna teams undertaking targeted studies of key sensitive habitats along a proposed transmission line. Project involved assessing impacts of the project on state and Commonwealth threatened species and obtaining endorsement of the project by the Commonwealth government.



- Aldoga Supplementary Studies, Calvale to Aldoga, Gladstone, Central Queensland, Powerlink Queensland. Project manager and prepared ecological and planning information (supplementary to the Environmental Impact Statement) to meet the Minister's information requests for the designation of the transmission project as community infrastructure.
- Aramara Vegetation Assessment, Aramara, Maryborough, South-east Queensland, Ergon Energy. Undertook vegetation and fauna habitat study for possible switching station site and easement widening at Aramara. Purpose of study was to validate regional ecosystem mapping and assess habitat in order to identify statutory requirements and constraints of proposed project.
- Gas-fired Power Station Environment Impact Statement, Townsville, North Queensland, Enertrade. Conducted review of significant environmental areas with regard to power project. Managing downstream impacts to important Ramsar wetlands, proposed fish habitat areas and Great Barrier Reef Marine Park were identified as important risks to project.
- Middle Ridge to Greenbank Transmission Project Environmental Impact Study (EIS) and Environmental Management Plan (EMP), South-east Queensland, Powerlink Queensland. Undertook flora and vegetation component of EIS and EMP. Assisted in referral of project to Department of Environment and Heritage as result of potential impact to Commonwealth-listed species and vegetation community.
- Korenan to Agnes Water Preliminary Route Alignment Report and Review of Environmental Factors, Agnes Water, Central Queensland, Ergon Energy. Conducted preliminary vegetation, habitat, landscape and social assessments to determine preferred powerline route between two substations. Undertook flora and fauna assessment of proposed alignment and prepared property vegetation management plans to support vegetation-clearing permits. Investigated methods by which to manage high biodiversity values of project area, including threatened species, habitat and wetlands.
- Wulkuraka 110-kV Transmission Line Environmental Impact Statement (EIS) and Environmental Management Plan (EMP), Ipswich, South-east Queensland, Energex. Undertook vegetation/flora assessment component of project.
- Nebo Transmission Line Environmental Impact Statement (EIS) and Environmental Management Plan (EMP), Central Queensland, Powerlink Queensland. Undertook flora and fauna components of EIS through desktop and field investigations. Conducted targeted studies of rare and threatened flora and fauna species to ensure minimal impact to these species and their habitat, particularly semi-evergreen vine thicket.
- Assessment Report, Crows Nest Wind Farm, Crows Nest, South-east Queensland, Wind Development Australia. Involved in assessment of more than 90 proposed turbine locations on ridgelines around Crows Nest on Great Dividing Range. Undertook preliminary flora, fauna and visual assessments as part of assessment report. Potential constraints on placement of individual turbines in order to minimise potential impacts to ecological and visual environments were identified. Project's primary ecological issue was potential for migrating birds, bats and flying foxes to be struck by operating turbines, given area's significance for such fauna and number of turbines proposed.
- Bundamba 110-kV Substation Establishment Draft Environmental Impact Statement and Environmental Management Plan, Ipswich, South-east Queensland, Powerlink Queensland. Undertook flora and fauna assessment and reporting of proposed substation and interconnector line site. Site was very disturbed. Main impacts largely related to management of pest animals and plants during construction.


- Review of Environmental Factors Australia TradeCoast, Hemmant, Southeast Queensland, Port of Brisbane Corporation. Conducted field investigation and reporting for primary environmental factors in relation to site developmental constraints. Large areas of site supported marine mangrove and wetland areas on Brisbane River that were considered significant for downstream Ramsar wetland and Moreton Bay Marine Park.
- Darling Downs Reinforcement Corridor Selection Report Millmerran Power Station to Middle Ridge Substation 330-kV Transmission Line, Millmerran, South-east Queensland, Powerlink Queensland. Analysed and prepared corridor selection report, including assessment methodology for key selection criteria. Identified potential social and environmental impacts associated with transmission line.
- TradeCoast to Belmont 275-kV Transmission Line, Murarrie, South-east Queensland, Powerlink Queensland. Undertook flora, fauna, noise and air assessments for proposed transmission line. Low-lying marine areas formed considerable sections of project area.
- Construction Environmental Management Plans for Blackwall to Greenbank 275-kV Transmission Line, Blackwall, South-east Queensland, Powerlink Queensland. Developed construction environmental management plans (CEMPs) for environmentally sensitive areas along transmission alignment, including White Rock Conservation Park, for use by construction staff.
- Property Vegetation Management Plans for Greenbank to Belmont 275-kV Transmission Project, Greenbank, South-east Queensland, Powerlink Queensland. Prepared property vegetation management plans and undertook property investigations for additional work requirements to obtain necessary permits and approvals for Greenbank project.
- Review of Environmental Factors and Management Plan for Additional 33/11 kV Overhead Powerline along Mundoolun Connection Road, Beaudesert, Southeast Queensland, Energex Queensland. Conducted environmental review of impacts associated with constructing proposed line.
- Review of Environmental Factors and Management Plan for Tanah Merah Substation, South-east Queensland, Energex Queensland. Undertook environmental review of social and environmental impacts associated with constructing and operating substation along Pacific Highway at Tanah Merah.
- Review of Environmental Factors and Management Plan for Archerfield Substation, Brisbane, South-east Queensland, Energex Queensland. Conducted environmental review of proposed works associated with installation of additional transformer circuit breaker at existing Archerfield substation.
- Vegetation Assessment for Awoonga Powerline Project, Gladstone, Central Queensland, Awoonga Dam Alliance. Conducted vegetation assessment of proposed corridor.
- Vegetation Management Plan for Aldoga Transmission Project, Calvale to Aldoga, Gladstone, Central Queensland, Powerlink Queensland. Prepared vegetation management plan (VMP) as part of application to clear vegetation along proposed easement. Plan estimated total vegetation clearing, delineated areas to be retained, and outlined clearing methodologies at specific locations.
- Environmental Impact Assessment and Environmental Management Plan for Blackwall to Greenbank 275-kV Transmission Line Project, Ipswich and Beaudesert Shires, South-east Queensland, Powerlink Queensland. Helped prepare and develop environmental impact assessments and environmental management plans. Compiled and developed responses to public comments and issues for inclusion in final assessment and plan.



- Environmental Impact Assessment and Environmental Management Plan for TradeCoast Substation and Transmission Line Projects, Murarrie to Young's Road, Wynnum Road and Newstead Terrace, Brisbane, South-east Queensland, Powerlink Queensland. Undertook field assessment for substation site and each proposed transmission line alignment. Report included assessment of potential impacts on flora and fauna resulting from proposed projects. Recommended mitigation strategies to minimise identified impacts and manage weeds and feral animals along proposed alignments.
- Environmental Impact Assessment and Environmental Management Plan for Aldoga Transmission Project (Calvale to Aldoga), Gladstone, Central Queensland, Powerlink Queensland. Conducted flora and fauna assessment of approximately 73 km of proposed transmission alignment through Calliope Range. Conducted field identification of flora, fauna, communities and regional ecosystems, reported on potential impacts to environment from proposed project, and made recommendations for managing biological environment during construction, operation and maintenance of proposed transmission lines. Management of threatened vine thicket and state forest was of particular concern.

## Water Infrastructure Projects

- Kawana Sewage Treatment Plant (STP), Sunshine Coast, South-east Queensland, Parsons Brinckerhoff. Prepared ecological assessment report for the proposed expansion of the Kawana STP. Marine plants formed the primary constraints for the project.
- Water for Bowen Project, Central Queensland, SunWater. Participated in flora surveys of main irrigation channel as part of environmental impact statement (EIS). Survey design and consultation with Environmental Protection Agency were key components of technical studies.
- Karumba Seawall Remedial Works Project, Karumba Norman River, North Queensland, Queensland Transport. Assessed proposed impacts to vegetation and habitat, particularly marine plants as result of remediation works.
- Preliminary Vegetation Assessment, Proposed Stapylton Wastewater Treatment Plant, Stapylton, South-east Queensland, Gold Coast Water. Undertook preliminary vegetation assessment of locally uncommon vegetation assemblage at the site.
- Ecological Assessment, Proposed Pimpama Wastewater Treatment Plant, Pimpama, South-east Queensland, Gold Coast Water. Conducted vegetation assessment of proposed site, with specific attention to potential impacts to significant Casuarina glauca open forest and mangrove shrubland resulting from proposed development of freshwater wetland.
- Review of Environmental Factors for Proposed Agnes Water Desalination Plant, Agnes Water and Town of 1770, Central Queensland, Miriam Vale Shire Council. Undertook physical, environmental and human assessments for proposed project. Report assessed most suitable location for desalination plant with least impact on local environmental features including Round Hill Creek, dunal systems, potential acid sulfate soils and tourist locations.
- Moodlu Quarry Raw Water Storage Planning Report, Caboolture Shire, South-east Queensland, Caboolture Shire Council. Assessed ecological impacts of construction of pipeline from Wararba Creek to proposed water storage facility, and aquatic and downstream impacts of water extraction from creek.
- Moorvale Pipeline Property Vegetation Management Plan, Ingsdon, Central Queensland, Australian Premium Coals. Undertook field vegetation assessment



(vegetation identification and assessment of land degradation) for proposed pipeline corridor. Assessment contributed to final route selection.

