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# Memorandum

To	<b>Mr Andrew Stannard</b>	From	<b>Aurecon C/o Jane Stark</b>
Copy		Reference	<b>225678</b>
Date	<b>28 September 2012</b>	Pages (including this page)	<b>30</b>
Subject	<b>Roma Ecological Assessment – Addendum Memo Lot 25 and 26 on SP214993</b>		

Mr Stannard,

This memorandum relates to the ground-truthing of the proposed development areas (ie Area A, Area B and Area C) as shown in Figure 1.1 and documents the results of ecological investigations of these areas.

These ecological investigations were undertaken on 3 and 4 September 2012 within Lot 25 and 26 on SP214993 by two (2) Aurecon ecologists (Joseph Callaghan and Sandra Walters).

Reports specific to the additional proposed development areas within Lot 26 on SP214993 and Lot 25 on SP214993 has been previously prepared and submitted to Santos Ltd (Ecological Assessment Report – Lot 26 SP214993; Santos Document Reference 0020-GLNG-4-1.3-0066 and Ecological Assessment Report – Lot 25 SP215993; Santos Document Reference 0020-GLNG-4-1.3-0044).

This memorandum should be considered as an addendum to the report listed above. This memorandum is specific to the ecology of the proposed development areas shown in Figure 1.1. For ecological information related to the proposed development that is in addition to that covered by this report, please refer to the appropriate Lot-specific report. Please note that an addendum memorandum specific to additional proposed development areas within Lot 25 on SP214933 has been recently submitted to Santos (awaiting document reference) covering the major development areas for Lot 25 on SP214993. Only those development areas which intersect both Lot 25 and 26 on SP214933 have been included within this report.

## 1 Ecological Assessment

### 1.1 Area A

#### 1.1.1 General

The proposed development areas are comprised of three (3) investigation sections (referred as Area A1, A2 and A3 in Figure 1.1) within Lot 26 on SP214993. Area A1 is located partially within Lot 25 on SP21499. The landscape of the proposed development areas (ie Area A1, A2 and A3) contains areas that have been previously cleared for agricultural practices (eg stock grazing) in addition to sporadic stands of mature woody vegetation. Area A2 and Area A3 contain an existing cleared access road that traverses the property.

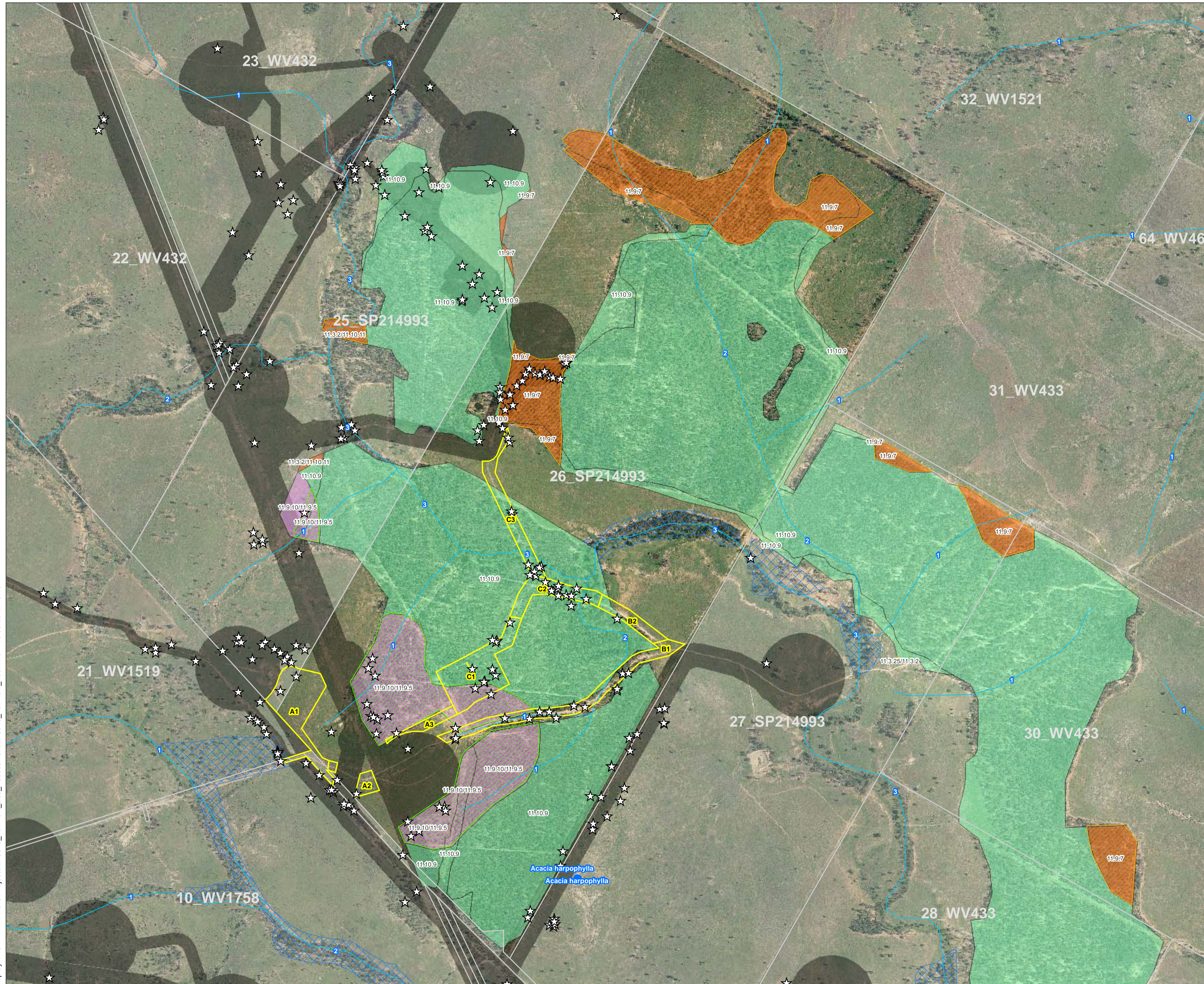
The proposed development areas are mapped as non-remnant and remnant vegetation on the Department of Environment and Heritage Protection's (DEHPs) certified Regional Ecosystem (RE) mapping. Area A1 is located partially within a RE (11.9.10/11.9.5) polygon which has the Biodiversity Status of 'endangered'. Area A2 and Area A3 are mapped entirely as non-remnant vegetation.

There is one (1) Environmentally Sensitive Area (ESA) located within or in close proximity to the proposed development areas:

- A 'Category B' ESA associated with an 'endangered' RE is located within and surrounding Area A3 (Refer Figure 1.1)

There are no DEHP mapped 'watercourses' located within the proposed development areas. There is, however, one (1) 'stream order one' 'watercourse' located approximately 80 m east of the middle portion of Area A1.





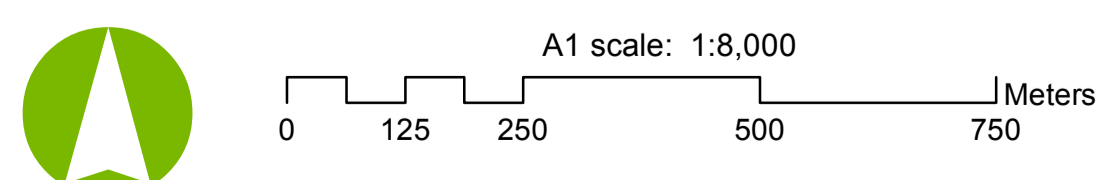
**Legend**

- Areas Assessed
- EVNT and Type A Species
- EVNT Region
- Corridors - Ground Truth
- Watercourse
  
- Amended Regional Ecosystem (Biodiversity Status)**
- Endangered - Dominant
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- Not of Concern
  
- ESA Mapping**
- Category A
- Category B
- Category C
  
- Wetland Regional Ecosystem**
- Riverine

Source:  
 Cadastre: DERM, 2011.  
 Regional Ecosystems: Version 6.1, The State of Queensland (Department of Environment and Resource Management), Sept 2011. As amended by Aurecon, 2011.  
 ESAs: Coordinator-General's Evaluation Report for an Environmental Impact Statement – Gladstone Liquefied Natural Gas GLNG Project (May 2010) and the Santos GLNG Project CSG Fields – Environmental Protocol for Constraints Planning and Field Development (September 2011). Note: No ESA buffers have been included on this figure.  
 Wetlands: Qld Wetland Data Version 3.0

Date: 18/09/2012

Version: 1



Job No: 225678  
 Coordinate system: GDA\_1994\_MGA\_Zone\_55

**Santos Upstream Ecological Assessment**

**Figure 1: Additional Development Areas on Lot 26SP214993**



The landform of the proposed development areas is undulating in Area A1 and A2 to sloping in Area A3. The soil structure is comprised mostly of red/brown silty-clay with some exposed rocky areas within Area A3.

