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Mundamia Residential Subdivision

State Significant Development (SSD 7069)

Biodiversity Offset Strategy

Report Number 610.14258.00000

27 April 2017

Jemalong Mundamia Pty Ltd

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Biodiversity Offset Strategy

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
610.14258.00000	Final	27 April 2017	Jeremy Pepper	J Pepper	J Pepper

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EXECUTIVE SUMMARY

Jemalong Mundamia Pty Ltd (the proponent) is proposing the residential subdivision and development of Lot 30 (in DP 1198692) George Evans Road, Mundamia (hereafter 'the Project'). The Project has been classified as 'State Significant Development' and as such, the *NSW Biodiversity Offsets Policy for Major Projects* applies, which is underpinned by the *Framework for Biodiversity Assessment* ('FBA'). SLR has been engaged to prepare a *Biodiversity Offset Strategy* (BOS) to support the project application.

The impacts on biodiversity of the construction and operation of the Project have been calculated in terms of biodiversity credits as follows:

- 544 ecosystem credits (across three plant community types); and
- 4980 species credits for the threatened plant Nowra Heath-myrtle *Triplarina nowraensis*.

To offset the impacts of the Project on biodiversity, the proponent may choose one, or a combination of, the following options:

- purchase like-for-like biodiversity credits from the BioBanking Credit Register (Option 1a);
- generate the required credits by creating a BioBanking Agreement over land owned (or to be purchased) by the proponent (Option 1b);
- apply the variation rules (after demonstrating 'reasonable steps' have been taken) and purchase other (not like-for-like) credits (Option 2);
- apply supplementary measures (also after demonstrating reasonable steps) and arrange monetary contribution for the equivalent value of the credits required (Option 3); and/or
- a combination of the above (Option 4).

The proponent owns residual lands adjoining the Development Site that contain like-for-like credit types. Should a BioBanking Agreement be placed over the residual lands (Option 1b), the proposed Offset Site would create 77 ecosystem credits and 7718 Nowra Heath-myrtle species credits. A total of 63 ecosystem credits within the Offset Site match those required to offset the Project impacts (i.e. 'like-for-like offsets), which would allow for partial offsetting of the ecosystem requirement, with a residual of around 468 ecosystem credits still required to be purchased. The Offset Site could potentially supply all of the 4980 Nowra Heath-myrtle species credits required for the Project offset, with a surplus of 2624 species credits remaining. Accordingly, the recommended approach to biodiversity offsetting for the Project is Option 4, which would involve:

- Establish a BioBanking Agreement over the Offset Site, and use the resultant biodiversity credits to offset the Project impacts (in part). Once the Agreement is finalised, transfer and retire the required ecosystem credits and species credits to offset the Project.
- Advertise an Expression of Interest for the additional required ecosystem credits on the 'Credits Wanted' register (BioBanking web site). An Expression of Interest was submitted December 2015.
- Monitor the availability of required ecosystem credits on the Credit Register during and after the Expression of Interest period (six months) and purchase and retire those credits if and when available.

If no suitable credits are available after the end of the advertisement period, the proponent will have demonstrated 'reasonable steps' and will apply 'supplementary measures' and make a monetary contribution equivalent to the cost of the remaining ecosystem credits, deposited into a NSW Government fund[1]. Alternatively, the proponent may choose to transfer the residual lands to Shoalhaven City Council, in which case, the Council would become the biobank owner and sell the biodiversity credits to the proponent. The remaining ecosystem credits would be sought from the BioBanking Credit Register (as per Option 4).

Additionally, it is proposed that credits are retired in stages, in accordance with the credit requirement associated with each stage of the Project.

[1] At the time of writing, no such fund is established, so this option might not be available to the proponent if the development were to commence in the near future.

1 INTRODUCTION

1.1 Background

Jemalong Mundamia Pty Ltd (the proponent) is proposing the residential subdivision and development of Lot 30 (in DP 1198692) George Evans Road, Mundamia (hereafter 'the Project'). The Project involves the following key elements:

- the subdivision of the majority of the site (31.6 hectares (ha) or 76 % of the site) for residential purposes (the Development Site), comprising 319 residential lots, one commercial lot and four public reserves, with associated roads and other infrastructure;
- the creation of four on-site detention basins totalling 1 ha in area, which for the purposes of this report have been included as part of the Development Site; and
- the creation of two areas to be dedicated for biodiversity conservation, occupying approximately 9.5 ha (or 23% of the site) (referred to collectively as the 'Offset Site' and exclusive of the detention basins).

The Project has been classified as 'State Significant Development' (SSD) pursuant to Part 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and a project application is currently before the NSW Department of Planning and Environment for assessment and determination. As an SSD, the *NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) applies to the Project. The Policy is supported by a framework and methodology document, known as the *Framework for Biodiversity Assessment* (FBA; OEH 2014b), which applies to all SSD projects and is based on the BioBanking Assessment Methodology.

As part of the assessment of the project application, a meeting was held in December 2015, attended by the proponent, SLR Consulting ('SLR'), the NSW Office of Environment and Heritage (OEH) and NSW Department of Planning and Environment. In relation to assessment of the project impacts on flora and fauna (including threatened species and communities), OEH recommended that a "*biodiversity offset strategy will need to be prepared and accepted by the OEH prior to determination of the application*"[2]. The Strategy is to be prepared in accordance with the requirements of the FBA.

Accordingly, SLR Consulting Australia Pty Ltd (SLR) has been engaged to prepare a *Biodiversity Offset Strategy* (BOS) according to the FBA. This Strategy has been prepared by Jeremy Pepper, Principal Ecologist and accredited assessor (#0107) under the Biodiversity Banking and Offsets ('BioBanking') Scheme.

This current BOS has been revised in light of comments on the draft BOS received from OEH in January 2017 (email D Robson (OEH) to C Page (OEH), dated 15 December 2016). It has been revised as follows:

- Revisions to the assumption and inputs to the BioBanking Credit Calculator (Proposal ID: 0107/2016/2436MP, v4.0), as follows:
    - IBRA subregion changed to Ettrema in the Landscape value section;
    - Changing the species predicted to occur within the site in the BioBanking Credit Calculator (Site Survey Details tab) to include all Predicted threatened species;
    - Geographic/habitat features tab - Broad-headed Snake ("land within 500 m of sandstone escarpments with hollow-bearing trees, rock crevices or flat sandstone rocks on exposed cliff edges and sandstone outcropping") and Rosenberg's Goanna ("land within 250 m of termite mounds or rock outcrops"), now ticked as relevant to the Development Site (and the Offset Site);
    - Patch size amended to be 201 ha in Landscape value tab.

[2] Email from Kate McDonald (NSW Planning & Environment) to Matt Philpott (APA), dated 18 December 2015.

  - The mean density of Nowra Heath-myrtle *Triplarina nowraensis* amended to be 306 (as per SLR submitted plot data) as discussed and agreed with OEH. This changed the number of Nowra Heath-myrtle to be removed from the Development Site to 332 stems.
- Amendments to the BOS as follows:
  - Text added to note that if offsets are secured after development commences, then a voluntary planning agreement is required prior to the granting of project approval.
  - delete reference to Lot and DP in description of offset site.
  - Erroneous text in Section 5.1 amended.
  - Section 5.6, which referred to the *Credit Converter for ecosystem credits and species* credits, has been deleted.

1.2 The Site

The site consists of proposed Lot 30 (in DP 1198692) George Evans Road at Mundamia (**Figure 1**). The site is located within the Local Government Area (LGA) of Shoalhaven City Council, and occupies a total area of approximately 41.4 hectares (ha). The site is located to the west of the township of Nowra and to the south of the Shoalhaven River (**Figure 1**), between:

- private land south of the Shoalhaven River (located to the immediate north);
- the main part of the town of Nowra to the east (across the forested valley of Flat Rock Creek);
- private land north of Yalwal Road (to the immediate south); and
- a Crown Road Reserve and other private land (to the immediate west).

The site is characterised by native vegetation with mature trees and well-developed mid-storey and groundcover (in the north and east), and substantial areas of cleared agricultural land. The western and southern parts of the site, which are predominantly cleared and disturbed, are the focus of development activities (**Figure 2**).

Surrounding lands are predominantly forested or contain other native vegetation (variously disturbed), although there are small areas of farmed land, occasional dwellings and formed roads, particularly to the west and north (see **Figure 1**).

1.3 The Project

The proposed subdivision layout, including residential lots, internal roads, stormwater basins, and APZs, is provided in **Appendix A**. Specific elements of the Project include:

- the subdivision and development of the land into roads, open space and residential allotments, over an 11 stage programme;
- the provision of a peripheral road system to provide access in the event of a bushfire and to provide a management interface between retained vegetation and the residential subdivision;
- the provision of stormwater controls and management features designed *inter alia* to mimic the existing surface hydrology and protect adjoining habitats and resources;
- the identification and dedication of land in the northern and eastern parts of the site for biodiversity conservation and environmental protection purposes; and
- the provision of bush fire management measures, consisting primarily of asset protection zones (APZs) within the Development Site.