- Flora and Fauna Survey of Yarraman State Forest, Proposed Tarong Ash Dam Raising, Tarong, South-east Queensland, Tarong Energy Corporation. Undertook 5-day/4-night survey as per Environmental Protection Agency ecological assessment guidelines. Survey involved Elliot, cage and pitfall trapping, spotlighting, call playback, Anabat recording and direct searching for fauna and potential fauna habitat on site. Flora component of survey was undertaken with specialist sub-consultant. Main findings of survey included large intact areas of state-listed semi-evergreen vine thicket (SEVT) and federally listed black-breasted button-quail (*Turnix melanogaster*). Subsequent detailed habitat assessment of black-breasted button-quail was undertaken to determine extent of potential impact to this species.
- Ecological Assessment, Proposed Tarong Ash Dam Engineering Works, Tarong, South-east Queensland, Tarong Energy Corporation. Assessed four main impact areas associated with spillway widening at Tarong ash dam. Mapped vegetation and identified fauna and fauna habitat. Undertook call playback, spotlighting and Anabat recordings. Project was assessed to have only minor impacts on native vegetation and habitat since site was already disturbed.
- Review of Environmental Factors for Toolooa Water Pipeline Project, Gladstone, Central Queensland, Gladstone Area Water Board. Investigated flora and fauna impacts, sediment and erosion potential, and noise and air quality impacts (particularly during construction phase of underground pipeline).
- Myall Creek Conservation and Management Plan, Dalby, South-east Queensland, Dalby Town Council. Helped develop plan, which comprised strategies to manage flora, fauna, water quality, tourism, recreation, and erosion and sediment issues.

#### Department of Defence

- Shoalwater Bay Training Area (SWBTA) Environmental Plan, Central Queensland, Department of Defence. Worked closely with range of environmental and land use managers of SWBTA, including managers, environmental officers, Defence force personnel, infrastructure planning officers and maintenance personnel, to develop standard operating procedures as part of plan.
- Amphibious Training Area Study Shoalwater Bay Training Area, Shoalwater Bay, Central Queensland, Department of Defence. Undertook field assessment and reporting to determine feasibility of number of proposed amphibious access tracks from beach to hardstand area. Investigations involved determining impacts on vegetation communities, dunal systems, hydrological regimes and habitat.
- Shoalwater Bay Training Area Environmental Officer Secondment, Shoalwater Bay, Central Queensland, Department of Defence. Undertook 4-week secondment as Environmental Officer for Singapore Armed Forces (SAF) Exercise Wallaby 2003 training activities. Was placed full-time at remote training area to manage SAF Environmental Monitoring Group. Specific tasks included broadscale electronic and on-ground communications with range control, permanent environmental officer, Australian Defence Force liaison officers, training officers, commanders and troops. Supervised training activities to ensure minimal disturbance to marine plants and terrestrial vegetation communities, and ongoing awareness training of such issues as abandoned campfires, track erosion and sensitive areas.



- Environmental Assessment of Aviation Gunnery Range at Wide Bay Training Area, Tin Can Bay, South-east Queensland, Department of Defence. Conducted flora and fauna survey of proposed range. Used Environmental Protection Agency trapping techniques and guidelines, including Elliot trapping, Anabat recording, call playback, harp trapping and early morning and evening bird surveys. Observed several threatened flora communities during transect flora surveys of each vegetation community. Site is located upstream of significant 'Fish Habitat Area' and Ramsar Wetland.
- Environmental Assessment of Proposed Direct Fire Support Weapons Range at Wide Bay Training Area, Tin Can Bay, South-east Queensland, Department of Defence. Undertook flora and fauna survey to determine presence of rare and threatened species, and potential impacts of proposed range on flora and fauna in training area. Survey included bird, mammal and reptile trapping and identification, call playback, Anabat recordings, and harp traps. Subsequent reporting included strategies to minimise and mitigate potential impacts.
- Pooh Corner Flora and Fauna Assessment, Army Driver Training Area, Wacol, South-east Queensland, Department of Defence. Undertook flora and fauna surveys throughout site to determine vegetation communities, species of conservation significance, potential impacts of future development and management recommendations to minimise potential impacts. Assessment was undertaken to determine site's future land-use options.
- Portsea Defence Land Master Planning Project, Portsea, Victoria, Department of Defence. Assisted with fauna survey of site. Survey involved identification of all terrestrial fauna occurring or likely to occur on site. Various surveying techniques were employed, including cage and Elliot trapping, spotlighting and bird identification transects.
- Evans Head Air Weapons Range Flora and Fauna Assessment of Boundary Delineation Project, Evans Head, New South Wales, Department of Defence. Assessed impacts of construction of boundary fence on ecological values of Evans Head Air Weapons Range in northern New South Wales. Fence alignment traversed SEPP 14 wetlands and habitat for number of rare and threatened species listed under Threatened Species Conservation Act 1995 (NSW) and National Parks and Wildlife Act 1974 (NSW). Eight-part tests were undertaken to assess potential impacts of project on each threatened species in accordance with Environmental Planning and Assessment Act 1979 (NSW).
- Wide Bay Training Area Threatened Plant Survey, Tin Can Bay, South-east Queensland, Department of Defence. Undertook background review, field surveys and reporting on distribution of three threatened plants: Macrozamia pauli-guilielmi, Melaleuca cheelii and Blandfordia grandiflora in Wide Bay Training Area. Survey included assessment of implications for future training activities.
- Halifax Bay Defence Practice Area: Sea Turtle and Migratory Bird Survey, Townsville, North Queensland, Spotless Facilities Management. Participated in turtle and bird surveys of two islands in Halifax Bay, with representative of Department of Defence, Earthworks Environmental and Indo-Pacific Sea Turtle Conservation Group. Survey involved diurnal and nocturnal beach surveys over 2 days during turtle laying period, and included measuring body pits and tracks for baseline data.
- Ecological Assessment for Defence Land Disposal at Willawong, Brisbane, South-east Queensland, Department of Defence. Conducted flora and fauna survey. Included assessment of existing ecological environment in terms of condition, level of disturbance, weed infestation, and floristic and faunal composition. Recommendations regarding future development of site included



ideal subdivision characteristics and development of site-based weed eradication program.

 Environmental Assessment for Defence Land Disposal, Wacol Army Barracks, Brisbane, South-east Queensland, Department of Defence. Conducted flora and fauna survey using Brisbane City Council Ecological Assessment Guidelines. Fauna identification included mammals, amphibians, birds and reptiles. Floral identification of riparian vegetation and highly disturbed, dry, open eucalypt forest was required.

### **Property Development Projects**

- Ecological Impact Audit of foliage harvesting in State Lands, South-east Queensland, Cedar Hill Flowers and Foliage. Undertook site inspections and prepared an audit of foliage harvesting operations in native vegetation within five areas of state land.
- Ecological Assessments of Breeder Farm Expansions, Namoi Catchment Management Area, New South Wales, PSA Consulting. Prepared the Ecological Assessment for three breeder farm expansion projects as part of development applications. The assessments addressed the *Environment Protection and Biodiversity Conservation Act 1999, Native Vegetation Act 2003*, SEP Policy No. 44 and the local environmental plans. One of the expansion projects involved preparation of a Koala Plan of Management.
- Knauf Bundaberg Plasterboard Plant Wader Bird Review, Bundaberg, Parsons Brinckerhoff. Conducted a desktop review of the potential for wader birds to be impacted by development in a new industrial precinct.
- Ecological Assessment, Proposed Subdivision Development, Brisbane, Southeast Queensland, Norris Clarke & O'Brien. Conducted vegetation assessment of proposed subdivision site at 44 Rogers Parade, Everton Park. Identified how site contributed to locally significant habitat corridors in north Brisbane region. Site's key features were large eucalypts, recommended for retention where possible as part of subdivision design in accordance with Brisbane City Council local laws.
- Comprehensive Planning Framework for Tweed Area 'E', Tweed Heads, New South Wales, Tweed Shire Council. Carried out field flora and vegetation assessment as part of local environmental studies for local environmental plan. Marine and freshwater wetlands formed significant ecological values of study area. Strategies to protect these were required.
- Ephraim Island Environmental Assessment, Ephraim Island, Gold Coast, Southeast Queensland, Mirvac. Environmental assessment included identification of flora and fauna species, vegetation communities and corresponding regional ecosystems. Report included recommendations for development design and construction to protect mangrove communities.
- Ecological Assessment, Proposed Subdivision Development, 65 Benhiam Street, Brisbane, South-east Queensland, Norris, Clarke & O'Brien. Conducted field assessment, including diurnal searching and spotlighting, to identify flora and fauna species, major vegetation communities and fauna habitat that would be impacted by future development of site. Prepared ecological report detailing field observations.
- Vegetation Management Plan, Torbay Road, Brisbane, South-east Queensland, Norris Clarke & O'Brien. Developed management plan to help site contractors to identify areas to be disturbed as part of site subdivision, and those areas to remain vegetated and undisturbed. Mitigation measures included clearing methodologies, vegetation protection techniques, and erosion and sedimentation prevention procedures.