### 1.1.2 Floristics

The vegetation within the non-remnant sections of proposed development areas (has been extensively cleared for agricultural purposes and the construction of access roads (refer Figure 1.2). The vegetation within the proposed development areas is characterised by a relatively dense ground stratum, with a sparse shrub stratum, and very sparse to absent canopy strata.



Figure 1.2 Landscape facing south in Area A1 depicting typical vegetation

The ground stratum within the non-remnant sections of the proposed development areas was co-dominated by *Pennisetum ciliare* (Buffel grass) and *Bothriochloa decipiens* (Pitted blue grass), with *Verbena tenuisecta* (Mayne's curse) occurring as an associated species. The ground stratum also contained a range of other native grasses and forbs and had approximately 80% vegetation cover.

The shrub stratum throughout the non-remnant sections of the proposed development areas was dominated by *Carissa ovata* (Currant bush). The shrub stratum of the RE (11.9.10/11.9.5) polygon within Area A3 was dominated by *Capparis lasiantha* (Nipan). A range of other native shrub species were also recorded throughout the proposed development area including *Geijera parviflora* (Wilga), *Acacia deanei* (Dean's wattle) and *Eremophila mitchellii* (False sandalwood). The shrub stratum with the proposed development areas had a height range between 0.5 and 3 m and had a vegetation cover of approximately 10%.

The sub-canopy stratum of the non-remnant sections within the proposed development areas was very sparse (approximately 5% vegetation cover) and had a height range of 4 to 7 m. Species recorded in this layer included *Acacia excelsa* (Ironwood), *Casuarina cristata* (Belah), *Acacia harpophylla* (Brigalow), *G. parviflora* (Wilga) and *E. mitchellii* (False sandalwood).

The canopy stratum of the non-remnant sections within the proposed development areas was comprised of a single *A. harpophylla* (Brigalow) and a few *C. cristata* (Belah). The sparse canopy stratum covered less than 5% of Area A and had a height range of 8 to 10 m.

The RE polygon that is located partially within Area A3 was dominated by *Eucalyptus populnea* (Poplar box) as the canopy species, with *Eucalyptus melanophloia* (Silver leaved ironbark) as an associated species. The sub-canopy and shrub strata were dominated by *Callitris glaucophylla* (White cypress pine). This is consisted with the description for RE 11.9.10 and RE 11.9.5 (*Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary rocks and *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks) as defined in the Regional Ecosystem Description Database (REDD v6.0b). Regional Ecosystem 11.9.5 is analogous to a Threatened Ecological Community (TEC) and listed as 'endangered' under the provisions of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Although the area mapped as RE (11.9.10/11.9.5) within Area A3 did not contain *A. harpophylla* (Brigalow), this species was observed occurring immediately adjacent to the north and north-east (refer Table 1.1 for full RE descriptions).

Table 1.1 Full description of REs that occur within the proposed development areas

RE	Biodiversity Status	Description
11.9.5	Endangered	Open-forest dominated by <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> (10-20m) or <i>Acacia harpophylla</i> with a semi-evergreen vine thicket understorey. Open-forest dominated by <i>C. cristata</i> is more common in southern parts of the bioregion. A prominent low tree or tall shrub layer dominated by species such as <i>Geijera parviflora</i> and <i>Eremophila mitchellii</i> , and often with semi-evergreen vine thicket species is often present. The latter include <i>Flindersia dissosperma</i> , <i>Brachychiton rupestris</i> , <i>Excoecaria dallachyana</i> , <i>Macropteranthes leichhardtii</i> and <i>Acalypha eremorum</i> in eastern areas, and species such as <i>Carissa ovata</i> , <i>Owenia acidula</i> , <i>Croton insularis</i> , <i>Denhamia oleaster</i> and <i>Notelaea microcarpa</i> in south-western areas. <i>Melaleuca bracteata</i> may be present along watercourses. Occurs on fine-grained sediments. The topography includes gently undulating plains, valley floors and undulating footslopes and rarely on low hills. The soils are generally deep texture-contrast and cracking clays. The cracking clays are usually black or grey to brown or reddish-brown in colour, often self mulching and sometimes with gilgai microrelief in flatter areas. Some texture contrast soils are shallow to only moderately deep
11.9.10	Endangered	<i>Eucalyptus populnea</i> predominates forming a distinct but discontinuous canopy (15-18 m tall). <i>Acacia harpophylla</i> and sometimes <i>Casuarina cristata</i> usually forms a lower tree layer (8-14 m tall) which occasionally becomes the dominant layer. An open to moderately dense layer of tall shrubs is usually present and dominated by <i>Eremophila mitchellii</i> and <i>Geijera parviflora</i> with <i>Acacia excelsa</i> , <i>Atalaya hemiglauca</i> , <i>Psyrdrax oleifolia</i> , <i>Alectryon oleifolius</i> frequent. Scattered low shrubs such as <i>Carissa ovata</i> and <i>Eremophila deserti</i> are frequently present. The ground cover is usually sparse, and dominated by the grasses <i>Aristida ramosa</i> , <i>Enteropogon acicularis</i> , <i>Bothriochloa decipiens</i> and <i>Paspalidium</i> spp. Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments. Occurs on lower parts of undulating plains often with deep texture-contrast soils. Occurs on sodic and saline soils which may act as a discharge area if adjacent to alluvium
11.10.9	No concern at present	<i>Callitris glaucophylla</i> woodland to open-forest often associated with <i>Eucalyptus melanophloia</i> in the tree canopy and a sparse ground layer. Various other tree species may be present including <i>Corymbia clarksoniana</i> , <i>Eucalyptus populnea</i> ,

RE	Biodiversity Status	Description
		<i>C. tessellaris</i> , <i>E. chloroclada</i> and <i>Angophora leiocarpa</i> which may form a mono-specific open-woodland in places. Low tress such as <i>Allocasuarina luehmannii</i> , <i>Alphitonia excelsa</i> , <i>Lysicarpus angustifolius</i> , <i>Geijera parviflora</i> and <i>Acacia</i> spp. sometimes conspicuous in mid low tree to tall shrub layer. The ground layer is often sparse and dominated by grasses such as <i>Aristida echinata</i> , <i>A. jerichoensis</i> , <i>A. caput-medusae</i> , <i>Bothriochloa decipiens</i> , <i>Eriachne mucronata</i> , <i>Enneapogon</i> spp. and sometimes <i>Triodia mitchellii</i> . Occurs on deep uniform sandy and deep texture contrast soils on course grained sediments

Two (2) Type A restricted plant species listed under the provisions of the *Nature Conservation Act 1992* (NC Act) were recorded within proposed development areas (ie *Brachychiton rupestris* (Narrow leaved bottle tree) and *Brachychiton populneus* (Kurrajong)). These individuals and their locations are listed in Table 1.2.

Table 1.2 'Type A restricted plant' species recorded within Area A

Scientific Name	Common Name	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)
<i>Brachychiton populneus</i>	Kurrajong	702535.04	7078644.54
<i>Brachychiton rupestris</i>	Narrow Leaved Bottle Tree	702123.82	7078876.76

No flora species of conservation significance (ie 'endangered', 'vulnerable' and 'near threatened' species under the provisions of the Queensland NC Act or 'critically endangered', 'endangered' and 'vulnerable' species as listed under the provisions of the Commonwealth EPBC Act) were recorded within Area A.