The Development Site comprises 31 ha (or 77% of the site) and is predominantly cleared agricultural land. The remainder of the site (i.e. the northeastern and southeastern portions), occupying approximately 9.5 ha, comprises native vegetation that is to be retained and managed for conservation purposes (in a proposed Offset Site), with an additional 1 ha for stormwater (on-site detention basins) (**Appendix A**).

The Project has been re-designed specifically to reduce impacts on the Nowra Heath-myrtle *Triplarina nowraensis* and also (in the southeast) to eliminate the impacts of APZs. This has involved a reduction in the extent of development in the northern part of the land, which significantly reduces the area of habitat for, and, the number of specimens of, the Nowra Heath-myrtle which will require removal.

1.4 Aims and Scope of the Strategy

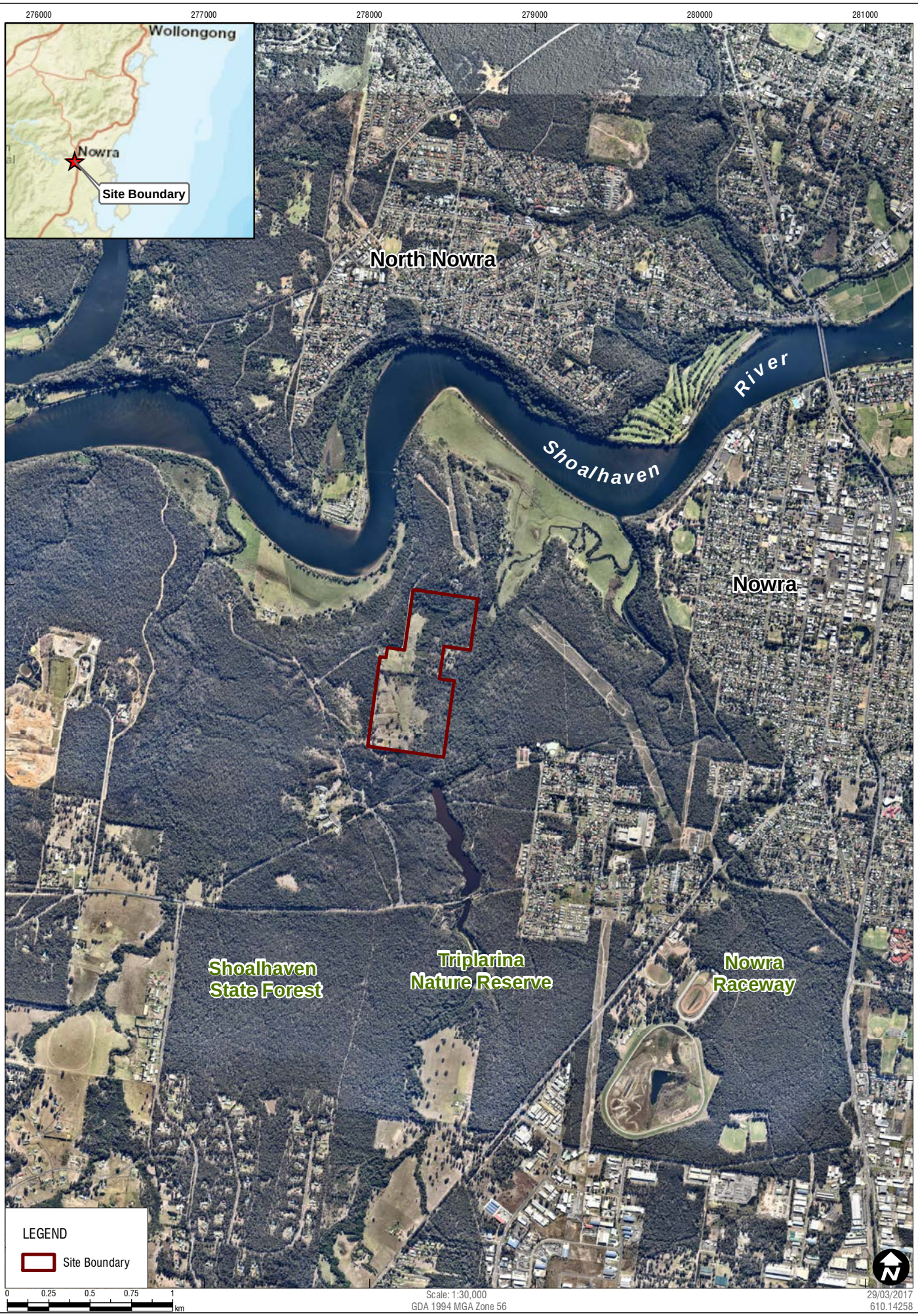
The primary aim of this Strategy is to establish the requirement for a biodiversity offset for the Project and to describe a suitable biodiversity offset that satisfies the requirements of the FBA.

The scope of this Strategy is based on the requirements of the FBA and is informed by previous consultation undertaken for this Project with NSW Department of Planning and Environment and with OEH. Table 22 of the FBA sets out the minimum requirements for biodiversity offset strategies. A copy of Table 22, showing where all relevant elements of the FBA have been addressed in this document, is provided in **Appendix B**.

1.5 Definitions

Common terms and definitions used throughout this Strategy document include:

- *Site*, being Lot 30 (in DP 1198692), George Evans Road, Mundamia, as shown in **Figure 1**. In this Strategy, the site is split into two components: (i) the Development Site; and (ii) the Offset Site.
- *Development Site*, inclusive of the onsite detention basins, totally around 31 ha.
- *Offset Site*, being two portions of land in the eastern flanks of the site, formerly referred to as the 'Public Reserve' (not inclusive of the onsite detention basins), comprising around 9.5 ha.
- *Project*, being the Project as described in the Preferred Project Report.



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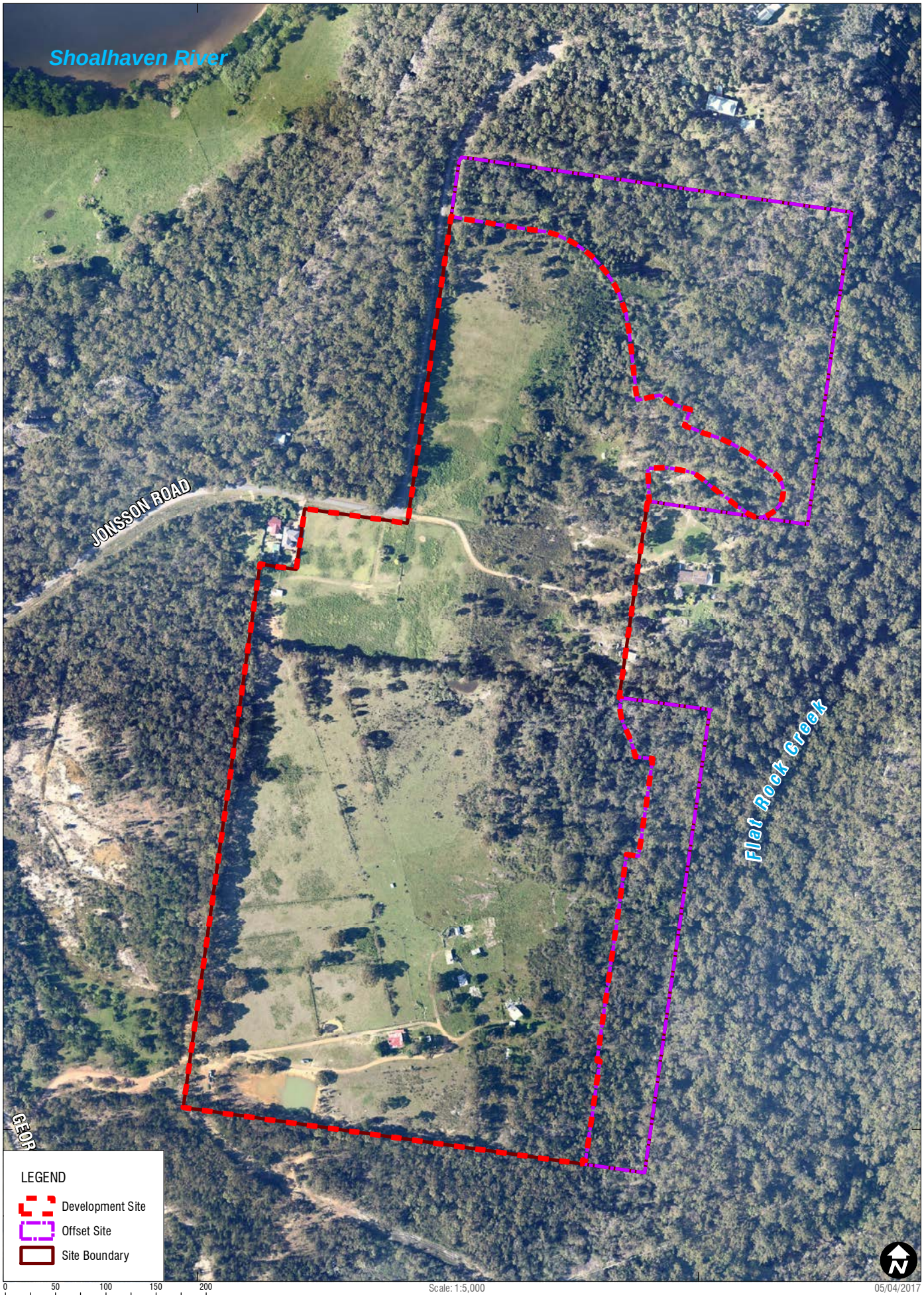
Location of the site at Mundamia

FIGURE 1



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Aerial photo of the site at Mundamia

FIGURE 2

2 MATTERS REQUIRING OFFSETS

This chapter provides a summary of the impacts of the Project on biodiversity, focussing on those impacts that require offsets under the FBA.