- Environmental Management Plan for Earthworks, Shingley Road and Altmann Avenue, Airlie Beach, Central Queensland, MH Palmer Consulting Engineers. Prepared environmental plan for excavation and transport of fill material to be used on adjacent site. Investigated expected environmental impacts and mitigation during excavation activities.
- Ecological Assessment of Whisper Bay Site, Shingley Drive and Altmann Avenue, Airlie Beach, Central Queensland, MH Palmer Consulting Engineers. Conducted flora and fauna assessment of site, including early-morning bird observations, reptile direct searching and walkthrough observations, as well as flora identification. Report included relocation recommendations for a large community of agile wallaby observed on site.
- Flora and Fauna Survey for Proposed Sewage Treatment Pipeline, Syd Lingard Drive, Buderim, South-east Queensland, John Wilson & Partners. Conducted fauna survey using Environmental Protection Agency guidelines. Assisted with flora survey of, and developed report on, wet sclerophyll closed forest.
- Flora Survey of Kings Christian Church Site, Buderim, South-east Queensland, Enembo Consulting. Assisted with on-site flora identification, and prepared report and mapping of vegetation communities.
- Flora Survey, Menary Road, Buderim, South-east Queensland, Downes Survey Group. Assisted with on-site flora identification of several significant flora species, including *Macadamia integrifolia*, *Choricarpia subargentea* and *Floydia praealta*, and prepared assessment report.
- Conservation Management Plan for Number One Dixon Road, Buderim, Southeast Queensland, Downes Survey Group. Prepared conservation management plan for *Graptophyllum reticulatum* and *Macadamia ternifolia* (listed as endangered and vulnerable respectively under state and federal legislation) for subdivision proposal.
- Vegetation Management Plan for Town of Seaside, Stage 2, Coolum, Southeast Queensland, Rod Tate & Partners. Developed vegetation management plan for vegetation pockets to be retained on proposed subdivision. Plan included native vegetation rehabilitation, and weed control and eradication. Vegetation included stand of endangered Eucalyptus conglomerata.
- Flora Survey of Sunshine Coast Grammar School, Buderim, South-east Queensland, John Marsson & Associates. Identified flora and prepared ecological report.
- Flora and Fauna Survey for Ilkley Road, Eudlo, South-east Queensland, Ken Matheson Surveyors. Assisted with fauna survey using standard trapping practices. Fauna inventory included mammals, birds, reptiles, butterflies, amphibians and crustaceans. Identified rare elf skink (*Eroticoscincus graciloides*) in pitfall traps. Assisted with flora survey and developed ecological report.
- Flora and Fauna Survey for Birdhaven Estate, Coolum, South-east Queensland, Covey & Associates. Assisted with flora and fauna survey and preparation of report.
- Flora and Fauna Survey for Coolum Ridges Estate, Coolum, South-east Queensland, Interplan Consultants. Assisted with flora and fauna survey of approximately 170-ha site. Fauna identification included mammals, amphibians, birds, reptiles, crustaceans, butterflies and bony fish. Assisted in targeted searches for vulnerable ground parrot (*Pezoporus wallicus wallicus*) and threatened flora species including rare *Blandfordia grandiflora* and endangered *Allocasuarina emuina*.



# Curriculum Vitae for Donald William Butler (Don)

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## SUMMARY

I am an innovative problem solver with strong technical skills as well as broad knowledge of plant ecology and conservation management. I have expertise in application and development of legislation and policy, particularly with regard to vegetation management, biodiversity conservation and, more recently, carbon sequestration and land sector greenhouse gas abatement. I have substantial experience applying science and technology to public policy and land management, as well as a significant research record in plant ecology.

My work experience includes ten years as a government scientist based at the Queensland Herbarium, undertaking vegetation survey and mapping, and contributing to the development, communication and application of policies related to vegetation clearing, biodiversity conservation and carbon farming/forestry. My work experience is described in more detail on pages two to four.

My research contributions touch on several key themes in landscape ecology, including plant invasions, fire ecology, conservation planning and plant functional traits. I enjoy a collaborative approach to research. Please see the publications list on pages five to seven for more information.

# CURRENT EMPLOYMENT

## July 2012 to present

# Project Manager (PO5), Queensland Herbarium, Science Delivery, Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

Wind-up project developing on-line information resources for landholders and facilitating opportunities to earn carbon credits from native forest regrowth under Commonwealth's Carbon Farming Initiative (CFI). Salvage value from work completed under previous government. Apply for external funding to continue work on CFI methodology for native forests from managed regrowth.

Key Responsibilities:

- Manage a team of 3 scientists and technical staff to deliver a web-based information system and inform landholders and others about potential economic and biodiversity benefits from carbon accumulation through reforestation, particularly using native regrowth.
- Work with policy makers and others to facilitate inclusion of reforestation by native forest regrowth into carbon markets and other relevant policies and regulation.

# June 2012 to present Sole trading environmental consultant

December 2010 to present

### Honorary Associate Comparative Ecology Group, Department of Biological Sciences, Macquarie University, Sydney.

# ACADEMIC QUALIFICATIONS

# **Doctor of Philosophy**

Department of Botany, University of Queensland, 2004

Thesis title - "Seed dispersal syndromes and the distribution of woody plants in south-east Queensland's vine-forests."

This project addressed the ecology, biogeography and evolution of seed dispersal syndromes as plant functional traits across the woody plants in southern Queensland's vine-forests. Analyses focused on: associations between dispersal syndromes, seed size, life forms and habitats; association between dispersal syndromes and regional abundance within and across habitat types; and, the importance of dispersal to recruitment at local scales. Supervised by Dr. D.Lamb (University of Queensland) and Dr. R.Green (Griffith University).

# **Bachelor of Science with First Class Honours**

Majors in Botany and Zoology, University of Queensland Honours research: 1994, Thesis title - "Vegetation history and environmental inferences from Quaternary sediments at Currimundi, coastal southeast Queensland." Department of Botany, University of Queensland.

# REFEREES

A/Professor Rod Fensham Queensland Herbarium and School of Biological Sciences, University of Queensland Phone: 07 3896 9547 Email: rod.fensham@derm.qld.gov.au

Dr. Gordon Guymer Director, Queensland Herbarium. Phone:3896 9325 Email: <u>Gordon.guymer@derm.qld.gov.au</u>

Alan Key Managing Director, Earthtrade Environmental Brokers. Phone: 0427 053 668 Email: <u>alan.key@earthtrade.com.au</u>

# WORK EXPERIENCE SUMMARY

# December 2010 to June 2012 Project Manager (PO5), Carbon Accumulation Through Ecosystem Recovery, Environment and Resource Sciences, Department of Environment and Resource Management, Queensland Government.

The CATER project (Carbon Accumulation Through Ecosystem Recovery) was a significant initiative to inform the developing carbon market, particularly landholders, to facilitate management of native forest regrowth and other forms of 'carbon farming' with benefits to rural economies and landscape health. The project involved development of a web-based decision support and mapping system to deliver location specific advice about potential carbon sequestration, biodiversity benefits, best practice land management, and regulation relevant to vegetation management and carbon markets.

Key Responsibilities:

- Manage a team of 5 scientists and technical staff to deliver a web-based information system and inform landholders and others about potential economic and biodiversity benefits from carbon accumulation through reforestation, particularly using native regrowth.
- Work with policy makers and others to facilitate inclusion of reforestation by native forest regrowth into carbon markets and other relevant policies and regulation.

# December 2008 – December 2010 - Research Fellow (lecturer level B), Comparative Ecology Group, Department of Biological Sciences, Macquarie University, Sydney.

The comparative ecology group at Macquarie University, led by Professor Mark Westoby, is a strong research group developing and testing theory around plant functional traits. Plant functional traits can be valuable tools to generalise the complexity of ecosystems, and will be an important component of the next generation of dynamic global vegetation models. The research group's current work focuses on wood density as a plant functional trait central to carbon cycling in the biosphere. Our approach directly addressed two major consequences of wood density variation, related to water conductance and mechanical strength. I was responsible for the mechanical 'side' of the research from 2008 to 2010. The team also includes a plant eco-physiologist and an anatomist. I maintain an ongoing relationship with the group as an adjunct.

Key Responsibilities:

- Design and implement a research program to quantify variation in species stem density, and the consequences of this variation for the safety of stems against mechanical failure and damage, and the economics of shoot deployment and growth.
- Establish a network of sites across rainfall and temperature gradients, from north Queensland to Tasmania, and from coast to desert.
- Integrate findings with results of work on hydraulics, anatomy, and other plant functional traits, to develop a well-rounded theory explaining wood density variation and the evolutionary forces that have shaped it.

# August 2008 – November 2008

# Senior Principal Biodiversity Planning Officer (PO5, on secondment), Resource Assessment Unit, Strategy and Policy, Environmental Protection Agency, Queensland Government.

My role in this period was to provide high level advice, contributing to policy development in several areas as listed below. It required liaison and negotiation with stakeholders, researchers and other government officers, and included some very complex issues.

Key Responsibilities:

- Input into and advice about policy for 'biodiversity offsets'
- Design and plan monitoring for impacts of horse-trails in National Parks in south-east Queensland for consideration of the horse trails scientific advisory committee
- Input into Queensland Government Biodiversity Strategy

#### September 2007 – August 2008

# Principal Botanist (PO4, acting), Ecology and Vegetation Management, Queensland Herbarium, Environmental Protection Agency, Queensland Government.

My work in this period involved summarising substantial amounts of data and research into Queensland's biodiversity to contribute to a nation wide biodiversity assessment organised by the National Land and Water Resources Audit. As well as technical work, compiling specimen and mapping data, the role also involved writing plain language case studies about threatened species and communities, and key threatening processes.

Key Responsibilities:

- develop and coordinate the Queensland Government's input into a "Terrestrial Biodiversity Assessment" conducted by the National Land and Water Resources Audit, including:
  - case studies on threatened ecological communities (bluegrass grasslands, brigalow • woodlands and spring wetlands of the Great Artesian Basin), threatening processes (vegetation clearing, grazing, climate change and changed fire regimes), and threatened species (cassowary, red-finned blue-eye)
  - data compilation and analysis of the distribution of threatened flora and fauna using • various specimen and site databases and GIS software, including identification of 'regional extinctions' based on history of sightings and consultation with experts
- provide advice regarding regional ecosystems and vegetation mapping to government officers and the public.
- research and provide advice on Queensland's vegetation and biodiversity, including service as a member of the Nature Refuge assessment panel and the expert panel for NatureAssist.