A full list of flora species recorded within the proposed development areas is outlined in Appendix A.

### 1.1.3 Habitat Value

Eighteen bird species were observed within proposed development areas during field investigations. Traces of an additional two mammals were also observed and are listed in Table 1.3. The scats of an unconfirmed mammal species, most likely a Wallaby, were also observed within Area A.

Table 1.3 Fauna species observed within Area A

Scientific Name	Common Name	Notes
<b>Birds</b>		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped thornbill	
<i>Acanthiza reguloides</i>	Buff-rumped thornbill	
<i>Anthus australis</i>	Australian pipit	
<i>Cacatua galerita</i>	Sulphur-crested cockatoo	
<i>Corvus orru</i>	Torresian crow	
<i>Cracticus nigrogularis</i>	Pied butcherbird	
<i>Dacelo novaeguineae</i>	Laughing kookaburra	
<i>Eolophus roseicapilla</i>	Galah	

Scientific Name	Common Name	Notes
<i>Falco cenchroides</i>	Nankeen kestrel	
<i>Gymnorhina tibicen</i>	Australian magpie	
<i>Manorina melanocephala</i>	Noisy miner	
<i>Megalurus timoriensis</i>	Tawny grassbird	
<i>Ocyphaps lophotes</i>	Crested pigeon	
<i>Pardalotus striatus</i>	Striated pardalote	
<i>Philemon corniculatus</i>	Noisy friarbird	
<i>Platycercus adscitus</i>	Pale-headed rosella	
<i>Rhipidura leucophrys</i>	Willie wagtail	
<i>Smicromnis brevirostris</i>	Weebill	
<b>Mammals</b>		
<i>Pteropus scapulatus</i>	Little red flying-fox	Observed skeleton
<i>Macropus</i> sp.	Kangaroo	Observed tracks only

Area A contained the following habitat resources:

- Limited amounts of canopy cover suitable for shelter, foraging and perching
- Limited amounts of dense groundcover vegetation
- Moderate amounts of felled woody debris within Area A3
- Limited amounts of leaf litter in the ground stratum
- Very limited amounts of rocky outcrops within Area A3

There was a limited amount of canopy cover within Area A that could provide habitat opportunities for bird species. There was an active Yellow-rumped thornbill (*Acanthiza chrysorrhoa*) nest containing chicks observed within Area A1 (Easting: 702058.92, Northing: 7078817.93). The limited amounts of dense groundcover could provide habitat opportunities (eg foraging, nesting and shelter sites) for small mammals and reptiles. There were moderate amounts of coarse woody debris which had resulted from felled timber observed within Area A3. This material has the potential to provide feeding and shelter (ie habitat opportunities) for small mammals and reptiles. The potential for fauna to utilise these sites for habitat was diminished as a result of the disturbance from extensive clearing and from subsequent cattle grazing.

No fauna species of conservation significance as listed in the provisions of the NC Act and/or the EPBC Act were recorded within Area A.

The overall habitat value of the proposed development areas is considered low to moderate due to vegetation clearing and fauna species observed.

## 1.2 Area B

### 1.2.1 General

Area B is comprised of two investigation sections (approximately 40 m wide) that follow the extent of an access road that traverses Lot 26 on SP214993 (referred as Area B1 and B2 in Figure 1.1). Clearing for the construction of an access road through the proposed development area has resulted in a section approximately 15 m in width being devoid of woody vegetation. The proposed



development areas are mapped as non-remnant and remnant vegetation (RE 11.10.9 and 11.9.10/11.9.5) (refer Figure 1.1).

There is a 'Category B' ESA associated with an 'endangered' RE 11.9.10/11.9.5 located within the western portion of Area B1.

Two (2) 'watercourses' as mapped on the DEHP hydrology layer occur within, or in close proximity to Area B, including:

- A 'stream order 1' 'watercourse' flowing west to east along the extent of Area B which converges with a separate 'stream order 1' 'watercourse'. There was minor erosion observed along the extent of these 'watercourses'. These 'watercourses' merge into the 'watercourse' below (refer Figure 1.1)
- A 'stream order 2' 'watercourse' flowing south-west to north-east traverses the eastern portion of Area B1 (refer Figure 1.1)

The landform of the west of Area B slopes gently towards the direction of the 'stream order 1' 'watercourses'. The landform is flat along the extent of and to the east of the 'stream order 2' 'watercourse'. The soil structure throughout most of the proposed development areas contains medium grain sandy soils. The soil structure in the western portion of Area B1 (west of the RE 11.9.10/11.9.5 polygon) contains silty-clay soils.

### 1.2.2 Floristics

The vegetation within the proposed development areas has been modified and disturbed by the clearing for the construction of access roads (refer Figure 1.3). As a result a 15 m wide section along the length of Area B is devoid of woody vegetation. In addition, edge effects were observed in the adjacent remnant vegetation.



Figure 1.3 Landscape facing east within Area B1 depicting typical vegetation and the cleared access road

The RE mapping for the proposed development areas indicate that RE 11.9.10/11.9.5 occurring along the northern edge of the western portion of Area B1. The REDD descriptions for these map units are



'*Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary rocks' and '*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks' which both have the Biodiversity Status of 'endangered'. Regional Ecosystem 11.9.5 is defined as a Threatened Ecological Community (TEC) by the Threatened Species Scientific Community (TSSC) 2001 and listed as 'endangered' under the provisions of the EPBC Act. The mapping of this RE within the proposed development areas was determined to be incorrect during site investigations based on species composition and geology structure. The accuracy of the RE mapping of this RE polygon is addressed in Section 4.

The RE mapping the proposed development areas also indicates that RE 11.10.9 is present along the northern edge of Area B1 and the western portion of Area B2. The REDD description for this map unit is '*Callitris glaucophylla* woodland on coarse-grained sedimentary rocks' and has a Biodiversity Status of 'No concern at present'. The RE mapping was confirmed as correct during site investigations (refer Table 1.1 for full RE descriptions).

The canopy stratum of the vegetated areas (ie areas outside the 15 m wide access road) within the proposed development areas had a height range of 13 to 18 m with approximately 40% vegetation cover. The canopy stratum was dominated by *C. glaucophylla* (White cypress pine), with *E. populnea* (Poplar box) and *E. melanophloia* (Silver leaved ironbark) recorded as associated species. Along the extent of the 'stream order 2' 'watercourse' there was also *Eucalyptus chloroclada* (Dirty gum) observed as an associate species.

The sub-canopy stratum of the vegetated areas within Area B had a height range of 6 to 12 m with approximately 20% vegetation cover. The sub-canopy stratum was dominated by *C. glaucophylla* (White cypress pine), with *E. populnea* (Poplar box) and *E. melanophloia* (Silver leaved ironbark) recorded as associated species.

The shrub stratum of the vegetated areas within Area B had a height range of 1 to 5 m with a vegetation cover of approximately 10%. The dominant species in the shrub layer was juvenile *C. glaucophylla* (White cypress pine) with a range of other common native shrub species also recorded including *E. mitchellii* (False sandalwood), *G. parviflora* (Wilga), *Bursaria incana* (Boxthorn) and *Eremophila longifolia* (Creek wilga).

The ground stratum varied in species composition and structure throughout the proposed development area. Within Area B1, west of the 'stream order 2' 'watercourse', the ground stratum was co-dominated by *Bothriochloa bladhii* (Forest blue grass), *P. ciliare* (Buffel grass), *V. tenuisecta* (Mayne's curse), *Cynodon dactylon* (Green couch) and *Chloris truncata* (Windmill grass). The ground cover in this section was approximately 40%. The ground stratum along the extent of the 'stream order 2' 'watercourse' was co-dominated by *Themeda avenacea* (Wild oats grass) and *Urochloa mosambicensis* (Sabi grass). The ground cover in this section was approximately 40%. The ground stratum within the cleared field, in the eastern portion of Area B1, was dominated by *Chloris ventricosa* (Tall chloris) and had a denser vegetation cover (approximately 95%).