2.1 Overview

The impacts of the proposed development on flora and fauna are described in the SLR (2015) *Flora and Fauna Assessment Report.* In general, the FBA requires that State Significant Developments must offset impacts on biodiversity that cannot be avoided or reduced. These impacts include:

- native vegetation to be permanently removed, including threatened ecological communities; and
- threatened species and their habitats to be permanently removed.

These impacts, insofar as they must be offset according to the FBA, are summarised in the following sections.

2.2 Native Vegetation (Plant Community Types)

2.2.1 Original vegetation mapping (SLR (2015)

Native vegetation types (or 'plant community types') with the Development Site were mapped by SLR (2015). The areas of vegetation removal for each plant community type, as per the nomenclature of SLR (2015), are listed in **Table 1**. Floristic descriptions of vegetation community types are provided in Chapter 4 of SLR (2015).

Table 1 Native vegetation within the Development Site (SLR 2015) – estimate of removal

SLR Vegetation Community	Area to be Removed (ha)
Grey Gum – Blue-leaved Stringybark Open Forest	4.18
Scribbly Gum – Bloodwood Forest	3.16
Paperbark Closed Forest	1.37
Kunzea Heathland	1.22
Total	**9.93**

2.2.2 Modifications to vegetation mapping

Areas that were mapped as "Pasture" in SLR (2015) are excluded and do not require offsetting. However, by exception, a small patch of vegetation that lies in the central parts of the site, north and south of Jonsson Road, that was previously mapped as Pasture, has been re-mapped 'Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux' (see **Table 2**). OEH (2016) have identified this vegetation as containing 'wetland' species. Whilst it is acknowledged that some sedges and other plants that occur in wetlands are present in this area, the vegetation does not constitute an example of a wetland community and furthermore does not comply with the description of *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community* (NSW Scientific Committee 2011).

However, due to its position in the landscape, the underlying geology and the surface hydrology of this part of the site, the area in question may be considered a modified form of sandstone heathland that contains elevated soil moisture, apparently as a result of impeded drainage from the construction of the road. A substantial portion of this vegetation lies underneath overhead power lines and is evidently slashed to maintain safety clearances to the overhead conductors.

A range of native shrubs, herbs, forbs and ferns occur in this area, with shrub and small tree species (e.g. eucalypts and paperbarks) occurring in low form (likely to be suckers or coppice from cut stumps) to less than one m high. Common species include *Melaleuca linariifolia*, *M. thymifolia*, *Kunzea ambigua*, *Hakea sericea*, *Schoenus brevifolius*, *Lepyrodia scariosa*, *Leptocarpus tenax*, *Epacris obtusifolia* and *Gleichenia dicarpa*.

Adjoining areas contain cleared exotic pasture to the west, Paperbark Closed Forest to the north, with Scribbly Gum – Bloodwood Forest to the east. The vegetation patch, although lacking a definitive shrub layer (due to apparent slashing and possibly altered moisture regimes) shares affinities with the PCT SR556 Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux (see **Table 2**), including the presence of characteristic shrub and small tree species *Melaleuca linariifolia*, *M. thymifolia*, *Kunzea ambigua* and *Hakea sericea*. The mapping for this patch is displayed in **Figure 3**.

Additionally, stands of Paperbark Closed Forest in SLR (2015) have been assigned to PCT SR648 Swamp mahogany swamp sclerophyll forest on coastal lowlands (see **Table 2** and **Figure 3**). The presence of *Melaleuca linariifolia*, which is the dominant canopy species in these patches, appears to be anomalous, and this species does not occur as the dominant canopy component in relevant South Coast[3] vegetation communities. It is likely therefore, that changed surface hydrology has allowed this species to colonise damp ground and periodically waterlogged soils. SLR (2015) describes the Paperbark Closed Forest community as follows:

> *"The upper stratum is dominated by Snow-in-Summer with a foliage cover of 50-75% and heights of 8-12m. The mid-stratum is variable based on available light levels associated with the upper stratum cover, with the main species being Prickly Tea-tree, Lemon-scented Tea-tree, Cheese Tree, Nowra Heath-myrtle, Sydney Golden Wattle, Narrow-leaved Geebung and Mock Olive.*
>
> *The lower stratum consists of a diverse range of grasses, herbs, sedges and ferns including Tall Saw-sedge, Bracken, Oplismenus aemulus, Mat Rush, Blady Grass, Bordered Panic, Common Silkpod, Sweet Morinda, False Bracken Fern, Common Couch, Pennywort and Climbing Guinea Flower.*"

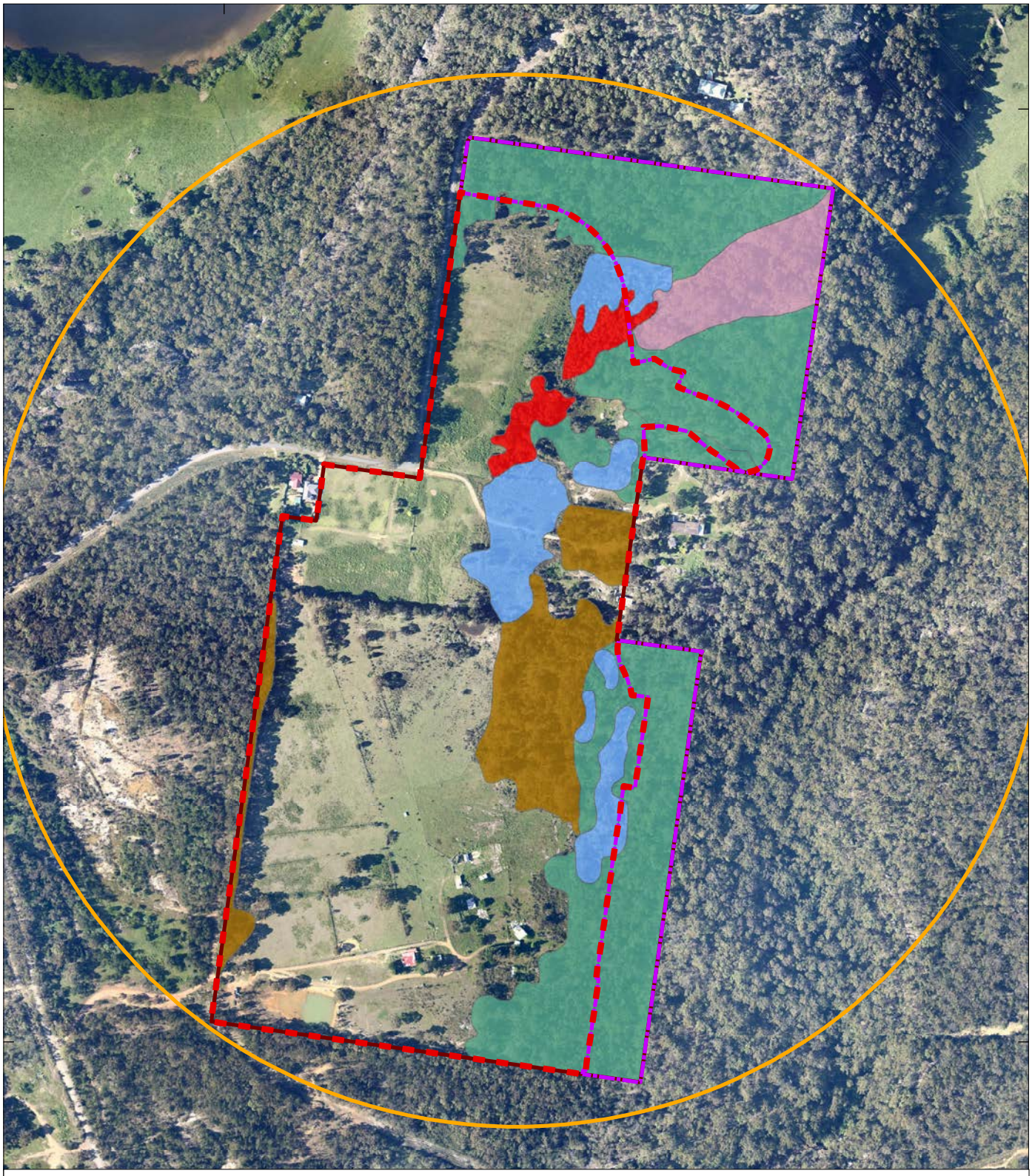
2.2.3 Assigning SLR vegetation types to PCTs

The original SLR (2015) mapping was verified and, where necessary, amended in the field as part of the field surveys for this BOS. Additionally, and for the purposes of calculating the required biodiversity credits to offset the above impacts on native vegetation, the SLR (2015) vegetation types have been converted into NSW Plant Community Types (PCTs) using the online database known as the NSW *Vegetation Information System* (or 'VIS Classification 2.1'), which is administered by OEH. The SLR vegetation types and corresponding PCTs are listed in **Table 2**.