## August 2002 – September 2007 (except as specified below)

## Senior Botanist (PO3), Ecology and Vegetation Management, Queensland Herbarium, **Environmental Protection Agency, Oueensland Government.**

My main role in this period was to help implement vegetation clearing controls by tending the Regional Ecosystem maps and data that underpinned them. This work involved interaction with landholders and other government officers, as well as service as an expert witness in the Land Court and the Planning and Environment Court. In this time I also prepared recovery plans for two ecological communities listed under the Commonwealth's EPBC Act, which involved developing plain English summaries of ecological knowledge as well as complex negotiation and liaison with stakeholders.

Key Responsibilities:

- provide advice regarding regional ecosystems and vegetation mapping to government • officers and the public.
- assess and process requests to modify certified regional ecosystem coverages. •
- research and provide advice on vegetation management issues. •
- draft recovery plans for brigalow woodlands and bluegrass grasslands listed as endangered ecological communities under Australian legislation (EPBC Act), including research and consultation with stakeholders.

# May 2006 - June 2006

# Principal Botanist (PO4, acting), Ecology and Vegetation Management, Queensland Herbarium, Environmental Protection Agency, Queensland Government.

Key Responsibilities:

- provide advice regarding regional ecosystems and vegetation mapping to government officers and the public.
- assess and process requests to modify certified regional ecosystem coverages. •
- research and provide advice on vegetation management issues. •
- supervise a principle botanist and senior botanist.

# April 2004

# Senior Policy Officer (PO3, acting), Vegetation Management Unit, Department of Natural Resources Mines and Energy, Queensland Government.

This was a brief but exciting secondment to work on amendments to vegetation clearing legislation.

Key Responsibilities:

- contribute to the final formulation of the *Vegetation Management and Other Legislation Amendment Act 2004*, which was passed toward the end of April 2004.
- contribute to the formulation and communication of vegetation management policy, principally concerning the *Vegetation Management Act 1999* and *Integrated Planning Act 1997*.

## September 2001- August 2002

### Botanist (PO2), Seconded to Forest Ecosystem Research and Assessment, Queensland Parks and Wildlife Service, Environmental Protection Agency, Queensland Government.

Key responsibilities:

- as part of a multidisciplinary team, survey flora, fauna and vegetation structure in State Forests throughout Queensland's Brigalow Belt Bioregion.
- collect and identify plant specimens to ensure accuracy in floristic data collection.
- check Queensland Herbarium mapping of Regional Ecosystems and correct any errors identified.

#### November 1998-August 2001

Variously employed as Technical Officer (TO2, 1.25 years total), Botanist (PO2 1.5 years total), and Senior Botanist (PO3, 3 months), Vegetation and Regional Ecosystem Survey and Mapping, Queensland Herbarium, Environmental Protection Agency, Queensland Government.

Key responsibilities:

- utilise aerial photographs, Landsat imagery, field survey, smaller scale mapping, SLATS data and other information to develop and maintain 1:100 000 scale digital coverage of the preclearing and remnant extent of Regional Ecosystems using the Arc View and Arc Info GIS software packages. Working in the Brigalow Belt, New England Tableland, Mulgalands, Einasleigh Uplands and Gulf Plains Bioregions.
- carry-out botanical field survey work including the collection of floristic and structural data for representative stands of Regional Ecosystems recognised in the mapping exercise.

#### 1995-2002

#### Various Tutoring and Lecturing

I have considerable experience as a tutor at the University of Queensland and have also worked as a tutor and lecturer for visiting American students from Hobart William Smith College on trips to the rainforest in Lamington National Park (1996 & 1998).

#### July - September 1997

# Consultant Naturalist, CMPS&F Brisbane

Key Responsibilities: survey flora and avifauna and produce reports and maps of findings for planning processes in various land and infrastructure developments

#### February - November 1995

#### PhD. student, University of Queensland.

"Vegetation History and Palaeo-environments of Ngarrabullgan (Mt Mulligan), north Queensland"

This project considered the palaeobotany/ecology of the area around Ngarrabullgan (southern Cape York) using analysis of fossil pollen. Ngarrabullgan is associated with very old human occupation sites (older than 40 000 years).

Supervised by Dr. M.Dettmann, Dr. D.Bergstrom and Prof. G.Stewart. Key responsibilities:

- several trips to north Queensland for plant and sediment collection (including an Earth Watch Expedition), working closely with the traditional owners of the land.
- analysis of preserved pollen in cored and surface sediments.
- development of a pollen reference collection, involving plant identification and specimen preparation.
- interpretation of pollen record and presentation of results in seminars and as a book chapter (see publications).

#### PUBLICATIONS

# Peer reviewed scientific publications

**Butler D.W.**, Gleason S.M. and Westoby M. (2012) Setbacks to shoot growth are common in woody plants, so how are shoots of some species safer than others? *Ecology*, 93, 1275–1282

Gleason, S.M., Butler D.W., Zieminska K., Waryszak P. & Westoby M. (2012) Stem xylem conductivity is key to plant water balance across Australian angiosperm species. *Functional Ecology*, 26, 343-352.

- **Butler D.W.**, Gleason S.M., Davidson I., Onoda Y. and Westoby M. (2012) Safety and streamlining of woody shoots in wind: an empirical study across 39 species in tropical Australia. *New Phytologist*, 193, 137-149.
- Eyre T.J., **Butler D.W.**, Kelly A.L. and Wang J. (2010) Effects of forest management on structural features important for biodiversity in mixed-age hardwood forests in Australia's subtropics. *Forest Ecology and Management* 259, 534-546.
- Dwyer J.M., Fensham R.J., **Butler D.W.** and Buckley Y.M. (2009) Carbon for conservation: Assessing the potential for win–win investment in an extensive Australian regrowth ecosystem. *Agriculture, Ecosystems and Environment* 134, 1-7.
- Fairfax R., Fensham R., Butler D., Quinn K., Sigley B. and Holman J. (2009) Effects of multiple fires on tree invasion in montane grasslands. *Landscape Ecology* 24, 1363-1373.
- **Butler D.W.** (2009) Planning iterative investment for landscape restoration: Choice of biodiversity indicator makes a difference. *Biological Conservation* 142, 2202-2216.
- **Butler D.W.** and Fensham R.J. (2008) Lose the plot: cost effective survey of the Peak Range, central Queensland. *Cunninghamia* 10(4), 521-538.
- Neldner V.J. and **Butler D.W.** (2008) Is 500m<sup>2</sup> an effective plot size to sample floristic diversity for Queensland's vegetation. *Cunninghamia* 10(4), 513-519.
- Holland A.E. and **Butler D.W.** (2007) *Trioncinia patens* A.E.Holland & D.W.Butler (Asteraceae: Coreopsideae: Chrysanthellinae), a new and endangered species from central Queensland. *Austrobaileya*.7, 567-571.
- **Butler D.W.**, Green R.J., Lamb D., McDonald W.J.F. and Forster P.I. (2007) Biogeography of seed dispersal syndromes, life-forms and seed sizes among woody rain forest plants in Australia's subtropics. *Journal of Biogeography* 34, 1736-1750.
- Butler D.W., Fairfax R.J. and Fensham R.J. (2006) Impacts of tree invasion on floristic composition of subtropical grasslands on the Bunya Mountains, Australia. *Australian Journal of Botany* 54(3), 261–270
- Pollock A.B., **Butler D.W.** and Price R.J. (2004) Floristic communities of the lower Dawson River plains, mid-eastern Queensland. *Cunninghamia* 8(4), 501-513.
- Fensham R.J., Fairfax R.J, Butler D.W. and Bowman D.M.J.S. (2004) Effects of fire and drought in a tropical eucalypt savanna colonised by rain forest. *Journal of Biogeography* 30, 1405-1414.

- Fensham R.J. and **Butler D.W.** (2004) The spatial pattern of dry rainforest colonising unburnt *Eucalyptus* savanna. *Austral Ecology* 29, 121-128.
- **Butler D.W.** and Fairfax R.J. (2003) Buffel grass and fire in a Gidgee and Brigalow woodland: a case study from central Queensland. *Ecological Management and Restoration* 4, 120-125.
- Batianoff G.N. and **Butler D.W.** (2003) Impact assessment and analysis of sixty-six invasive weeds in southeast Queensland. *Plant Protection Quarterly* 18, 11-17.
- Batianoff G.N. and **Butler D.W.** (2002) Assessment of Invasive Naturalised Plants in Southeast Queensland. *Plant Protection Quarterly*. 17, 27-34.
- Smith I.R. and **Butler D.** (2002) The Bunya in Queensland's forests. *Queensland Review* 9, 31-38
- Butler D.W. (1998) Environmental change in the Quaternary. In "Ngarrabullgan: Geographical investigations in Djungan country, Cape York Peninsula." B. David (ed.). Monash Publications in Geography and Environmental Science 51. Monash University, Clayton. pp. 78-92.
- Rogers R., **Butler D.** and Carnell J. (1993) Dispersal of germinable seeds by emus in semiarid Queensland. *The Emu* 94, 132-134.

#### **Selected other reports**

- **Butler D.W.** (2011) Report on potential greenhouse gas emissions from clearing on Lot 1 on Plan MGL13 between 10 August 2006 and 22 February 2008. Unpublished report to the Magistrates Court. Department of Environment and Resource Management, Brisbane.
- Smith, G.C. and **Butler D.** (2009) Bald and beautiful in the Bunyas. *Wildlife Australia*, winter 2009, 20-23.
- **Butler, D.W.** (2008) Draft recovery plan for the "Brigalow (*Acacia harpophylla* dominant and co-dominant)" endangered ecological community. Report to Department of the Environment, Water, Heritage and the Arts, Canberra. Environmental Protection Agency, Brisbane.
- **Butler D.W.** (2007) Report to The Planning and Environment Court of Queensland on the Regional Ecosystems and Landscapes of Lot 1 on Plan SP157697 pertaining to appeal BD845 of 2007. Environmental Protection Agency, Brisbane.
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of management" compiled by B.David for the Kuku Djungan Aboriginal Corporation, Mareeba.