Two (2) Type A restricted plant species listed under the provisions of the NC Act were recorded within Area B (ie *Brachychiton rupestris* (Narrow leaved bottle tree) and *Brachychiton populneus* (Kurrajong)). These individuals and their locations are listed in Table 1.4 and depicted in Figure 1.1

Table 1.4 Type A restricted plant species recorded within Area B

Scientific Name	Common Name	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)
<i>Brachychiton populneus</i>	Kurrajong	702979.53	7078706.13



Scientific Name	Common Name	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)
<i>Brachychiton populneus</i>	Kurrajong	703080.39	7078703.65
<i>Brachychiton populneus</i>	Kurrajong	703122.36	7078732.13
<i>Brachychiton populneus</i>	Kurrajong	703161.98	7078732.17
<i>Brachychiton populneus</i>	Kurrajong	703461.68	7078889.33
<i>Brachychiton populneus</i>	Kurrajong	703486.75	7078890.82
<i>Brachychiton rupestris</i>	Narrow leaved bottle tree	703190.41	7078706.45

No flora species of conservation significance as listed in the provisions of the NC Act and/or EPBC were recorded within the proposed development areas.

### 1.2.3 Habitat Value

Twenty-two bird and two reptile species were observed within Area B during the field investigations (refer Table 1.5). The scats of an unconfirmed mammal species, most likely a Wallaby, were also observed within the proposed development areas.

Table 1.5 Fauna species observed within Area B

Scientific Name	Common Name	Notes
<b>Birds</b>		
<i>Cacatua galerita</i>	Sulphur-crested cockatoo	
<i>Corvus coronoides</i>	Australian raven	
<i>Corvus orru</i>	Torresian crow	
<i>Cracticus nigrogularis</i>	Pied butcherbird	
<i>Cracticus torquatus</i>	Grey butcherbird	
<i>Dacelo novaeguineae</i>	Laughing kookaburra	
<i>Eolophus roseicapilla</i>	Galah	
<i>Gymnorhina tibicen</i>	Australian magpie	
<i>Haliastur sphenurus</i>	Whistling kite	
<i>Malurus melanocephalus</i>	Red-backed fairy-wren	
<i>Manorina melanocephala</i>	Noisy miner	
<i>Myiagra rubecula</i>	Leaden flycatcher	
<i>Pachycephala rufiventris</i>	Rufous whistler	
<i>Pardalotus striatus</i>	Striated pardalote	
<i>Philemon citreogularis</i>	Little friarbird	
<i>Philemon corniculatus</i>	Noisy friarbird	
<i>Platycercus adscitus</i>	Pale-headed rosella	
<i>Pomatostomus temporalis</i>	Grey-crowned babbler	
<i>Rhipidura albiscapa</i>	Grey fantail	
<i>Smicromnis brevirostris</i>	Weebill	



Scientific Name	Common Name	Notes
<i>Strepera graculina</i>	Pied currawong	
<i>Struthidea cinerea</i>	Apostle bird	
<b>Reptiles</b>		
<i>Ctenotus robustus</i>	Robust ctenotus	Refer Figure 1.4
<i>Heteronotia binoei</i>	Bynoe's gecko	



Figure 1.4 Robust Ctenotus (*Ctenotus robustus*) observed in coarse woody debris in the east of Area B1

Area B contained the following habitat resources:

- Canopy cover suitable for shelter, foraging and perching
- Fissured tree bark
- Limited amounts of dense groundcover vegetation
- Woody debris (ie felled timber, including hollow-bearing logs and tree bark in groundcover)
- Limited amounts of leaf litter in the groundcover
- Limited watercourse habitat (ie small eroded sand banks)

The canopy cover within Area B may provide suitable habitat (eg feeding, nesting and shelter sites) for birds and arboreal mammals. A large nest of an unidentified bird species (possibly a raptor or Torresian crow) was observed within a mature *E. coolabah* (Coolabah) tree within Area B1 (Easting: 703462.87, Northing: 7078888.87). There was also potential habitat for birds and arboreal mammals provided by numerous stags (ie standing dead trees containing hollows). Within Area B there was a moderate amount of felled timber that contained hollows which may provide shelter and nesting sites for mammal species. The exfoliating and peeling tree bark on standing stags and on felled timber could provide suitable habitat opportunities for a range of reptiles (eg. Golden-tailed gecko [*Strophurus taenicauda*] which prefers sandy soil types that were present throughout Area B).



No fauna species of conservation significance as listed in the provisions of the NC Act and/or EPBC Act were recorded within Area B.

The overall habitat value of Area B is considered to be moderate due the reasons outlined above.

## 1.3 Area C

### 1.3.1 General

Area C is comprised of three (3) investigation areas that follow the extent of a narrow access road through the middle portion of Lot 26 on SP214993 (referred as Area C1, C2 and C3 in Figure 1.1). In addition the extent of the access road, Area C1 also contains a section of 'remnant' vegetation (approximately 190 m by 245 m) that extends to the south. The 'remnant' vegetation within Area C1 is mapped as RE 11.10.9 and 11.9.10/11.9.5 (RE 11.9.5 is analogous with a TEC - refer Section 1.1.2 and Table 1.1 for TEC/RE information), Area C2 is mapped entirely as RE 11.10.9 and the southern half of Area C3 is also mapped as RE 11.10.9. The northern half of Area C3 is mapped as non-remnant vegetation as a result of previous clearing for agricultural purposes. The accuracy of the RE mapping in these areas is addressed in Section 4.

There are two (2) ESAs located within or in close proximity to the proposed development areas:

- A 'Category C' ESA associated with an 'of concern' RE is located approximately 20 m north of Area C3
- A 'Category B' ESA associated an 'endangered' RE is located within and directly adjacent to Area C1

Two (2) 'watercourses' that are mapped on the DEHP hydrology layer occur within Area C:

- A 'stream order 3' 'watercourse' flowing west to east traverses the southern portion of Area C3
- A 'stream order 2' 'watercourse' flowing south to north traverses the eastern portion of Area C2 and converges with the above 'watercourse'

The landform of the proposed development area is flat to gently undulating and the soil structure contains light brown silty-sandy soils.

### 1.3.2 Floristics

The landscape of the proposed development areas was dominated by DEHP mapped remnant vegetation. Historic disturbance to this area, as a result of clearing associated with the construction of the access road and selective timber clearing, was apparent (refer Figure 1.5). Although variations in terms of vegetation structure and species compositions were apparent the dominant species were generally consistent throughout the investigation areas.





**Figure 1.5** Landscape facing north-east within Area C1 depicting typical vegetation and cleared access road

The canopy stratum was co-dominated by *E. melanophloia* (Silver leaved ironbark), *Eucalyptus crebra* (Narrow leaved ironbark) and *C. glaucophylla* (White cypress pine) throughout Area C. The canopy stratum had a height range of 12 to 17 m. The canopy stratum was relatively well developed and had a Foliage Projection Cover (FPC) of approximately 50.5% and a stem count of 240 stems/ha. FPC was calculated using the line-intercept method over a 100 m transect adapted from Eyre *et al*, 2011. Stem count per hectare was extrapolated from five (5) 10 m by 20 m survey quadrats (refer Appendix B).

In the south-western portion of Area C2 and north-eastern portion of Area C1 the canopy stratum contained *Corymbia tessellaris* (Moreton Bay ash) and *Corymbia trachyphloia* (Brown bloodwood) as associate species. In the south-western portion of Area C3 (mapped as RE 11.9.10/11.9.5) there were higher proportions of *E. crebra* (Narrow leaved ironbark) and *E. melanophloia* (Silver leaved ironbark) in the canopy stratum. The canopy stratum was co-dominated by *Angophora floribunda* (Rough-barked apple) in addition to *C. glaucophylla* (White cypress pine) along the extent of the 'watercourses' that traverse Area C (refer Figure 1.6).





**Figure 1.6** Depiction of *A. floribunda* (Rough-bark apple) co-dominated vegetation along the 'watercourse' within Area C

The sub-canopy was co-dominated by *E. melanophloia* (Silver leaved ironbark), *Eucalyptus crebra* (Narrow leaved ironbark) and *C. glaucophylla* (White cypress pine) throughout Area C. The sub-canopy stratum had a height range of 6 to 10 m. The sub-canopy stratum had a relatively well developed which is reflected in a relatively high FPC of approximately 38% and a relatively high stem count of 700 stems/ha.