Table 2 Conversion of SLR vegetation types (Development Site) to plant community types (PCTs)

SLR (2015) Vegetation Community	Plant Community (PCT)
Grey Gum – Blue-leaved Stringybark Open Forest Highly disturbed Grey Gum-Stringybark Woodland	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes
Scribbly Gum – Bloodwood Forest	SR595 Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux
Paperbark Closed Forest	SR648 Swamp mahogany swamp sclerophyll forest on coastal lowlands
Kunzea Heathland Regrowth woodland with Kunzea Heath (New 'wetland' patch identified by OEH)	SR556 Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux

[3] Sydney Basin Bioregion – Ettrema subregion



LEGEND

- 100ha Buffer
- Development Site
- Offset Site
- Site Boundary

Plant Community

- SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney
- SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney
- SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and northeast South Eastern Highlands Bioregion
- SR641 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion
- SR648 Swamp Mahogany swamp sclerophyll forest on coastal lowlands, Sydney Basin and South East Corner

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Plant Community Types within the Site

FIGURE 3

No threatened ecological communities (TECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded or mapped on the site by SLR (2015).

PCTs and their mapped areas are listed in **Table 3** and mapped in **Figure 3**.

Table 3 Plant community types (PCTs) mapped within the Development Site

Code#	Plant Community (PCT)	Area (ha)
SR549	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	4.27
SR556	Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux	2.29
SR595	Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	3.16
SR648	Swamp Mahogany swamp sclerophyll forest on coastal lowlands	0.74
	Total	**10.46**

Biometric code for Southern Rivers (SR) CMA plant community types (PCTs), according to the VIS.

2.3 Threatened Species

The threatened biota that have been recorded on or adjacent to the site (see SLR 2015) are:

- one threatened plant species: Nowra Heath-myrtle *Triplarina nowraensis*, which is listed as 'endangered' in Part 1 of Schedule 1 of the TSC Act and as 'endangered' in the EPBC Act; and
- eight species of threatened fauna, including four threatened bird species and four mammals, as listed in **Table 4**.

Figure 4 shows the locations of records of threatened species from previous ecological surveys conducted on the site.

No endangered populations or threatened ecological communities listed under the TSC Act were recorded on the site by SLR (2015).

Two threatened species listed under the EPBC Act, Nowra Heath-myrtle and Grey-headed Flying Fox, were recorded within the site (**Table 4**). No other matters of national environmental significance were recorded on the site.

Table 4 Threatened species recorded within the site at Mundamia

Species	Common Name	TSC Act#	EPBC Act#
Triplarina nowraensis	Nowra Heath-myrtle	E	E
Lophoictinia isura	Square-tailed Kite	V	
Callocephalon fimbriatum	Gang-gang Cockatoo	V	
Calyptorhynchus lathami	Glossy Black-cockatoo	V	
Ninox strenua	Powerful Owl	V	
Petaurus australis	Yellow-bellied Glider	V	
Pteropus poliocephalus	Grey-headed Flying Fox	V	V
Mormopterus norfolkensis	East-coast Free-tail Bat	V	
Miniopterus schreibersii oceanensis	Common Bent-wing Bat	V	

E = endangered; V = vulnerable.

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Previous threatened species records on the site at Mundamia

FIGURE 4

Of the four threatened mammal species identified, the Yellow-bellied Glider is likely to be a long-term resident of the site and surrounding lands. The other three mammal species are highly mobile and more wide-ranging, although some microchiropteran bats could reside within the site.

With reference to the 'Predicted Species' section of the Credit Calculator, based on the above survey results to date, and the presence of at least one habitat component (breeding, foraging or shelter), the threatened species previously recorded on the site that generate ecosystem credits have been assumed to be 'On Site' (in accordance with Section 6.3 of the FBA), as follows:

- Powerful Owl, which was recorded aurally and visually within the gully that runs through the Offset Site (see **Figure 4**). In accordance with OEH comments on the BOS, we have changed the assessment to assume that this species occurs within the Development Site.
- Yellow-bellied Glider, for which the majority of records lie outside of the Development Site. Historical records of this species via visual observation and aural detection are within the Offset Site (see **Figure 4)**. We previously assumed that the Yellow-bellied Glider did not occupy the Development Site, based on previous survey records (see SLR 2015). However, in accordance with OEH comments on the BOS, we have changed the assessment to assume that this species occurs within the Development Site.
- Grey-headed Flying Fox, Square-tailed Kite, which were observed in flight only. No evidence of flying fox camps, or of roosting or nesting on site.
- East-coast Free-tail Bat and Common Bent-wing Bat, which were observed in flight using Anabat ultrasonic detection only. Conversely, there is no evidence of bats roosting within the Development Site.
- Glossy Black-cockatoo recorded by indirect evidence of feed trees and chewed cones, most of which lie outside the Development Site (see **Figure 4**); no records of roosting or nesting birds within site.
- Gang-gang Cockatoo, which relates to an old record from BES (2004). The nature of the record is unknown but is assumed to be visual observation of a bird in flight. There are no records of nesting Gang-gang Cockatoos on the site to date.

The assumptions regarding the presence of predicted threatened species in the Credit Calculator are listed in **Table 5**.

Table 5 Threatened species – Credit Types and BioBanking Credit Calculator Entries

Species	Common Name	TSC Act[4]	On-Site?
Triplarina nowraensis	Nowra Heath-myrtle	E	Yes
Lophoictinia isura	Square-tailed Kite	V	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo	V	Yes
Calyptorhynchus lathami	Glossy Black-cockatoo	V	Yes
Ninox strenua	Powerful Owl	V	Yes
Petaurus australis	Yellow-bellied Glider	V	Yes
Pteropus poliocephalus	Grey-headed Flying Fox	V	Yes
Mormopterus norfolkensis	East-coast Free-tail Bat	V	Yes
Miniopterus schreibersii oceanensis	Common Bent-wing Bat	V	Yes

[4] TSC Act: E = endangered, V = vulnerable

2.4 Nowra Heath-myrtle

2.4.1 Mapping and Area of Occupancy

A total of 4.16 ha of patches of Nowra Heath-myrtle have been mapped within the site, with an additional 198 ramets[5] also mapped across the northeastern and eastern parts of the site (SLR 2015).

Within the Development Site, SLR (2015) mapped patches of Nowra Heath-myrtle totalling 0.94 ha in area, as well as 45 ramets. The distribution of Nowra Heath-myrtle patches and ramets is displayed in **Figure 6**.

To quantify the impact of a development on a threatened species that generates species credits, the BioBanking Credit Calculator requires a number of ramets to be entered. Accordingly, the areas (or patches) of Nowra Heath-myrtle mapped by SLR (2015) were converted into a number of ramets by multiplying the area of patch by an estimated mean density of 306 plants per hectare. This mean density was derived from the results of 20 m X 20 m plot data collected as part of the plot/transect surveys conducted according to the FBA in January 2016 for this BOS. A discussion of the method for calculating the mean density of Nowra Heath-myrtle is presented in Section **2.4.2**.

The Nowra Heath-myrtle records within the development area are listed in **Table 6**. The results indicate that 332 stems of Nowra Heath-myrtle lie within the Development Site.

Table 6 Nowra Heath-myrtle removal within the Development Site

Stage	Area (ha)	Mean Density (stems/ha)	Calculated No. Stems	Waypoints (individual plants)	Total No.
7	0.08	306	24.5	7	31
8	0.03	306	9.2	4	13
9	0.0005	306	0.2	0	0
10	0.45	306	137.7	22	160
11	0.38	306	116.3	12	128
	0.9405	**Total:**	**287.9**	**45**	**332**

In accordance with the calculated number of Nowra Heath-myrtle ramets within the Development Site, the loss of individuals of Nowra Heath-myrtle entered in the Credit Calculator is 332.

The loss of Nowra Heath-myrtle within the Development Site is proposed to be offset by the purchase of species credits. Sufficient species credits to offset the loss of Nowra Heath-myrtle from the Development Site could be generated in the proposed Offset Site, as described in Section **4.2.2**.

2.4.2 Estimate of Population Density

Plot based field surveys were carried out according to FBA methods by SLR on 20 and 21 January 2016. An opportunistic assessment of the size of the population of Nowra Heath-myrtle *Triplarina nowraensis* within the site was carried out and involved:

- Counting ramets within 20 m X 20 m quadrats; and
- Counting ramets within populations observed during movement between quadrats.

5 A ramet is a group of genetically identical individuals, such as plants, fungi, or bacteria, that have grown in a given location, all originating vegetatively, not sexually, from a single ancestor.