- **Butler D.W.** (1993) Quaternary climates and vegetation of north eastern Australia. Honours Literature Review. Botany Department, University of Queensland.
- **Butler D.W.** (1993) Vegetation history and environmental inferences from Quaternary sediments at Currimundi, coastal southeast Queensland. Honours Thesis. Botany Department, University of Queensland.



Qualifications B. App. Sc. (Horticultural Technology) Certificate IV Government (Compliance and Investigations) Certificate IV Government (Audit and Fraud detection)

Specialisation

Exsitu Plant Conservation Natural Resource Management Ecological assessments Landscape design Environmental legislation and Policy

Years in industry 23

#### Expertise

Natural Resource Management Vegetation Identification and Management, Compliance and Investigations, Revegetation, Ecological Assessments, Field Surveys, Environmental Legislation and Policy, Project Management, Agronomy, Plant Breeding, Landscape Planning and Design, Soils, Community Consultation and Training

# **Grant Paterson**

# Senior Environmental Scientist

Grant is a Department of Environment Accredited Ecologist with extensive expertise in the Design and Implementation of Flora and Fauna Surveys and Ecological Assessments to meet the requirements of the *Environment Protection and Biodiversity Conservation Act 1999.* 

Grant joined Aurecon from the Queensland Department of Natural Resources & Mines (DNRM) and has very extensive experience in vegetation assessment, Natural Resource Management, Agronomy, Vegetation, Soils, Legislation, Policy, Approvals and Appeals. Whilst at DNRM Grant was Senior Vegetation Management Officer and responsible for management of the Vegetation Management Team and approvals under the Queensland Vegetation Management Act 1999 and Integrated Planning Act 1997. Grant also assisted in the development of Field Methodologies for the assessment of regional Ecosystems for Vegetation management Status and Fauna Habitat and Bio condition.

As a Lead Field Ecologist with Aurecon Grant has been responsible for the conduct of field surveys assessments and reporting.

# **Project experience**

February 2008 to Present Aurecon Australia Pty Ltd Mackay QLD Senior Environmental Scientist

**Ecology Assessment and Management** 

- Dysart Road Relocation Project, Flora and Fauna Surveys, PMAV application, Vegetation Management Act 1999 applications, Nature Conservation Act 1994 applications, EPBC assessment and advice Peak Downs Mine, BMA Coal
- Type A species Relocation Management Plan, Central and Southern Queensland, Santos
- Development of Species Management Plans for management and relocation of Protected Plant species, GLNG pipeline, Santos
- Central Arnhem Highway realignment and Goyder River Crossing Flora and Fauna Assessment, NOI and EPBC referrals, Arnhem Land, Department of Communities and Infrastructure
- Roma and Fairview Gas field, Water to Grade Ecological assessments, Roma and Injune, Santos

# Grant Paterson Senior Environmental Scientist

- Nerimbera Quarry vegetation management assessment and threatened species relocation advice, Central Queensland, Readymix
- Lochart River to Old Mission Road upgrade Flora and Fauna assessment for REF and EMP. Cape York, Queensland Department of Main Roads
- 18 Mile Ridge to Lilly Creek Road upgrade Flora and Fauna assessment for REF and EMP. Cape York, Queensland Department of Main Roads
- Jilalan Railyard Expansion Vegetation Management advice and rehabilitation success assessment and monitoring. Queensland Rail

#### Water Management

- Review of various Site Based Stormwater Management Plans for urban developments in Mackay
- Development of various aquatic weed management (Water Hyacinth, Water lettuce, Cabomba, Salvinia, Hymenachne and Para Grass and others) plans and strategies for Local Government and corporate clients
- Assist concept development for water supply & wastewater management, Eungella - Mirani Shire Council
- Development of Water Sensitive Urban Design and Bio-retention Area local species lists - Mackay Regional Council, Mackay

#### Environmental Assessment and Management

- Assist with development approval for expansion of liquid fertiliser facility, CSR
- Development Approvals and Management plans for several quarries and riverine sand extraction entities, various clients
- GLNG Upstream ecological assessments and Regional Ecosystem map amendments for pipeline, wells and irrigation areas, Fairview, Roma and Arcadia Valley CSG Fields, Santos
- Review of the Status, Distribution and Ecology of *Gonocarpus urceolatus*, Methodology development, Field

surveys and Preparation of Technical Report for Reclassification, Santos

- GLNG Upstream Development of Internal Approvals Process for the CSG Fields and Procedures for Conducting Desktop and Field Assessments, Assisting the Development of GIS Data Capture and Reporting Processes, Santos
- Author of "Type A Species Relocation and Management Plan", Santos and GLNG Pipelines
- Dysart Road Relocation Flora and Fauna Surveys and Reporting for NC act, VM act and EPBC compliance, Moranbah, BMA Coal
- Flora, Fauna, Fisheries and Macro Invertebrate Surveys, including Bushfire Ecology assessments. Including NOI and EPBC Goyder River Road and Bridge realignment, NT Government

# Soils and Site Contamination Assessment

- Soil sampling for Mt Bassett WWTP
  Stage 2 site contamination assessment
  Mackay Regional Council
- Graham Heggie Street and Presto Avenue, Site Contamination Assessments - North Queensland Bulk Ports Mackay
- Cremorne Carpark Site Contamination and Acid Sulphate Soil Assessments -Mackay Regional Council
- Blue Diamond Diesel Terminal, Site Contamination Assessments - Port of Mackay

Landscape Planning, Design and Implementation

- LPG Cylinder refilling and bulk gas transfer station, Landscape plan Development, Mackay, Origin Energy
- Diesel Terminal Landscape Plan Development, Blue Diamond Australia, Mackay
- Member of the Mackay Regional Botanic Garden - Master Planning Committee, Horticultural Reference Group and Advisory Panel since 2000

# Grant Paterson Senior Environmental Scientist

#### **Bushfire Hazard Assessment**

- Sugar View Development Bushfire hazard Assessment and representations to Department of Community Safety and Department of Natural Resources on setback distances. Mackay, Sugar View Developments
- Defence site Bush fire hazard assessments At 21 defences Bases and establishments across Northern Australia, Department of defence

Palm Built Development Bushfire hazard Assessment and representations to Department of Community Safety and Department of Natural Resources on setback distances, Mackay, Palm View Developments

February 1996 to February 2008

During this time, Grant has been privately employed as a consultant to a number of developers, mining companies of horticultural producers, and other individuals, providing consultancy services, assessment and advice on:

- Salvage and relocation of mature Brachychiton, Cycads, Ferns, Orchids, Ficus, Pandanus and other Horticulturally desirable or threatened plants
- Environmental Impact Assessment
- Remediation (site stabilization, erosion control, weed control and offsite effect mitigation)
- Revegetation (species lists, techniques maintenance and implementation)
- Ecological and vegetation assessments
- Flora and fauna surveys
- Environmental monitoring
- Project Management and coordination
- Landscape design, construction and maintenance
- Pest and disease control
- Farm Business Management
- Pre purchase property inspections
- Nursery production and propagation techniques
- Crop nutrition and management



# **CURRICULUM VITAE**

# **CHRIS HANSEN**

Director / Principal Botanist

# Education

Bachelor of Biomedical Science, Griffith University (1994) Bachelor of Science (Honours), University of Queensland (1995)

# **Professional Development**

Bio-condition Monitoring training, Queensland Herbarium Regional Ecosystem Training, Queensland Herbarium (certified by the Department of Natural Resources Mines and Water) Vegetation Structure Training, Queensland Herbarium Seed Collection and Propagation Workshop, Greening Australia Compilation of 1500+ plant herbarium from across Queensland and northern NSW

# Skills and Expertise

Chris has worked within the consultancy sector for the past 14 years. During this time he has gained a wealth of experience in the assessment of vegetation types from Gunnedah, NSW to Tully, Queensland, with experience in Gove in the Northern Territory, Balranald in south-western NSW and Tooralee National Park in north-western NSW. Following over five years of service as the senior botanist and associate for a specialist environmental consultancy, Chris established his own specialist botanical consultancy practice in 2008 before formally joining Ecological Survey and Management in 2010.

Chris has conducted detailed botanical assessments on sites which range from  $800 \text{ m}^2$  to more than 100,000 hectares in area. These assessments have been conducted as part of the environmental assessment process relating to the reconfiguration of residential lots through to Environmental Impact Statements for large infrastructure and mining projects.

Chris has regularly been engaged to provide the technical lead role for the on-ground qualitative vegetation assessment of projects such as water pipelines, dams, power transmission corridors, major highway upgrades, coal and metaliferous mining and liquefied natural gas infrastructure. Chris has also conducted numerous bio-condition monitoring and vegetation offset assessments relating to these and other projects. Chris has developed a specialty for the assessment of vegetation to which the *Vegetation Management Act 1999* (Queensland), *Native Vegetation Act 2003* (New South Wales) and *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) applies.

# **Professional History**

2010 – present:	Director & Senior Botanist, Ecological Survey & Management
2008 - 2010:	Principal Consultant, Hansen Botanical Assessments
2007 - 2008:	Associate - Senior Botanist/Ecologist, PLACE Design Group (Environment)
2004 - 2007:	Botanist/Ecologist, PLACE Design Group Pty Ltd (Environment)
2003 - 2004:	Botanical Sub-consultant and Regeneration Contractor, Hansen Vegetation Management
2000 - 2003:	Bushland Regeneration Contractor, Rainforest Repairs

### Experience

The following projects have been categorised into specific resource sectors. It should be noted that most of the projects undertaken in the past six to twelve months are subject to confidentiality agreements and as such are yet to be included. Once the corresponding reports (E.g. EIA, EIS, REFs) are submitted for assessment the CV will be updated.