The shrub stratum was dominated by juvenile *C. glaucophylla* (White cypress pine) with a range of other native shrub species also present in lower proportions including juvenile *C. cristata* (Belah), juvenile *E. populnea* (Poplar box), *Alphitonia excelsa* (Red ash), *B. incana* (Boxthorn) and *A. excelsa* (Ironwood). The shrub stratum had a height range of 1 to 5 m. The shrub stratum had a high stem count of 970 stems/ha (refer Appendix B).

The ground stratum varied in vegetation structure and species composition throughout Area C. The ground stratum in the 'non-remnant' northern portion of Area C3 was dominated by *C. ventricosa* (Tall



chloris) and was relatively dense (approximately 95%). Along the extent of the ‘watercourses’ that traverse Area C the ground stratum was co-dominated by *Austrostipa verticillata* (Slender bamboo grass) and *Heteropogon contortus* (Black spear grass) with *Lomandra longifolia* (Lomandra) and *Lomandra leucocephala* (Lomandra) recorded as associates. The ground stratum within the ‘remnant’ portions of the proposed development areas (outside the ‘watercourse’ areas) contained a range of native and non-native grasses and forbs including; *Aristida caput-medusae* (Curly head wire grass), *Ancistrachne uncinulata* (Giant spear grass), *Glycine tomentosa* (Hairy glycine), *Themeda triandra* (Kangaroo grass), *Goodenia glabra* (Smooth goodenia) and *Cheilanthes aspera* (Mulga fern). The ground stratum within the remnant vegetation was relatively sparse which is reflected in a ground cover of approximately 50% (average cover of native grasses, forbs and herbs). Ground cover was extrapolated from five (5) 1 m by 1 m quadrat plots (refer Appendix B).

Two (2) Type A restricted plant species listed under the provisions of the NC Act were recorded within Area C (ie *Cymbidium canaliculatum* (Black orchid) and *Brachychiton populneus* (Kurrajong)). These individuals and their locations are listed in Table 3.1.

Table 1.6 Type A restricted plant species recorded within Area C

Scientific name	Common name	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)
<i>Brachychiton populneus</i>	Kurrajong	703199.29	7079249.11
<i>Brachychiton populneus</i>	Kurrajong	703100.70	7079306.74
<i>Brachychiton populneus</i>	Kurrajong	703009.81	7079542.56
<i>Brachychiton populneus</i>	Kurrajong	703007.20	7079554.35
<i>Brachychiton populneus</i>	Kurrajong	702947.12	7079024.03
<i>Brachychiton populneus</i>	Kurrajong	702928.69	7079026.20
<i>Brachychiton populneus</i>	Kurrajong	702928.49	7078905.85
<i>Brachychiton populneus</i>	Kurrajong	702894.04	7078854.42
<i>Brachychiton populneus</i>	Kurrajong	702923.40	7078804.53
<i>Brachychiton populneus</i>	Kurrajong	703145.82	7079263.36
<i>Cymbidium canaliculatum</i>	Black orchid	703155.13	7079239.61
<i>Cymbidium canaliculatum</i>	Black orchid	703195.92	7079238.08
<i>Cymbidium canaliculatum</i>	Black orchid	703273.97	7079237.73
<i>Cymbidium canaliculatum</i>	Black orchid	703312.62	7079195.01
<i>Cymbidium canaliculatum</i>	Black orchid	703129.37	7079327.79
<i>Cymbidium canaliculatum</i>	Black orchid	702941.19	7078882.38



No flora species of conservation significance as listed in the provisions of the NC Act and/or the EPBC Act were recorded within Area C.

### 1.3.3 Habitat Value

Nineteen bird, one mammal and one reptile species were observed within Area C during field investigations. Traces of an additional three mammal and one reptile species were also observed and are listed in Table 1.7. The pellet of an unconfirmed bird species, most likely an Owl, was observed within Area C. The scats of an unconfirmed mammal species, most likely a Possum, were observed within Area C. The diggings of an unconfirmed mammal species, likely from an Echidna or a Bandicoot, were recorded within Area C (refer Figure 1.7).

Table 1.7 Fauna species observed within Area C

Scientific name	Common name	Notes
<b>Birds</b>		
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped thornbill	
<i>Aquila audax</i>	Wedge-tailed eagle	Flyover
<i>Cacatua galerita</i>	Sulphur-crested cockatoo	
<i>Corvus coronoides</i>	Australian raven	
<i>Cracticus nigrogularis</i>	Pied butcherbird	
<i>Cracticus torquatus</i>	Grey butcherbird	
<i>Dicaeum hirundinaceum</i>	Mistletoe bird	
<i>Eolophus roseicapilla</i>	Galah	
<i>Gymnorhina tibicen</i>	Australian magpie	
<i>Malurus melanocephalus</i>	Red-backed fairy-wren	
<i>Manorina melanocephala</i>	Noisy miner	
<i>Pardalotus striatus</i>	Striated pardalote	
<i>Platycercus adscitus</i>	Pale-headed rosella	
<i>Pomatostomus temporalis</i>	Grey-crowned babbler	
<i>Smicromnis brevirostris</i>	Weebill	
<i>Strepera graculina</i>	Pied currawong	
<i>Struthidea cinerea</i>	Apostle bird	
<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted lorikeet	
<i>Trichoglossus haematodus</i>	Rainbow lorikeet	
<b>Reptiles</b>		
<i>Carlia vivax</i>	Tussock rainbow-skink	
<i>Varanus</i> sp.	Goanna	Observed tracks only
<b>Mammals</b>		
<i>Macropus rufogriseus</i>	Red-necked wallaby	
<i>Felis catus</i>	Feral cat	Observed tracks only (non-native, LP Act Class 2 Pest)
<i>Macropus</i> sp.	Kangaroo	Observed tracks only



Scientific name	Common name	Notes
<i>Oryctolagus cuniculus</i>	European rabbit	Observed burrow only(non-native, LP Act Class 2 Pest)

Table Notes: LP Act – Land Protection (Pest and Stock Route Management) Act 2002

Area C contained the following habitat recourses:

- Intact canopy cover suitable for shelter, foraging and perching
- Fissured tree bark
- Dense groundcover vegetation (ie grassy tussocks)
- Large amounts of woody debris (ie fallen / felled timber, including hollow-bearing logs)
- Leaf litter in the ground stratum
- Watercourse habitat (ie exposed sand banks)

Throughout Area C there were numerous large, standing hollow-bearing stags that may provide shelter and nesting sites for a range of birds and arboreal mammals. There was also potential habitat for woodland bird species provided by the relatively intact cover provided by the developed canopy and sub-canopy strata. Three nests of unidentified bird species were recorded within Area C and are listed in Table 1.8. The woody debris from felled timber and fissured tree bark could provide foraging and shelter sites for small mammals and reptiles. Numerous diggings in the sandy soil were also observed which indicates that Area C may support a range of mammal species (eg Bandicoots) (refer Figure 1.7). The sandy banks along the extent of the ‘watercourses’ have the potential to provide nesting sites for reptiles and birds (eg Striated pardalote [*Pardalotus striatus*] and Rainbow bee-eater [*Merops ornatus*]). Both ‘watercourses’ were dry at the time of field investigations and no pooled water was observed in proximity to the proposed development areas. It is therefore unlikely that there is habitat within Area C that is able to support amphibian and fish species.

No fauna species of conservation significance as listed in the provisions of the NC Act and/or EPBC Act were recorded within Area C.

The overall habitat value of Area C is considered moderate due to the reasons outline above.

Table 1.8 Bird nests observed within Area C

Nest Description	Tree	Easting (Zone: 55, GDA 94)	Northing (Zone: 55, GDA 94)
Ball shaped. Approximately 20 cm diameter	<i>E. melanophloia</i> (Silver leaved ironbark)	703121.02	7079323.60
Inactive. Approximately 30 cm by 30 cm	<i>C. tessellaris</i> (Moreton Bay ash)	703000.69	7079098.21
Two (2) nests. Approximately 20 cm diameter	<i>C. tessellaris</i> (Moreton Bay ash)	702845.87	7078907.05





**Figure 1.7** One of the various diggings observed within the sandy soil of Area C. The triangular shape of the digging suggests this could be from an Echidna or Bandicoot.