Because of the limited time available to assess the required number of quadrats, no additional targeted searches for populations of *Triplarina nowraensis* were possible. Hence, the area of occupancy (i.e. mapped extent and distribution) of *Triplarina nowraensis* adopted for the current BOS is as per SLR (2015). The quadrats within which ramets of Nowra Heath-myrtle *Triplarina nowraensis* were recorded are listed in **Table 7**.

Table 7 Number of Nowra Heath-myrtle recorded in FBA plots

FBA Plot Ref.	No. ramets[#]
DVZ1/P1	20
DVZ4/P1	5
DVZ5/P3	9
OVZ1/P1.	30
OVZ4/P1	4
OVZ4/P2	20
OVZ4/P4[##]	5
OVZ6/P1	5
Total	**98**
Mean	**12.25**

\# Recorded during FBA plots/transect surveys in January 2016.
Listed as OVZ4/P5 in previous BOS and field sheets.

The mean number of counted ramets of Nowra Heath-myrtle *Triplarina nowraensis* in the eight quadrats is 12.25. This mean is calculated based on the assumption that only plots containing suitable habitat for *Triplarina nowraensis* (i.e. SR 556 and SR 549) are included. It is likely that the distribution of this species over the site follows a Poisson Distribution (see Harper 1990), because of the wide range of habitats in which this species occurs over the site, as well as the great variation in cover and density of this species over the site (see SLR 2015). However, a calculation for Poisson Distribution could not be applied, because of the limited amount of data. Therefore an assumption was made that the raw data obtained from the quadrats could be applied to derive a number per hectare (see Elzinga, Salzer and Willoughby [undated]). The estimated number of ramets of *Triplarina nowraensis* per hectare was therefore calculated to be 306. This mean density is generally consistent with the findings of SLR (2015) in the previous *Flora and Fauna Assessment*.

3 BIODIVERSITY IMPACT - CREDIT REQUIREMENT

This chapter describes and quantifies the biodiversity offset required for the Project, in terms of the biodiversity credits that would be required to be purchased and retired to offset the development in accordance with the FBA.

3.1 Overview

The 'major projects' module of the BioBanking Credit Calculator v3.0 (Proposal ID 0107/2016/2436MP) was used to calculate the impacts of the proposed development and potential offset requirements in accordance with Section 8 of the *Framework for Biodiversity Assessment* (FBA). This section of the BOS provides a summary of the results of the credit calculations. A full copy of the credit profile for the impacts of the Project is provided in **Appendix C**.

3.2 Ecosystem Credits

The vegetation zones mapped across the Development Site are shown in **Figure 5.** These vegetation zones were assessed and plot data collected from each zone according to methods set out in Chapter 5 of the FBA. Site value scores for each vegetation zone are derived from the plot data collected during field surveys conducted in January 2016.

The current assessment indicates that clearing of native vegetation associated with the Project will require the purchase and retirement of 544 ecosystem credits, as listed in **Table 8.**

The final credit report from the BioBanking Credit Calculator for the Development Site is provided in **Appendix C.**

Table 8 Ecosystem credits requiring offsetting in the Development Site

Code	Ecosystem Credit (PCT)	Area (ha)	Credits Required
SR549	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	4.27	251
SR556	Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux	2.29	109
SR595	Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	3.16	151
SR648	Swamp Mahogany swamp sclerophyll forest on coastal lowlands	0.74	33
	Total	**10.46**	**544**

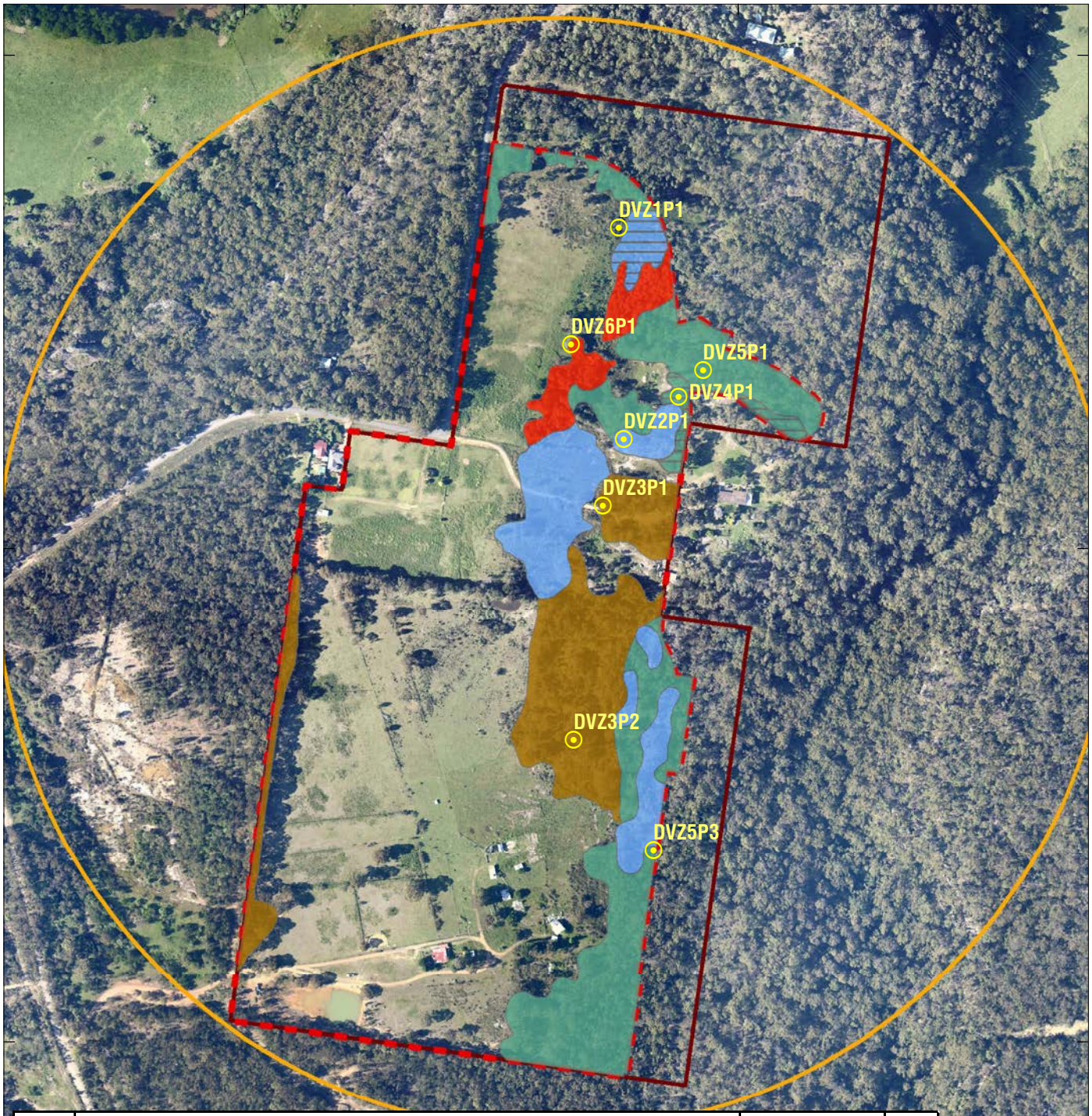
3.3 Species Credits

The species polygons for Nowra Heath-myrtle that lie within the Development Site and that will require clearing to allow construction of the Project are mapped in **Figure 6**. The species credits required to offset the clearing of Nowra Heath-myrtle within the Development Site are listed in **Table 9**. A total of 4980 species credits for Nowra Heath-myrtle would be required to be purchased and retired to fulfil the offset requirement (see **Appendix C**).

Table 9 Summary of species credits required to offset the development

Common Name	Species Name	No. Stems Removed[6]	Credits Generated by Development
Nowra Heath-myrtle	*Triplarina nowraensis*	332	4980

[6] Estimated using mean density of stems taken from a series of 20 m X 20 m plots during January 2016 surveys BOS. Number of stems amended in February 2017 following consultation with OEH.