# Mining Projects (Bowen Basin)

- Terrestrial Flora Ecology Assessment, Belvedere Lease Areas, Moura (HBA for Ecological Survey and Management). Provided lead direction and conducted detailed seasonal (wet and dry season) botanical assessment of three mine lease areas in the Moura district. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted and resulted in the identification of a nationally vegetation community.
- Terrestrial Flora Ecology Assessment, Minyango Lease Areas, Blackwater (HBA for Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an underground mine lease area in the Blackwater district. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.
- Terrestrial Flora Ecology Assessment, Grosvenor Mine, Moranbah (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an additional series of longwall panels at the existing Grosvenor Mine. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted the project involved assessment of field findings against Queensland and Commonwealth assessment guidelines, including the assessment of potential offset liability.
- Terrestrial Flora Ecology Assessment, Isaac Plains East, Moranbah (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of the existing Isaac Plains Mine. The assessment identified threatened species within the study area and assessed potential impacts to these species against Queensland and Commonwealth assessment guidelines.
- Terrestrial Flora Ecology Assessment, Moranbah South Project, Moranbah (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an underground mine lease area in the Moranbah district. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.
- Terrestrial Flora Ecology Assessment, Oaky Creek Fairhill and Tieri Projects, near Tieri (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an underground mine lease area in the Capella district. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.
- Terrestrial Flora Ecology Assessment, Byerwen Mine Offsets Assessment, north of Glenden, (Ecological Survey and Management). Provided lead direction and field assessment of impact areas of Stage 1 of the Byerwen Coal Project and sought out and assessed suitable offset areas.
- Terrestrial Flora Ecology Assessment, Drake Mine Offsets Assessment, Collinsville Provided lead direction and field assessment of impact areas of Stage 1 of the Drake Coal Project and sought out and assessed suitable offset areas.
- Terrestrial Flora Ecology Assessment, Valeria Project, Capella (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an underground mine lease area in the Capella district. Floral inventory,



targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.

- Terrestrial Flora Ecology Assessment, Winchester South Project, Moranbah (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an underground mine lease area. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.
- Natural Grassland Assessment, Eagle Downs Project, Moranbah (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of an underground mine lease area. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.
- Terrestrial Flora Ecology Assessment, Train Load Out (TLO) Facility and Haul Road, Baralaba Coal Mine (Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of a proposed train load out facility near Moura and haul road alignment of approximately 55 km in length. Floral inventory, targeted species searches and mapping of four threatened species, and regional ecosystem and endangered ecological community assessment were conducted.
- Terrestrial Flora Ecology Assessment, Backwater Creek Diversion, East Curragh Mine, (PLACE Design Group for Parsons Brinckerhoff). Provided lead direction in a Terrestrial Flora Ecology Assessment on an existing open cut coal mine in the Bowen Basin for the diversion of Backwater Creek to facilitate mine expansion. Detailed floral inventory and regional ecosystem validation and mapping were conducted. Commonwealth listed ecological endangered communities were encountered and detailed assessment and reporting was conducted to facilitate the preparation of significance assessments under the Commonwealth EPBC Act as part of a Referral to the Commonwealth Department of Environment, Water, Heritage and the Arts.
- Terrestrial Flora Ecology Assessment, Abbot Point State Development Area, Abbot Point, Bowen (HBA for Parsons Brinckerhoff). Provided lead direction and conducted detailed seasonal botanical assessment of a specific study area located within the State Development Area at Abbot Point in the Bowen district. Assessment was geared toward assessing the conservation/ecological significance of extant vegetation communities in order to best locate a proposed infrastructure corridor of approximately 8 km in length. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted and resulted in the identification of a nationally threatened ecological community.
- Terrestrial Flora Ecology Assessment, Coppabella Underground Lease Areas, Coppabella (HBA for Ecological Survey and Management). Provided lead direction and conducted detailed seasonal botanical assessment of underground mine lease areas located immediately north of the operational Coppabella Mine. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted.
- Terrestrial Flora Ecology Assessment, Collinsville Mine Lease Areas, Collinsville (HBA for Biodiversity Australia). Provided lead direction and conducted detailed wet season botanical assessment of several mine lease areas associated with the Collinsville Coal Project, which in combination total greater than 9,000 hectares in area. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted and resulted in the identification of a nationally threatened eucalypt. The survey effort was conducted as part of a prescribed bio-monitoring programme.
- Endangered Ecological Community Assessment, Rolleston Coal Mine, Rolleston (HBA for Booyong Forest Service). Conducted assessments of vegetation communities identified as



potentially aligning with either of three EPBC Act listed EEC within a proposed expansion area of the mine.

- Endangered Ecological Community Assessment and EIS, "Winchester South" Mine Lease Area, Moranbah (Ecological Survey & Management). Conducted field-validation of DERM mapped remnant vegetation for the presence of Endangered REs that would require setbacks prior to the commencement of geotechnical exploration.
- Regional Ecosystem Map Amendment Application, Hail Creek Mine (Ecological Survey and Management). Assessed and compiled detailed regional ecosystem map amendment applications for vegetation within the mine lease of Hail Creek Mine.
- Bio-condition monitoring, Zamia Creek Offsets Management Area Baseline Monitoring, Central Queensland (Ecological Survey and Management). Provided lead direction and conducted the baseline bio-condition monitoring survey for an approved offset management area.
- Bio-condition Monitoring, Curragh East Mine (HBA for PLACE Design Group). Established detailed bio-condition monitoring plots within retained regrowth and remnant Brigalow as part of conditions imposed by DEWHA in relation to the diversion of Blackwater Creek.
- Bio-condition, Rehabilitation and Black Ironbox Monitoring, Hail Creek Mine, north-west of Nebo (Ecological Survey and Management). Conducted detailed bio-condition and Black Ironbox monitoring in the Hail Creek Mine lease area. An additional ten sites were established within under-represented areas. The original twenty-five sites were re-visited. Ten rehabilitation monitoring sites were also established.
- Bio-condition Monitoring, Hail Creek Mine (Ecological Survey and Management). Established and maintain detailed bio-condition monitoring plots within retained remnant vegetation communities as part of environmental approval conditions. Plots first established in 2009.
- Bio-condition Monitoring, Hail Creek Mine, north-west of Nebo (HBA for Sinclair Knight Mertz). Conducted detailed bio-condition monitoring in the Hail Creek Mine lease area. Replicates were conducted in accordance with the proportional distribution of regional ecosystems (vegetation types) throughout the study area. Particular focus was volunteered to the numerous drainage lines and EECs within the study area.
- Rehabilitation Monitoring, Hail Creek Mine (Ecological Survey and Management). Established and maintain detailed rehabilitation monitoring plots on waste rock dumps. Plots first established in 2011.
- Rehabilitation Manual, Hail Creek Mine (Ecological Survey and Management). Developed a detailed and concise rehabilitation manual for rehabilitation of waste rock dumps.
- Exotic Flora Audit, Hail Creek Mine (Ecological Survey And Management). Provided a detail audit of State and local declared pest flora species in non-operational areas of the Hail Creek Mine lease.
- Exotic Flora Audit, Mt. Flora Offset, Nebo (Ecological Survey & Management). Conducted within an external offset area that was established as part of the conditions imposed by DEWHA in relation to the diversion of Blackwater Creek.

# Mining Projects (Surat Basin)

 Terrestrial Flora Ecology Assessment, Wandoan Mine Lease Areas, Wandoan (PLACE Design Group for Parsons Brinckerhoff). Provided lead direction and conducted detailed seasonal botanical assessment of three mine lease areas in the Wandoan district, which in combination total greater than 60,000 hectares in area. A proposed gas pipeline corridor of approximately 28 km in length and proposed construction camp were also investigated. Floral inventory, targeted species searches, and regional ecosystem and





endangered ecological community assessment were conducted and resulted in the identification of a nationally threatened grass.

- Terrestrial Flora Ecology Assessment, Linc Energy Gas Extraction Project, Chinchilla (PLACE Design Group for Sinclair Knight Mertz). Provided detailed botanical assessment of a proposed subsidence area of approximately 80 km2 in area. Detailed floral inventory and regional ecosystem and endangered ecological community assessment were conducted.
- Baseline Bio-condition Monitoring, Spring Gully Gas Fields, north-east of Roma (HBA for Lewis Ecological Services). Conducted detailed bio-condition monitoring in the Spring Gully gas field lease area. Sites were conducted at the location of previous sample sites. Additional sites were added to this survey effort following the removal of pseudoreplication sites. These were chosen in accordance with the proportional distribution of regional ecosystems (vegetation types) throughout the study area. Particular focus was volunteered to the numerous drainage lines and EECs within the study area, as well as vegetation that has been under-represented in previous monitoring efforts. One hundred sites were established.