## 1.4 Regional Ecosystem Assessment

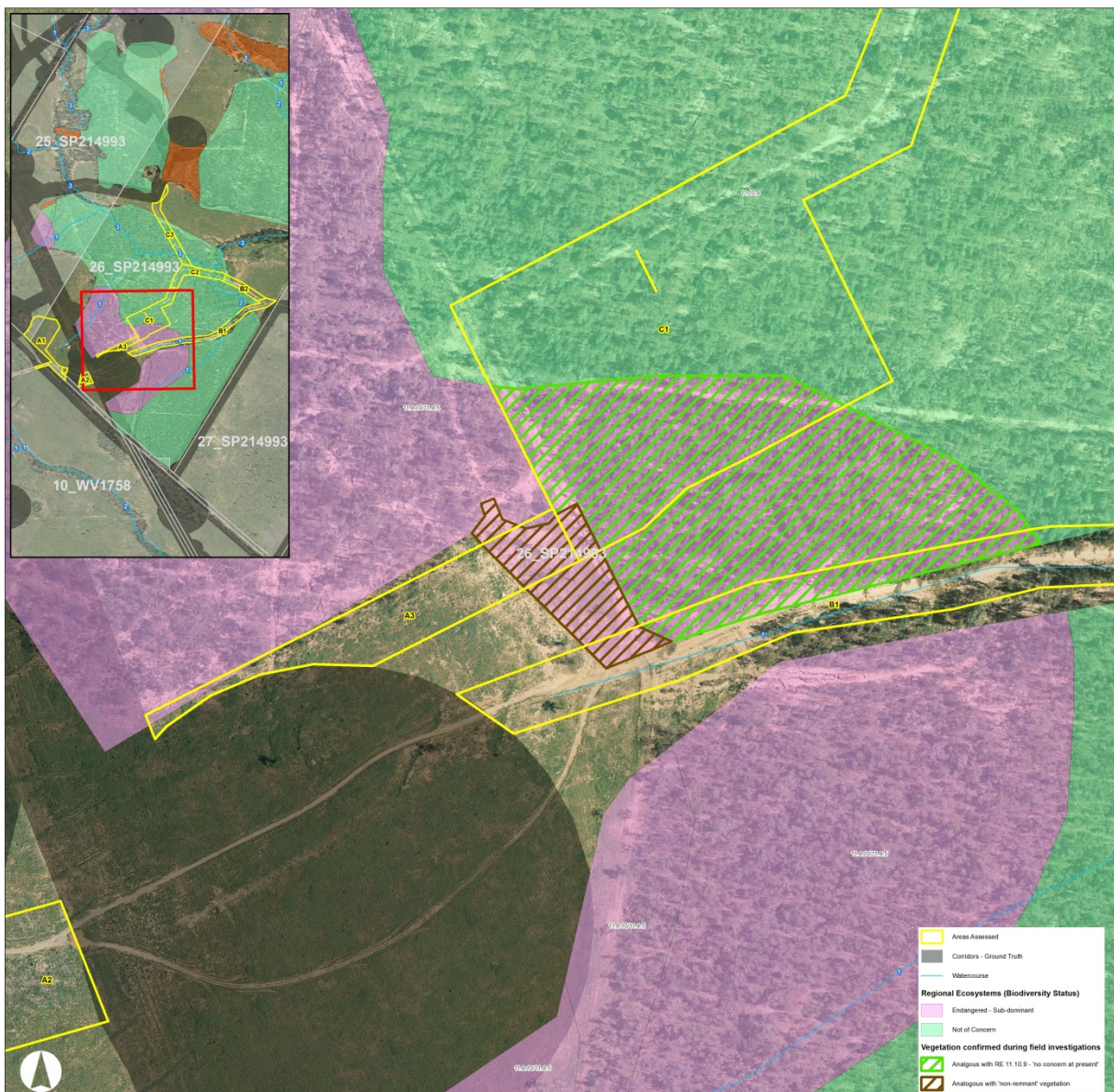
As part of the Environmental Authority (EA) for this project certain Regional Ecosystems (RE) that are analogous to ESAs must be assessed. This section documents ground-truthing results for the 'endangered' RE (analogous to a 'Category B' ESA) located within the proposed development areas.

### 1.4.1 RE 11.9.10/11.9.5 within Area A3, Area B1 and Area C1

The 'endangered' RE 11.9.10/11.9.5 is located within the southern portion of Lot 26 on SP214933 and overlaps with three (3) investigation sections. The RE polygon overlaps the western portion of Area B1 along the northern edge and extends to the north-west into the south-western portion of Area C1. The RE polygon also occurs within the northern edge and eastern portion of Area A3 (refer Figure 1.1). The RE (11.9.10/11.9.5) is described in the REDD as "*Acacia harpophylla*, *Eucalyptus populnea* open forest on fine-grained sedimentary rocks (11.9.10); and *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks (11.9.5)" (refer Table 1.1 for full RE descriptions).



Regional Ecosystem 11.9.5 is defined as a Threatened Ecological Community (TEC) by the Threatened Species Scientific Community (TSSC) 2001 and listed as 'endangered' under the provisions of the EPBC Act. The description of this vegetation community is not analogous with the vegetation of certain portions of the proposed development areas surveyed. The geology structure description is also not analogous with the geology structure of certain portions of the proposed development areas surveyed. The sections where mapping was incorrect and requires amendment is presented in Figure 1.8.



**Figure 1.8** Current Regional Ecosystem (11.9.10/11.9.5) polygon in the south of Lot 26 on SP214993. Recommended map modifications to the heterogeneous 11.9.10/11.9.5 RE polygon are provided

The mapping within the portion of the RE (11.9.10/11.9.5) that occurs along the northern edge of Area A3 was determined to be correct and does not require amendment. The mapping of the RE (11.9.10/11.9.5) polygon that occurs within the cleared portion in the east of and adjacent to Area A3 was incorrect and therefore requires amendment. The mapping of the RE (11.9.10/11.9.5) that occurs



within Area C1 and B1 in addition to the section between the proposed development areas was determined to be incorrect and therefore requires amendment.

The canopy stratum within the RE (11.9.10/11.9.5) overlapping Area C1 and Area B1 was dominated by *C. glaucophylla* (White cypress Pine) with associated *E. melanophloia* (Silver leaved ironbark). There was no *A. harpophylla* (Brigalow) recorded in the canopy or sub-canopy strata within the RE (11.9.10/11.9.5) polygon overlapping Area C1 and B1 (refer Table 1.1 for full RE descriptions). There were approximately five (5) *A. harpophylla* (Brigalow) observed in the canopy stratum along the south-western edge of the RE (11.9.10/11.9.5) between Area C1 and Area B1. The soil structure within the investigation sections contained medium coarse sandy soils.

The species recorded in the area, in addition to the overall vegetation community structure (refer Appendix A) indicated the area is analogous to RE 11.10.9 (*Callitris glaucophylla* woodland on coarse-grained sedimentary rocks) which has the Biodiversity status 'no concern at present'. It is likely that this area is an extension of the adjacent 'remnant' vegetation of the same RE description.

The portion of the RE polygon located with the cleared portion in the east of and adjacent to Area A3 was devoid of vegetation constituting a canopy or sub-canopy stratum (refer Figure 1.9). The vegetation community identified during field investigations in this area is not analogous with 'remnant' vegetation and the RE mapping in this area is incorrect. This area was dominated by exotic pasture species and therefore should be mapped as 'non-remnant' vegetation.





**Figure 1.9** High resolution aerial imagery depicting remnant and non-remnant areas that occur within and in proximity to the proposed development areas

Should an RE amendment request be submitted and accepted by the Department of Natural Resources and Mines (DNRM), it would result in the reclassification of this RE's biodiversity status from 'endangered' (ESA Category B) to 'no concern at present' which does not have an associated ESA. A refined polygon of the extent vegetation that is analogous to RE 11.10.9 is depicted in Figure 1.8.