Zone Code	Vegetation Zone	Condition	Area (Ha)
DVZ1	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	Moderate-Good / Poor	0.3
DVZ2	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	Moderate-Good / Medium	2.0
DVZ3	SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	Moderate-Good / Good	3.2
DVZ4	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	Moderate-Good / Poor	0.3
DVZ5	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	Moderate-Good / Medium	4.0
DVZ6	SR648 Swamp Mahogany swamp sclerophyll forest on coastal lowlands, Sydney Basin and South East Corner	Moderate-Good	0.7

LEGEND

- Plot / Transect Locations
- Development Site
- Site Boundary
- 100ha Landscape Assessment Circle

Development Vegetation Zone

- SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux (Mod-good / Poor)
- SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux (Mod-good / Medium)
- SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux (Mod-good / Good)
- SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes (Mod-good / Poor)
- SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes (Mod-good)
- SR648 Swamp Mahogany swamp sclerophyll forest on coastal lowlands, Sydney Basin and South East Corner (Mod-good)

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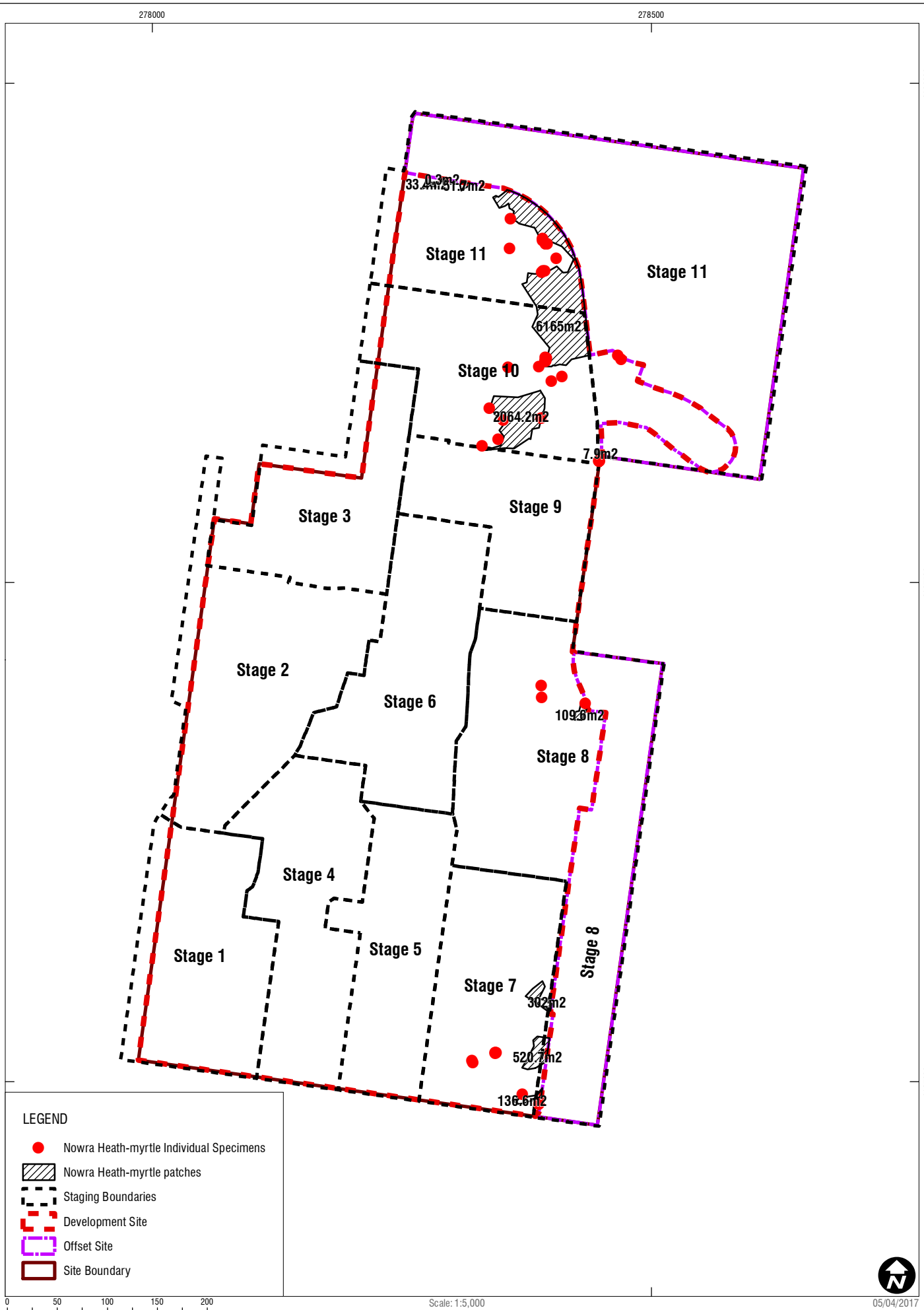
Vegetation Zones - Development Site

FIGURE 5



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Species Polygons in Development Site (Nowra Heath-myrtle)

FIGURE 6

4 BIODIVERSITY OFFSET SITE

This chapter provides details pertaining to the proposed 'Offset Site', which adjoins the Development Site to the east, in accordance with Table 22 of the FBA. The chapter presents the findings of a BioBanking assessment, in terms of the number and type of biodiversity credits potentially created, at the Offset Site.

4.1 Description of the Offset Site

The proposed Offset Site, which is referred to as the 'Public Reserve' in the previous *Flora and Fauna Assessment* (SLR 2015), adjoins the Development Site to the east and lies within two distinct parcels of land in the eastern parts of the site. The Offset Site is currently zoned *E2 – Environmental Conservation* under *Shoalhaven Local Environmental Plan 2014*.

The proposed Offset Site comprises 9.5 ha, split into two portions: a southern rectangular area of around 3.10 ha and a northern area of around 7.39 ha (**Appendix A**). Within both areas, stormwater detention basins are to be constructed, with a northern basin comprising 7000 m^2 ('C2') and a southern basin ('C1') comprising 2000 m^2. Construction of basins C1 and C2 will require vegetation removal and so these areas have been excluded from credit calculations for the Offset Site.

The site, incorporating the Offset Site, has historically been used for agricultural uses, and stock grazing continues across most of the cleared parts of the Development Site, with stray cattle observed within the proposed Offset Site during the January 2016 survey. The Offset Site is adjoined by a residential lot to the east and beyond by Flat Rock Reserve, with the cleared paddocks of the Development Site to the immediate west. Further afield the Offset Site is surrounded by bushland that lies within various reserves, including Triplarina Nature Reserve to the south, Shoalhaven State Forest to the southwest and Nowra Raceway to the southeast (**Figure 1**).

Flat Rock Creek runs south to north beyond the eastern boundary of the Offset Site and eventually flows into the Shoalhaven River. A small ephemeral tributary of Flat Rock Creek runs through the northern part of the Offset Site, draining to the northeast through an incised channel that is characterised by exposed sandstone outcrops. Native vegetation described as Spotted Gum Blackbutt shrubby open forest follows the alignment of the incised channel. The northern part of the Offset Site also supports a dense shrubland of Tickbush *Kunzea ambigua* and Nowra Heath-myrtle *Triplarina nowraensis*, with surrounding areas on sandstone supporting a dry sclerophyll forest of Grey Gum *Eucalyptus punctata* and Blue-leaved Stringybark *E. agglomerata*. The southern portion of the Offset Site also supports Grey Gum-Blue-leaved Stringybark open forest, with a series of steep sandstone benches traversing its eastern margins.

The Offset Site supports mainly native bushland in moderate to good condition, although there are small areas that show signs of historic disturbance, mainly around the southern end of the northern section, near the residential dwelling, with associated soil disturbance and weed growth. Three plant community types have been mapped across the Offset Site, as shown in **Figure 3** and listed **Table 10**.

Table 10 Plant community types mapped with the Offset Site

Plant Community Type (PCT)	Area (ha)
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	7.51
Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux	0.24
Spotted Gum - Blackbutt shrubby open forest on the coastal foothills	1.6
Total	**9.35**

4.2 Improvement in Biodiversity Values at the Offset Site

The biodiversity credits potentially created at the Offset Site are set out in this section, in terms of the two credit types available under the BioBanking Scheme:

- Ecosystem credits (see Section **4.2.1**); and
- Species credits (see Section **4.2.2**).

The credit results in the following subsections are based on a combination of GIS mapping and assessment to calculate 'Landscape Value' for the Offset Site, mapping of 'vegetation zones and plot/transect surveys (conducted in January 2016) to collect data to inform 'Site Value'.

4.2.1 Ecosystem credits available in Offset Site

The ecosystem credits (or PCTs) that would be created on the Offset Site, assuming the land is placed under a BioBanking Agreement and managed for biodiversity conservation purposes according to an approved Management Actions Plan, are listed in **Table 11**. A total of three ecosystem credit types have been identified and mapped within the Offset Site, generating a total of 77 credits.

The credit reports generated by the BioBanking Credit Calculator for the Offset Site are provided in **Appendix D**.

Table 11 Ecosystem credits potentially available in the Offset Site

Code	Ecosystem Credit (PCT)	Area (ha)	Credits Generated
SR549	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	7.51	61
SR556	Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux	0.24	2
SR641	Spotted Gum - Blackbutt shrubby open forest on the coastal foothills	1.6	14
	Total	**9.35**	**77**

The distribution of ecosystem credit types within the Offset Site is displayed in **Figure 7**.

A detail breakdown of the following variables for each ecosystem credit type is provided in **Table 12:**

- future site value score for each vegetation zone;
- change in landscape value score;
- 'Averted loss' at the offset site (noting that the Offset Site is zoned for environmental purposes under SLEP 2014 and so averted loss does not apply); and
- number of ecosystems credits created.