# Mining Projects (outside Bowen and Surat Basin)

- Offset Management Plan, BHP Cannington Mine (Ecological Survey and Management). Prepared an Offset Management Plan for the proposed offset area for the proposed Tailings Storage Facility #3.
- Ecological Equivalence Assessments, BHP Cannington Mine (Ecological Survey and Management). Undertook baseline terrestrial ecology assessment of the proposed Tailings Storage Facility #3 and proposed offset area at Cannington Mine. This survey determined ecological equivalence scores of the proposed clearing area that impacts remnant vegetation within a stream protection zone and proposed offset area to the north-west of the impact area. This score was used to find and assess the suitability of an appropriate offset for the proposed impacts.
- Bio-condition Monitoring, Rio Tinto-Alcan Aluminium Refinery, Gove (HBA for Booyong Forest Service). Assisted with the annual monitoring and establishment of new bio-condition monitoring sites within remnant vegetation surrounding the refinery and residual disposal area ponds.
- Woolgar Gold Project Baseline Terrestrial Vegetation Report, Gulf Plains, north Queensland, Strategic Minerals Corporation Pty Ltd. Provided lead direction and conducted detailed seasonal botanical assessment of an approved mine lease area. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted
- Terrestrial Flora Ecology Assessment, Trekelano Satellite Operation, Osborne Mine, northwest Queensland (PLACE Design Group for Resource Strategies Australia). Provided detailed floral inventory and regional ecosystem mapping and assessment along two 200m wide corridors, each approximately 6 km long. Differential GPS technology was utilised for the delineation of regional ecosystem boundaries as mapping does not currently exist for this region of Queensland.
- Terrestrial Flora Ecology Assessment, Lucky Luke Satellite Operation, Osborne Mine, north-west Queensland (PLACE Design Group for Resource Strategies Australia). Provided detailed floral inventory and regional ecosystem mapping and assessment of the Lucky Luke Mine Development Lease and 100m wide corridor of approximately 30 km in length. The latter is to facilitate construction of a haul road from the MDL to Osborne Mine. The study area traversed two bioregions. Differential GPS technology was utilised for the delineation of regional ecosystem boundaries as mapping does not currently exist for this region of Queensland.



- Terrestrial Flora Ecology Assessment, T9 West Terrestrial Ecology Baseline Assessment, Tiaro (Ecological Survey & Management). Undertook preliminary and targeted seasonal Terrestrial Flora Ecology Assessments of a site for a proposed open cut coal mine in the Tiaro Shire. Several threatened species were recorded.
- Terrestrial Flora Ecology Assessment, Kunioon Coal Mine, Kingaroy, (PLACE Design Group for Parson Brinckerhoff). Undertook preliminary and targeted seasonal Terrestrial Flora Ecology Assessments of a site for a proposed open cut coal mine in the Kingaroy Shire. Gross variance in the regional ecosystem mapping was encountered and required detailed assessment due to prevalence of endangered vegetation communities. Follow-up surveys have included detailed weed mapping and investigation of road upgrade areas and proposed construction camps.
- Terrestrial Flora Ecology Assessment Proposed, Conveyor, Kingaroy (PLACE Design Group for Parson Brinckerhoff). Undertook preliminary and targeted seasonal Terrestrial Flora Ecology Assessments of a conveyor alignment in the Kingaroy Shire. The supplementary route for the dragline walk was also investigated.
- Targeted Terrestrial Flora Ecology Assessment, Tarong Power Station, Tarong (PLACE Design Group for Parson Brinckerhoff). Conducted targeted searches for threatened flora, a floral inventory and validation of regional ecosystem mapping within a 200 Ha study area proposed for the construction of the Tarong Northern Ash Emplacement Dam. Also assisted with fauna surveys that were conducted simultaneously.

# Water Infrastructure Projects

- Terrestrial Flora Ecology Assessment, Nimmie-Caira Ecological Assessment, near Balranald (Ecological Survey & Management for Biosis). Member of a six person assessment team that undertook an ecological assessment to inform land and water management arrangements for 84,417 hectares of land recently purchased by the NSW Government on the lower Murrumbidgee floodplain between Maude and Balranald in the NSW Riverina.
- Terrestrial Flora Ecology Assessment, Wandoan Mine Water Pipelines, Wandoan (HBA for Parsons Brinckerhoff). Provided lead direction and conducted detailed botanical assessment of two pipeline corridors required to provide water to the proposed Wandoan Mine. An east-west pipeline extended from the MLA west to a reverse osmosis water treatment plant operated by Origin Energy, and traversed primarily cleared Brigalow country. The road reserves, in which the pipeline corridor was positioned, are the primary refuge for regrowth vegetation, particularly Brigalow, which as a community is afforded national significance. The north-south pipeline extended from the MLA south toward Miles and was situated within private land, local council road reserves and along the Leichhardt Highway. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted. Seasonal surveys were conducted along the north-south route and resulted in the identification of a nationally threatened grass, and two state listed sub-shrubs.
- Terrestrial Flora Ecology Assessment, Wetella to Acland Water Pipeline, Toowoomba/Oakey (HBA for Parsons Brinckerhoff). Provided lead direction and detailed botanical assessment of a 45 km long pipeline corridor located primarily in road reserves and extending from the Wetella Water Treatment Plant (Toowoomba) to the Acland Mine. Floral inventory, targeted species searches, and regional ecosystem and endangered ecological community assessment were conducted and resulted in the identification of a nationally threatened grass and thistle (herb).
- Terrestrial Flora Ecology Assessment, Water for Bowen, North Queensland (HBA for Parsons Brinckerhoff). Provided botanical assistance for the Terrestrial Flora Ecology Assessment of a proposed 130 km long irrigation channel between Home Hill and Bowen in north Queensland. Provided regional ecosystem validation through detailed assessment





involving compilation of structural characteristics and condition of all vegetation communities traversed.

- Baseline Terrestrial Terrestrial Flora Ecology Assessment, Hinze Dam Wall Raising, Gold Coast (PLACE Design Group for Sinclair Knight Mertz). Provided detailed Terrestrial Flora Ecology Assessment of the proposed inundation area for the raising of the Hinze Dam in the Gold Coast Hinterland. The survey located a twenty-one regionally significant species within the study area and the habitat that these species were associated with and were likely to utilise throughout the study area. The most note-worthy species included the nationally threatened *Randia moorei* (Spiny Gardenia) and *Owenia cepiodora* (Onion Cedar). Significant populations of these were encountered and resulted in the total known population of spiny gardenia to be increased by at least 500%.
- Targeted Threatened Terrestrial Flora Ecology Assessment, Hinze Dam Wall Raising, Gold Coast (HBA for Sinclair Knight Mertz). HBA was engaged to map, flag and record all specimens of threatened flora within the inundation area and provide in sector reports (including maps). All sectors were surveyed, and individual trees and exclusion zones flagged prior to clearing.
- Terrestrial Flora Ecology Assessment, De-salination Water Pipeline, Gold Coast (PLACE Design Group for Sinclair Knight Mertz). Provided targeted species searches for threatened flora, regional ecosystem validation and mapping, tree mapping and marine plant assessment along a pipeline corridor from the de-salination plant in Tugun (under construction) to Worongary. The mapping provided tunnel-boring options and exact area of remnant regional ecosystems to be impacted, and thus required to be offset.

## **Power Transmission Projects**

- Targeted Species Survey, Weed Audit and Treatment Control Plan, Western Downs to Coolumboola High Voltage Transmission Line and Substations (Ecological Survey and Management). Conducted targeted surveys for threatened flora species and declared pest plants that occur along the proposed alignment. The weed audit was used to produce detailed weed mapping and a corresponding Treatment Control Plan.
- Close-out Weed Audit, Western Downs to Halys High Voltage Transmission Line and Substations (Ecological Survey and Management). Undertook a close-out audit of weed distribution on the constructed powerline.
- Targeted Species Survey and RE Assessment, Surat Stage 1 and 2 (Coolumboola-Wandoan South and Coolumboola to Talinga), High Voltage Transmission Line and Substations (HBA for Parson Brinckerhoff). Conducted threatened species surveys targeting threatened flora species that may occur along the proposed alignment. The survey identified the presence of two state significant flora species and an assessment of the potential impacts of the proposed construction of the line on these species was undertaken.
- Targeted Species Survey, Darling Downs Power Station (DDPS) 2, Braemar (HBA for Parsons Brinckerhoff). Conducted a botanical assessment of populations of *Philotheca sporadica* (Sporadic Waxflower) [Vulnerable] which were to be impacted by Stage 2 of the DDPS. Detailed assessment of the vegetation assemblages throughout the remainder of the site was conducted to supplement pre-existing knowledge of the study area. A further three populations were identified. Input into the Threatened Species Management Plan was also provided.
- Vegetation Offset Analysis, Kogan Creek Power Station (Ecological Survey & Management). Undertook detailed botanical assessment of vegetation assemblages within a designated offset area of non-remnant vegetation within the property holdings of Kogan Creek Power Station. The offset area were assessed for their suitability to adequately offset proposed clearing of remnant Least Concern vegetation.