## Appendix A Botanical species list

Family name	Scientific name	Common name	Notes
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga fern	
Apocynaceae	<i>Alstonia constricta</i>	Bitter bark	
Apocynaceae	<i>Carissa ovata</i>	Currant bush	
Asteraceae	<i>Bidens pilosa</i>	Cobblers pegs	Non-native
Asteraceae	<i>Calotis cuneifolia</i>	Purple burr daisy	
Asteraceae	<i>Cassinia laevis</i>	Cough bush	
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow buttons	
Asteraceae	<i>Cirsium vulgare</i>	Spear thistle	Non-native
Asteraceae	<i>Conyza bonariensis</i>	Fleabane	Non-native
Asteraceae	<i>Emilia sonchifolia</i>	Emilia	
Asteraceae	<i>Podolepis jaceoides</i>	Showy copper wire daisy	
Asteraceae	<i>Pterocaulon sphacelatum</i>	Apple bush	
Asteraceae	<i>Senecio lautus</i>	Fire weed	
Asteraceae	<i>Tagetes minuta</i>	Stinking rodger	Non-native
Asteraceae	<i>Xanthium occidentale</i>	Noogoora burr	Non-native
Asteraceae	<i>Sonchus oleraceus</i>	Sow thistle	Non-native
Asteraceae	<i>Conyza sp</i>	Fleabane	Non-native
Asteraceae	<i>Leucochrysum molle</i>	Hoary sunray	Non-native
Bignoniaceae	<i>Pandorea pandorana</i>	Wonga vine	
Cactaceae	<i>Opuntia stricta</i>	Prickly pear	Non-native , LP Act Class 2 Weed
Cactaceae	<i>Opuntia tomentosa</i>	Velvety tree pear	Non-native , LP Act Class 2 Weed
Campanulaceae	<i>Wahlenbergia gracilis</i>	Sprawling bluebell	
Capparaceae	<i>Capparis loranthifolia</i>	Nipan	
Capparaceae	<i>Capparis spinosa</i>	Capparis	
Casuarinaceae	<i>Casuarina cristata</i>	Belah	
Chenopodiaceae	<i>Maireana microphylla</i>	Small-leaf bluebush	
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanised burr	
Euphorbiaceae	<i>Acalypha sp.</i>	Turkey bush	
Fabaceae	<i>Acacia deanei</i>	Dean's wattle	
Fabaceae	<i>Acacia decora</i>	Pretty wattle	



Family name	Scientific name	Common name	Notes
Fabaceae	<i>Acacia excelsa</i>	Ironwood	
Fabaceae	<i>Acacia harpophylla</i>	Brigalow	
Fabaceae	<i>Acacia leiocalyx</i>	Black wattle	
Fabaceae	<i>Acacia salicina</i>	Sally wattle	
Fabaceae	<i>Acacia sp.</i>		Sample sent to Qld Herbarium for identification
Fabaceae	<i>Glycine tabacina</i>	Hairy glycine	
Fabaceae	<i>Medicago polymorpha</i>	Burr medic	Non-native
Fabaceae	<i>Glycine tomentella</i>	Hairy glycine	
Fabaceae	<i>Hovea lorata</i>	Hovea	
Fabaceae	<i>Acacia amblygona</i>	Fan wattle	
Geraniaceae	<i>Erodium crinitum</i>	Blue crowfoot	
Goodeniaceae	<i>Goodenia glabra</i>	Smooth goodenia	
Juncaceae	<i>Juncus usitatus</i>	Juncus	
Laxmanniaceae	<i>Lomandra multiflora</i>	Lomandra	
Lomandraceae	<i>Lomandra leucocephala</i>	Lomandra	
Lomandraceae	<i>Lomandra longifolia</i>	Lomandra	
Luzuriagaceae	<i>Eustrephus latifolia</i>	Wombat berry	
Malvaceae	<i>Abutilon leucopetalum</i>	Abutilon	
Malvaceae	<i>Malvastrum americanum</i>	Spiny malvastrum	Non-native
Malvaceae	<i>Sida rhombifolia</i>	Paddy's lucerne	Non-native
Malvaceae	<i>Sida rohlenae</i>	Shrub sida	
Malvaceae	<i>Sida subspicata</i>	Queensland hemp	
Meliaceae	<i>Owenia acidula</i>	Emu apple	
Myoporaceae	<i>Eremophila mitchellii</i>	False sandalwood	
Myoporaceae	<i>Myoporum acuminatum</i>	Boobialla	
Myoporaceae	<i>Eremophila deserti</i>	Turkey bush	
Myrsinaceae	<i>Anagallis arvensis</i>	Scarlett pimpernel	
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked apple	
Myrtaceae	<i>Corymbia erythrophloia</i>	Variable-barked bloodwood	
Myrtaceae	<i>Corymbia tessellaris</i>	Moreton Bay ash	
Myrtaceae	<i>Eucalyptus chloroclada</i>	Dirty gum	
Myrtaceae	<i>Eucalyptus coolabah</i>	Coolabah	

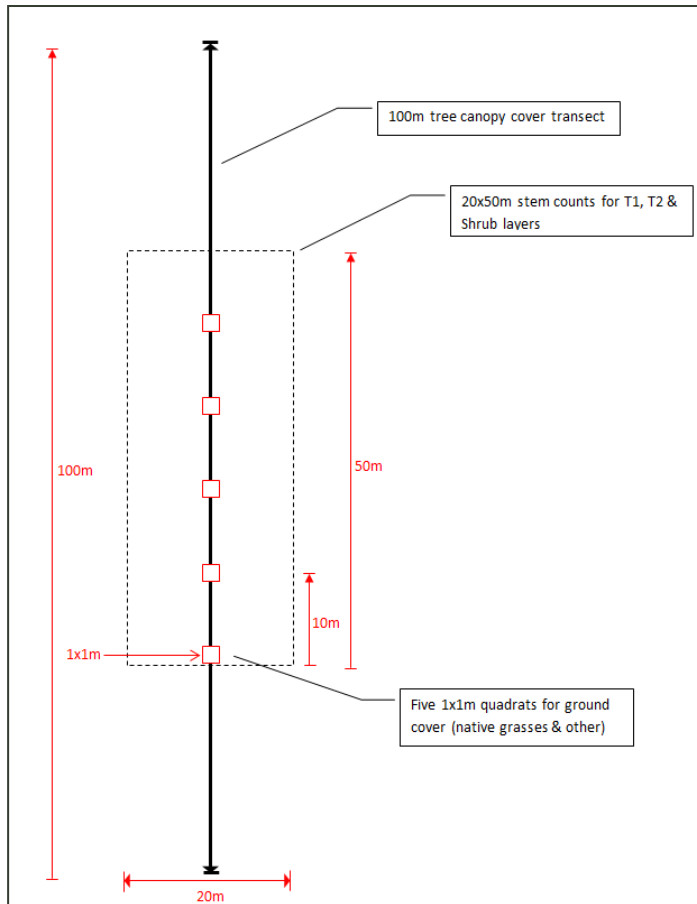
Family name	Scientific name	Common name	Notes
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow leaved ironbark	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver leaved ironbark	
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar box	
Myrtaceae	<i>Eucalyptus tereticornis</i>	Queensland blue gum	
Oxalidaceae	<i>Oxalis stricta</i>	Yellow wood sorrel	
Phormiaceae	<i>Dianella caerulea.</i>	Dianella	
Picrodendraceae	<i>Petalostigma pubescens</i>	Quinine	
Pittosporaceae	<i>Bursaria incana</i>		
Pittosporaceae	<i>Pittosporum angustifolium</i>	Native apricot	Pittosporaceae
Poaceae	<i>Ancistrachne uncinulata</i>	Giant spear grass	
Poaceae	<i>Aristida jerichoensis</i>	Jericho wire grass	
Poaceae	<i>Aristida caput-medusae.</i>	Curly head wire grass	
Poaceae	<i>Austrostipa verticillata</i>	Slender bamboo grass	
Poaceae	<i>Bothriochloa bladhii</i>	Forest blue grass	
Poaceae	<i>Chloris divaricata</i>	Windmill chloris	
Poaceae	<i>Chloris gayana</i>	Rhodes grass	Non-native
Poaceae	<i>Chloris pectinata</i>	Comb chloris	
Poaceae	<i>Chloris truncata</i>		
Poaceae	<i>Chloris ventricosa</i>	Tall chloris	
Poaceae	<i>Cymbopogon refractus</i>	Barbed wire grass	
Poaceae	<i>Cynodon dactylon</i>	Green couch	
Poaceae	<i>Dichanthium sericeum</i>	Queensland blue grass	
Poaceae	<i>Enneapogon pallidus</i>	Conetop nine awn	
Poaceae	<i>Eragrostis brownii</i>	Browns love grass	
Poaceae	<i>Eragrostis cilianensis</i>	Stink grass	Non-native
Poaceae	<i>Eragrostis sororia</i>	Woodland love grass	
Poaceae	<i>Heteropogon contortus</i>	Black spear grass	
Poaceae	<i>Iseilema vaginiflorum</i>	Red flinders	
Poaceae	<i>Melinis repens</i>	Red natal	Non-native
Poaceae	<i>Panicum effusum</i>	Inquisitive grass	
Poaceae	<i>Pennisetum ciliare</i>	Buffel grass	Non-native
Poaceae	<i>Perotis rara</i>	Comet grass	