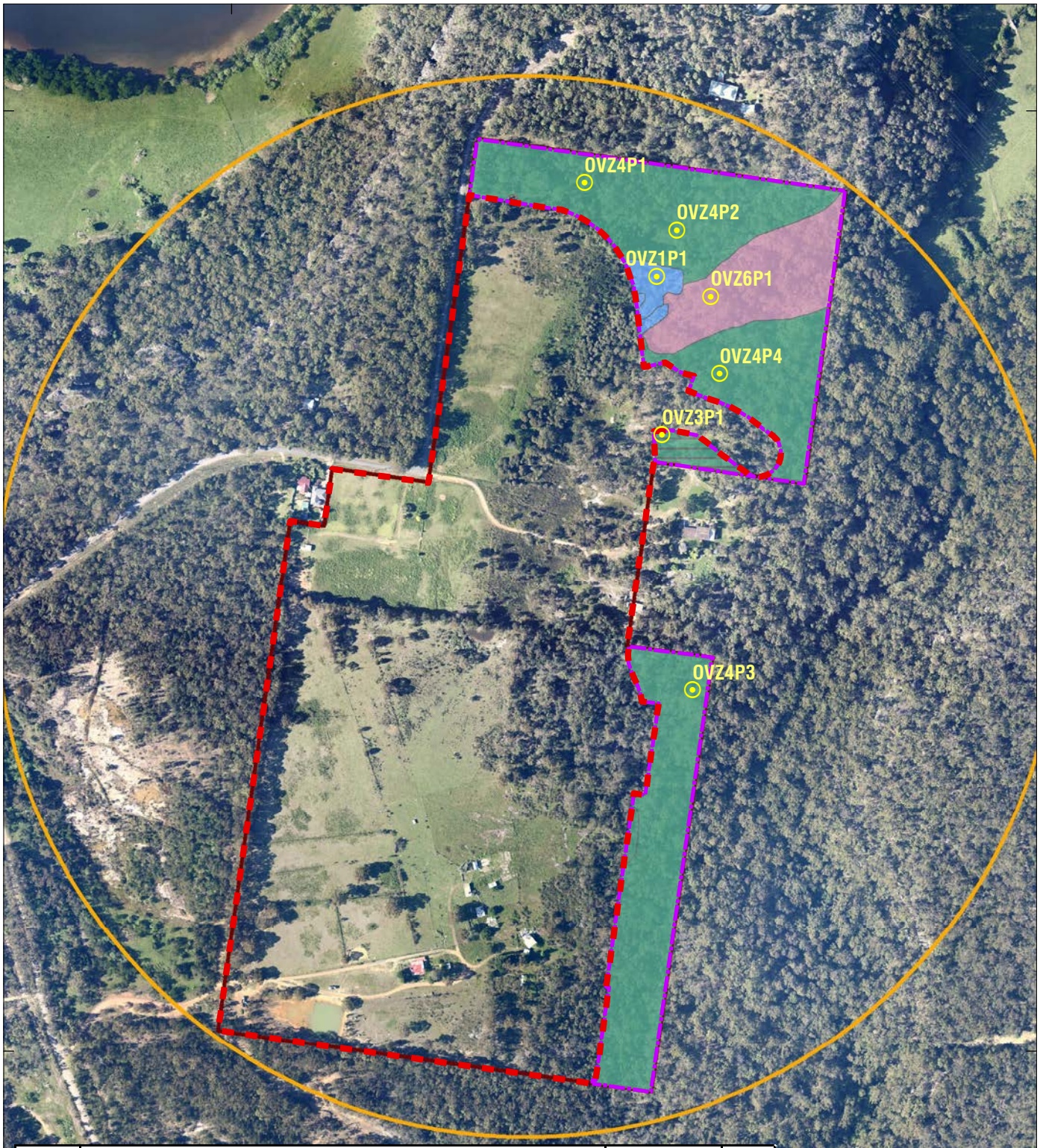
The results in **Table 12** indicate that overall the management of the Offset Site under a BioBanking Agreement will result in improvements in biodiversity values, with an overall site value increase of 68.27, landscape score of 14.5 and total credit output of 77 ecosystem credits (split across three PCTs).

Species credits that could potentially be created at the Offset Site are discussed in Section **4.2.2**.

Table 12 Ecosystem credits created for each vegetation zone at the Offset Site

Landscape score	Vegetation type name[#]	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
14.50	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good	OMZ4	7.31	72.92	84.38	11.46	59
14.50	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good -Poor	OMZ3	0.20	57.99	79.17	21.18	2
14.50	Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good	OMZ1	0.24	76.00	96.00	20.00	2
14.50	Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Moderate/Good	OMZ6	1.60	78.12	93.75	15.63	14
			Total	**9.35**	**285.03**	**353.3**	**68.27**	**77**

See **Figure 7** for distribution of vegetation zones (ecosystem credit types) within the Offset Site.



Zone Code	Vegetation Zone	Condition	Area (Ha)
OVZ1	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	Moderate-Good	0.3
OVZ3	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	Moderate-Good-Poor	0.2
OVZ4	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	Moderate-Good	7.4
OVZ6	SR641 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills	Moderate-Good	1.6

LEGEND

- Plot / Transect Locations
- 100ha Landscape Assessment Circle
- Development Site
- Offset Site
- Site Boundary

Vegetation Zone

- SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux (Mod-good)
- SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes (Mod-good-poor)
- SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes (Mod-good)
- SR641 Spotted Gum - Blackbutt shrubby open forest on the coastal foothills (Mod-good)

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Vegetation Zones - Offset Site

FIGURE 7

4.2.2 Species credits available in Offset Site

The creation of a biobank within the Offset Site will allow the retention of 3.13 ha and 129 ramets of Nowra Heath-myrtle. The distribution of Nowra Heath-myrtle within the Offset Site is shown in **Figure 8**.

Using the calculated mean density of 306 stems per hectare (see Section **3.3**), the mapped patches (totalling 3.13 ha) of Nowra Heath-myrtle have been converted into 958 ramets. When these ramets are added to the 129 ramets that were mapped individually, the total number of Nowra Heath-myrtle ramets within the Offset Site is estimated to be 1087 ramets.

Species credits generated within the Offset Site are listed in **Table 13**. A total of 7718 species credits for Nowra Heath-myrtle would be generated.

Table 13 Species credits available in Offset Site

Species Credit	Individuals	Credits Generated
Nowra Heath-myrtle *Triplarina nowraensis*	1087	7718

4.3 Management of the Offset Site

To generate the biodiversity credits described in Section **4.2**, a BioBanking Agreement must be placed over the land by the landowner, and approved by the OEH (and signed by the NSW Minister for the Environment). Under this arrangement, as with any biobank site, the Offset Site would be managed for biodiversity conservation according to a Management Actions Plan, approved by OEH, which will set out the methods for maintaining and improving biodiversity values over the life of the site (i.e. in perpetuity).

The key biodiversity values to be managed in the Offset Site are:

- stands of the threatened plant species Nowra Heath-myrtle *Triplarina nowraensis*;
- feed trees and denning sites (i.e. suitable tree hollows) for the local population of Yellow-bellied Glider;
- hollow bearing trees, particularly those containing large hollows that could act as potential roost or nest sites for the local population of Powerful Owl;
- other hollow-bearing trees that could provide roosting sites for threatened microchiropteran bats (including those previously recorded on the site);
- potential habitat for a selection of threatened orchid species that have been recorded in the locality, including *Pterostylis vernalis* and *Cryptostylis hunteriana*;
- habitat resources and fauna shelter sites available in sandstone rock outcrops; and
- riparian and freshwater habitat values associated with the drainage line (a tributary of Flat Rock Creek) that runs northeast into a gully in the northern section of the Offset Site.

The proposed management of the Offset Site is described in Chapter 8 of the *Flora and Fauna Assessment*. Key management actions that would be implemented in the Management Actions Plan include:

- collection of seed and cuttings from specimens of Nowra Heath-myrtle located within the Development Site prior to construction. Propagated specimens would be planted in the Offset Site within areas of suitable habitat;
- retention of hollow-bearing trees and fallen logs;
- weed management;
- feral animal control;