- Targeted Species Survey, Granite Creek to Agnes, High Voltage Transmission Line and Substation (PLACE Design Group for Parson Brinckerhoff). Conducted a threatened species survey targeting threatened flora species that may occur along the proposed alignment. The survey identified the presence of two nationally significant flora species and an assessment of the potential impacts of the proposed construction of the line on these species was undertaken.
- Terrestrial Flora Ecology Assessment, Blackwater Powerline Alignment, Blackwater (Ecological Survey & Management). Conducted detailed targeted Terrestrial Flora Ecology Assessment of a gazetted and unconstructed power transmission easement. A detailed floral inventory and regional ecosystem mapping were conducted, and resulted in identification of three threatened taxon.
- Vegetation Offset Analysis, 'Rockwood' gas fields, Wieambilla (HBA for Parsons Brinckerhoff). Undertook detailed botanical assessment of vegetation assemblages within and surrounding potential offset areas of regulated regrowth and non-remnant vegetation within the 'Rockwood' property. The offset areas were assessed for their suitability to adequately offset proposed clearing of essential habitat for *Philotheca sporadica* (Sporadic Waxflower) which had been proposed to facilitate the construction of the DDPS2.
- Property Map of Assessable Vegetation (PMAV) Tarong Power Station (Ecological Survey & Management). Developed a PMAV for all remnant and high value regrowth vegetation within the property holdings of Tarong Power Station. Proposed diversion routes for Black Creek were also investigated.
- Moratorium Vegetation Assessment, Tarong Power Station (HBA for Ecological Survey & Management). Prior to the lifting of the moratorium on the clearing on remnant vegetation, HBA was engaged to perform a detailed assessment of mapped moratorium vegetation within the lands held by Tarong Power Station. The intent was to ascertain the proportion and condition of mapped vegetation, which was analogous with an endangered RE.Terrestrial Flora Ecology Assessment, Woolooga to Cooroy High Voltage Transmission Line and Substation (PLACE Design Group for Parson Brinckerhoff). Provided botanical assistance for the Terrestrial Flora Ecology Assessment of a proposed 75 km long power transmission line, through compilation of a detailed inventory of floral species within all vegetative communities traversed. In excess of 700 species were identified and included five threatened flora, three of which are nationally threatened.
- Targeted Terrestrial Flora Ecology Assessment, Ebenezer to Greenbank High Voltage Transmission Line, South East Queensland (PLACE Design Group for Parson Brinckerhoff). Conducted detailed targeted Terrestrial Flora Ecology Assessment of a gazetted and unconstructed power transmission easement. A detailed floral inventory and regional ecosystem mapping were conducted, and resulted in identification of three threatened taxa.
- Targeted Terrestrial Flora Ecology Assessment, Springdale to Blackwall and Lockrose to Abermain High Voltage Transmission Line and Substation, Gatton to Ipswich (HBA for Parsons Brinckerhoff). Conducted detailed botanical assessment of vegetation assemblages located within and/or immediately adjacent to the proposed Blackwall-Springdale 500kV Transmission Line corridor and 110kV Transmission Line that was also partially located within the aforementioned easement. A detailed floral inventory and regional ecosystem mapping were conducted, and resulted in identification of three threatened taxa and two nationally threatened ecological communities.
- Terrestrial Flora Ecology Assessment, Goodna Substation (PLACE Design Group). Provided the botanical assessment of a substation site in Goodna important in securing the ongoing supply of electricity to the south western suburbs of Brisbane. The assessment involved a detailed Terrestrial Flora Ecology Assessment including the mapping of all trees possessing a diameter at breast height over bark (DBH) of 200 mm or greater across the entire study area and validation of regional ecosystem mapping. The assessment confirmed that the site supported an endangered regional ecosystem.





# Transport Infrastructure Projects

- Eton Range Supplementary Terrestrial Flora Ecology Assessments (Ecological Survey and Management). Survey of three proposed options for the upgrade of the Eton Range crossing of the Peak Downs Highway west of Mackay.
- Terrestrial Flora Ecology Assessment, Multi-modal Transport Corridor, Kawana (PLACE Design Group for Parsons Brinckerhoff). Conducted targeted searches for threatened flora, collation of a floral inventory and validation of regional ecosystem mapping along a proposed corridor traversing intact, regionally significant, remnant vegetation.
- Detailed Terrestrial Flora Ecology Assessment, Dickson Road, Sippy Downs (PLACE Design Group for Parsons Brinckerhoff). Conducted targeted searches for threatened flora, a floral inventory and validation of regional ecosystem mapping, which resulted in the identification and mapping of five threatened species, three of which are nationally threatened.
- Terrestrial Flora Ecology Assessment, Tarong Transport Corridor, Tarong Transport Alliance (HBA for Parsons Brinckerhoff). Managed one of two Terrestrial Flora Ecology Assessment teams responsible for seasonal fauna surveys of a 65km long proposed transport alignment from New Acland Mine to the Tarong Power Station. The survey focused on determining the potential for threatened species and endangered ecological communities (EPBC) to occur along the alignment and determining the potential distribution of these species and communities. A number of threatened species and communities were identified and subsequently mapped. Supplementary work involved the assessment of route variations and new corridor study areas.
- Targeted Terrestrial Flora Ecology Assessment, Stage B Bruce Highway Upgrade, Cooroy to Curra (HBA for Parsons Brinckerhoff). Conducted targeted searches for threatened flora, collation of a floral inventory and validation of regional ecosystem mapping along a proposed corridor traversing intact, regionally significant, remnant vegetation, regrowth and pastoral expanse. Two species of conservation significance were identified.
- Targeted Terrestrial Flora Ecology Assessment, Dawson Highway Upgrade, Eaton Range Crossing (HBA for Ecological Survey & Management). Conducted targeted searches for threatened flora, collation of a floral inventory and validation of regional ecosystem mapping along a proposed corridor to provide safe passage over Eaton Range and eliminate the existing series of dangerous hairpin turns.

#### **Natural Resource Management Projects**

 Terrestrial Flora Ecology Assessment, Parkinson Bushland, Brisbane City Council (PLACE Design Group). Facilitated the Terrestrial Flora Ecology Assessment of a 200 hectare bushland site which is an integral component to the Karawatha to Greenbank Corridor. The survey was undertaken over two seasons catalogued the values of the area and identified potential threats such as weed infestations, inappropriate uses, altered fire regimes, validation of regional ecosystem mapping, location of local, regional and state significant flora and detailed mapping of habitat trees. The assessment developed management strategies for these threats to maintain and enhance the biodiversity values of the site. Also assisted with fauna surveys conducted simultaneously.

#### **Property Development Projects**

Chris has conducted numerous Botanical Assessments relating to proposed property developments throughout south East Queensland and northern NSW (PLACE Design Group).



These assessments included assessments of small one into two lot reconfigurations through to assessments across hundreds of hectares. This has required detailed knowledge of the regulatory framework of numerous local government bodies and state concurrence agencies. Some larger and/or noteworthy examples are provided below.

- Regional Ecosystem Remap Applications, Fernvale. Facilitated the preparation of several Regional Ecosystem map modification requests around Fernvale in the Brisbane Valley. All requests were successful in altering the regional ecosystem mapping to accurately reflect the nature of vegetation on the sites.
- Regional Ecosystem Remap Applications, Parkinson. Facilitated the preparation of a Regional Ecosystem map modification request around Parkinson in the south of Brisbane. Endangered vegetation prevented the development of a major arterial road. The request was successful in altering the regional ecosystem mapping to accurately reflect the nature of vegetation on the site.
- Terrestrial Flora Ecology Assessment, Caloundra Coastal Walk, Caloundra City Council. Conducted targeted searches for threatened flora, a floral inventory and validation of regional ecosystem mapping along the entire length of a proposed coastal walkway.
- Botanical Assessment, Thornlands Master Plan, Thornlands. Conducted detailed floral inventory and validation of regional ecosystem mapping across greater than twenty rural properties to facilitate the preparation of PMAV applications, assessment against koala management plans, detailed master plan design and designation of significant fauna corridors and vegetation populations.
- Terrestrial Flora Ecology Assessment, Trinity Drive Master Plan, Lismore. Conducted detailed botanical assessment of an urban release area designated by Lismore City Council. Assessment identified significant populations of a nationally threatened shrub and vine. A Species Impact Statement was prepared and is currently being assessed by the regulatory authorities.
- Terrestrial Flora Ecology Assessment, Shute Harbour Marina, Airlie Beach. Conducted targeted searches for threatened flora, a floral inventory and validation of regional ecosystem mapping on a site of a proposed marina in the Shute Harbour area. The site was immediately adjacent to Conway National Park and supported considerable populations of twelve species of mangrove. Detailed assessment facilitated design reconfiguration. Also assisted with fauna surveys conducted simultaneously.
- Terrestrial Flora Ecology Assessment, Mongogarie Chicken Sheds, near Casino. Conducted targeted searches for threatened flora, a floral inventory, tree mapping and forest ecosystem mapping across a large rural property proposed for establishment of chicken sheds. The site supported an endangered ecological community, two threatened flora and ten threatened fauna. Collaboration with local councils and engagement of state authorities negotiated an acceptable outcome. Also assisted with fauna surveys conducted simultaneously.
- Terrestrial Flora Ecology Assessment, Baida Chicken Sheds, near Tamworth and Gunnedah. Conducted targeted searches for threatened flora, floral inventories tree mapping and forest ecosystem mapping for proposed expansion of existing chicken farms on three rural properties. One of the sites supported an endangered ecological community. Collaboration with local councils and engagement of state authorities negotiated an acceptable outcome. Also assisted with fauna surveys conducted simultaneously.
- Terrestrial Flora Ecology Assessment, Morayfield Aged Care Facility, Morayfield. Undertook a detailed Terrestrial Flora Ecology Assessment on a heavily vegetated site of a proposed aged care facility. The site vegetation, though not mapped by the EPA under the regional ecosystem framework, was afforded conservation status by the Caboolture Shire. Detailed survey confirmed that this status was not warranted and the situation resolved.



• Ecological Assessment, Eumundi Noosa Road, Doonan. Conducted the botanical assessment of the proposed rural residential development of a heavily vegetated site in Noosa Shire, which supported a variety of habitat types and three threatened species. The location of threatened flora species was recorded with a differential GPS and the layout amended to retain individuals. The site had complex Vegetation Management Act issues which were also resolved.

# **Rehabilitation Projects**

- Assisted in the preparation of the rehabilitation plan for the constructed diversion of Blackwater Creek within the Curragh Mine lease near Blackwater in central Queensland.
- Prepared a rehabilitation plan for the degraded terraces of Oxley Creek in the Larapinta area. The site had been subjected to intensive sand-mining activities.
- Prepared a rehabilitation plan that was required as part of the operation works application for a site bordering the Brisbane River. The plan provided detailed strategies to manage weeds and revegetate the degraded bank of the river.
- Prepared a rehabilitation plan for Yandina Caravan Park, which was required to support a development application to expand the existing Yandina Caravan Park. The site was bordered by the Maroochy River and traversed by two of the river's tributaries.
- Prepared numerous rehabilitation plans for property developments located throughout the Richmond Valley Shire (greater Lismore area). These sites were primarily modified landscapes with rehabilitation intent afforded to drainage lines and minor watercourses vegetated with pastoral grasses or weed tree species.