Family name	Scientific name	Common name	Notes
Poaceae	<i>Setaria australiensis</i>	Pigeon grass	
Poaceae	<i>Sporobolus creber</i>	Western rats tail grass	
Poaceae	<i>Themeda avenacea</i>	Wild oats grass	
Poaceae	<i>Themeda triandra</i>	Kangaroo grass	
Poaceae	<i>Urochloa mosambicensis</i>	Sabi grass	Non-native
Poaceae	<i>Cymbopogon oblectus</i>	Fluffy tops	
Proteaceae	<i>Grevillea striata</i>	Beefwood	
Proteaceae	<i>Hakea lorea</i>	Bootlace oak	
Rhamnaceae	<i>Alphitonia excelsa</i>	Red ash	
Rubiaceae	<i>Psydrax oleifolium</i>	Hat stand	
Rutaceae	<i>Citrus glauca</i>	Lime bush	
Rutaceae	<i>Geijera parviflora</i>	Wilga	
Sapindaceae	<i>Alectryon diversifolius</i>	Scrub boonaree	
Sapindaceae	<i>Atalaya hemiglauc</i>	Whitewood	
Sapindaceae	<i>Alectryon oleifolius</i>	Boonaree	
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	NC Act Type A Species
Sterculiaceae	<i>Brachychiton rupestris</i>	Narrow leaved bottle tree	NC Act Type A Species
Verbenaceae	<i>Verbena bonariensis</i>	Bunchy verbena	Non-native
Verbenaceae	<i>Verbena litoralis</i>	Tall verbena	Non-native
Verbenaceae	<i>Verbena tenuisecta</i>	Mayne's curse	Non-native
Zygophyllaceae	<i>Zygophyllum howittii</i>	Red twinleaf	

## Appendix B Detailed vegetation assessment

This appendix provides the ground cover, canopy cover and stem count data collected during the field investigations throughout the proposed development areas which is referenced throughout the ecological assessment. The diagram below shows the transect arrangement in the field.





**Mapped RE 11.10.9 within the south of Area C2**

**Ground cover data**

The following values indicate the percentage of each ground cover category for five (5) 1 m by 1 m quadrats. The average ground cover for each category is also provided in the 'Averages' column.

**Stem count data**

Groundcover	Q 1 (%)	Q 2 (%)	Q 3 (%)	Q 4 (%)	Q 5 (%)	Averages (%)
Native grasses	70	30	85	30	5	44
Native forbs and herbs	5					5
Non-native grasses						-
Non-native forbs and herbs						-
Shrubs				50	20	35
Bare ground	10	10		5	5	7.5
Rock						-
Leaf litter	10	40	10	10	55	25
Woody debris	5	20	5	5	15	10

**Stem count data**

The following table is the stem count data collected during the field investigation for the Canopy (T1), Sub-canopy (T2) and Shrub layer (S1). The heights for each of the stratum are also defined below.

Transect	Stem counts per stratum per 10 x 20 m plots		
	T1 (12-17 m)	T2 (6-10 m)	S1 (1-5 m)
0-10 m	2	22	13
10- 20 m	7	9	18
20- 30 m	7	5	37
30- 40 m	2	7	20
40- 50 m	6	27	9
<b>Totals</b>	24	70	97

**Stems per hectare calculations**

- T1 (12-17 m) – 240 stems per hectare
- T2 (6-10 m) – 700 stems per hectare
- S1 (1-5 m) – 970 stems per hectare

**Foliage projective cover data**

The total Foliage Projective Cover (FPC) for the T1 and T2 canopies along two (2) 50 m transects, expressed as a percentage is:

- T1 (12-17 m) – 50.5% FPC
- T2 (6-10 m) – 38% FPC

The canopy transect data collected during the field investigation is provided in the following table.

Stratum	Distance		Total (m)
	Start	End	
<b>0-50 m</b>			
T1	0	3	3
T1	0	12	12
T1	9	16	7
T2	4	12	8
T2	4	12.5	8.5
T1	17.5	23	5.5
T2	18.5	23	4.5
T1	25	44.5	19.5
T2	26.5	27.5	1
T2	29.5	32	2.5
T2	33.5	36	2.5
T2	37	39.5	2.5
T2	36.5	41	4.5
T2	45	46	1
T1	46.5	50	3.5
T2	48	50	2
<b>Totals</b>			
<b>Total T1</b>			50.5
<b>Total T2</b>			38

***Mapped RE 11.9.10/11.9.5 within the south-west of Area C1***

**Ground cover data**

The following values indicate the percentage of each ground cover category for five (5) 1 m by 1 m quadrats. The average ground cover for each category is also provided in the 'Averages' column.

Groundcover	Q 1 (%)	Q 2 (%)	Q 3 (%)	Q 4 (%)	Q 5 (%)	Averages (%)
Native grasses	50	30	80	30	25	43
Native forbs and herbs	10	10			30	17
Non-native grasses					0	0
Non-native forbs and herbs	0					0
Shrubs	0	40			5	15



Bare ground	10	5	5	20	30	14
Rock					0	0
Leaf litter	15	5	10	20	10	12
Woody debris	15	10	5	20		12.5

### Stem count data

The following table is the stem count data collected during the field investigation for the Canopy (T1), Sub-canopy (T2) and Shrub layer (S1). The heights for each of the stratum are also defined below.

Transect	Stem counts per stratum per 10 x 20 m plots		
	T1 (13-18 m)	T2 (6-12 m)	S1 (1-5 m)
0-10 m	9	12	9
10- 20 m	2	7	7
20- 30 m		11	3
30- 40 m	4	7	14
40- 50 m	1	10	8
<b>Totals</b>	16	47	41

### Stems per hectare calculations

- **T1** (13-18 m) – 160 stems per hectare
- **T2** (6-12 m) – 470 stems per hectare
- **S1** (1-5 m) – 410 stems per hectare

### Foliage projective cover data

The total Foliage Projective Cover (FPC) for the T1 and T2 canopies along two (2) 50 m transects, expressed as a percentage is:

- **T1** (13-18 m) – **12.5% FPC**
- **T2** (6-12 m) – **49.5% FPC**

The canopy transect data collected during the field investigation is provided in the following table.

Stratum	Distance		Total (m)
	Start	End	
<b>0-50 m</b>			
T2	5	6.5	1.5
T2	6.5	19.5	13
T2	10	14	4
T2	21	27	6
T2	24	26.5	2.5
T2	31.5	41	9.5
T1	31	35.5	4.5
T1	37	29	8
T2	41	49	8
T2	45	50	5
<b>Totals</b>			
Total T1			12.5
Total T2			49.5