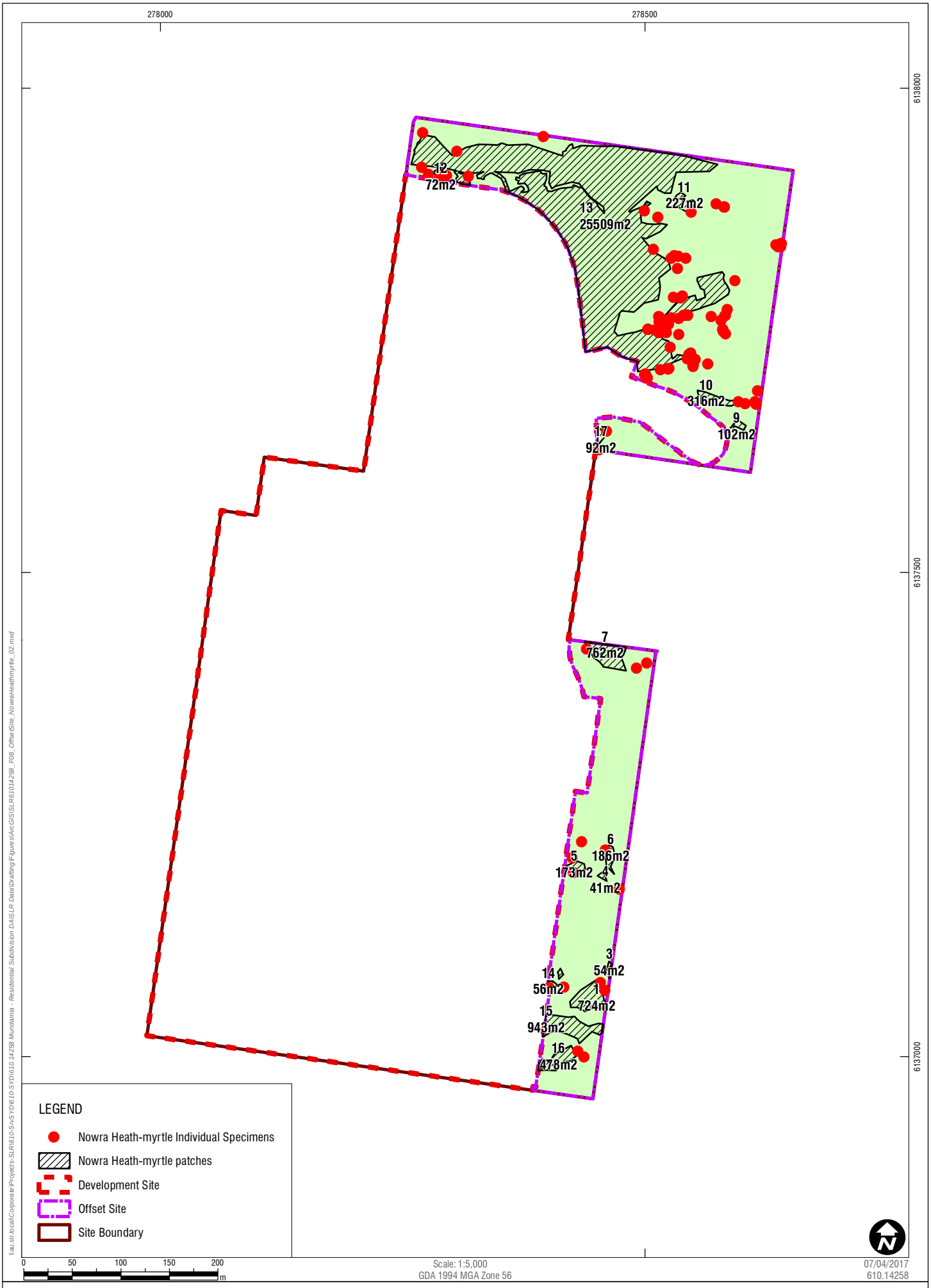
- exclusion of grazing stock using stock-proof fencing;
- placement of hollow sections of felled trees from the Development Site on the ground as 'hollow log' habitat for ground dwelling fauna; and
- placement of nest boxes in suitable trees as surrogate tree hollow habitat, and to compensate for the loss of tree hollows as part of construction of the Development.

'Additional management actions' are also identified in the credit report for each ecosystem credit type (see **Appendix D**), including:

- control of feral pigs;
- exclusion of commercial apiaries;
- exclusion of miscellaneous feral species;
- over-abundant herbivore control; and
- fox control.

As most of the Offset Site is located downslope of the proposed development, there will be a need to install bio-swales and other safeguards to minimise downslope siltation and nutrient flows from the development.

The biobank landowner may choose to implement additional actions on the land, which can be used to derive an increase in site value score in the Credit Calculator and thereby increase the ecosystem credits generated. This option will be explored further during the application for a BioBanking Agreement over the Offset Site.



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Species Polygons in Offset Site (Nowra Heath-myrtle)

FIGURE 8

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5 BIODIVERSITY OFFSET STRATEGY

This chapter provides the an overview of the available and feasible options to offset the biodiversity impacts of the Project, based on outputs of the BioBanking Credit Calculator, in accordance with Section 10 of the FBA.

5.1 Overview

The assessment completed as part of this BOS has determined that a biodiversity offset is required in accordance with the FBA and the *NSW Biodiversity Offsets Policy for Major Projects* (the 'Offsets Policy'; OEH 2014). The offset requirement for the project is described in Section **3**, and is as follows:

- 544 ecosystem credits are required to offset the project impacts, with the type and number of required ecosystem credits, and matching credit options, listed in **Table 8**; and
- 4980 Nowra Heath-myrtle species credits are required as part of the offset.

According to the Offsets Policy, a *Biodiversity Offset Strategy* (BOS) is required to set out how the proponent intends to fulfil the project's offset requirement and is to be submitted to NSW Planning and Environment with the project application.

5.2 Overview of Offset Options

The biodiversity credits required to offset the clearing of native vegetation and of Nowra Heath-myrtle have been calculated according to the methods prescribed in the FBA, as described in Section **3**. As the project is State Significant Development, the *NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) applies. Under the Policy, a proponent may choose to:

- purchase and retire the required like-for-like credits if they become available on the credit market (within the timeframe set out on the conditions of approval for the SSD project);
- apply variation rules where the like-for-like credits are not available, and purchase other ecosystem credits from the same vegetation formation or other species credits (as per the variation rules);
- if "supplementary measures" are applicable:
    - convert credits to hectares (see Section **5.6**) and purchase the required area of land (and manage that land in perpetuity under an approved management plan subject to a suitable legal agreement); or
    - other supplementary measures, such as donation to a local conservation project or a combination of the above measures. For example, the *Threatened Species Profile Database* for Nowra Heath-myrtle lists "Undertake further research into the species' response to fire" as a recommended management action; or
    - Deposit equivalent cost of the offset into an Offset Fund, as per Section **5.6.2**.

According to the Offsets Policy, proponents can meet their offset obligations through one or a combination of the following offset options:

- Like-for-like credit purchase (Option 1a) – the proponent purchases the required number and type of BioBanking credits from the BioBanking credit 'market' (publically available through the BioBanking Credit Register);
- Like-for-like credit creation (Option 1b) - the proponent creates a biobank site on their own land, which generates the required credits to fulfil their offset requirement; the proponent retires the required number and type of credits from their own portfolio of credits;

- Variations (Option 2) – where like-for-like offsets are not available, and the proponent can demonstrate that "reasonable steps" have been taken to find a suitable offset, proponents may apply the 'variation rules', as outlined in the Offsets Policy. Importantly, however, the Offsets Policy states that the variation rules cannot be applied to critically endangered species and communities (as listed under the TSC Act) and to species and communities listed under the EPBC Act. This applies to Nowra Heath-myrtle, which is a 'species credit' species and is listed under the EPBC Act. (No other matters requiring offsets, being the native vegetation to be removed, are listed as critically endangered or under the EPBC Act, hence the variation rules can apply);
- Rehabilitation of mine sites, which is not relevant to the Project; and
- Monetary contribution (to supplementary measures or to a State Government fund) (Option 3) - For this option to be available, proponents must demonstrate that the 'reasonable steps' have been taken to secure like-for-like offsets under Option 1 and/or 'varied' offsets under Option 2. Under this option, the proponent would calculate the equivalent monetary value of their offset requirement and pay this amount into a fund. At the time of writing, the fund had not been developed. During the current 'transitional implementation period' this option is not currently available to proponents, but is likely to become available within the next two to three years and hence is considered as a potential offsetting option for this BOS.

A summary of the available offsetting options for the Project is listed in **Table 14**.

Where the proponent has demonstrated reasonable steps have been taken to find a suitable like-for-like offset, but none are available, 'supplementary measures' can be used to fulfil offset obligations. The rules for applying and calculating supplementary measures are provided in the Offsets Policy. An interim method for calculating the monetary contribution for supplementary measures will be applied by OEH until a "fund calculator" is developed. An administrative cost of 10 % is added to the equivalent cost of a like-for-like offset. The amount calculated is deposited into a NSW Government fund, or invested in another approved conservation fund.

A proponent may use a combination of offset sites and supplementary measures to fulfil an offset requirement. All options listed in **Table 14**, as applicable to the Project, have been considered, and are discussed below.

Table 14 Ecosystem credits required for offset and matching credit types

Option	Offset Option	Offset Options/Comments

1a	Purchase and retire matching (like-for-like) ecosystem credits	• Like-for-like ecosystem credits comprise:
		  • Those of same PCT; or
		  • A PCT from the same vegetation class that has equal or higher percentage cleared value for the CMA
		• Like-for-like species credits comprise must be offset with the same threatened species credit, but not constrained by locality
		• Number and type of credits must be available on credit register, or will become available prior to construction (or during timeframe specified in the development consent)

1b	Purchase land and create required credits through a BioBanking Agreement	• Requires proponent to find suitable properties for sale in the IBRA subregion, purchase property (or properties) and then apply to have a BioBanking Agreement placed over the land; • Biobank site should contain matching credit types and minimum number of credits required • Proponent retires their own credits to offset project, using only Part A costs (i.e. management costs of biobank per credit).

2	Variation rules - Purchase and retire other credits within same vegetation formation	• Apply variation rules when matching credit types not available;
		• Variation rules cannot be applied to critically endangered species or communities or matters listed under EPBC Act;
		• For ecosystem credits, find ecosystem credits for PCTs that fall within same formations as those within Development Site, with equal or greater % cleared value for CMA;
		• For threatened species, find species credits as follows:
		  o for flora species (i.e. Nowra Heath-myrtle), same family and same life-form (i.e. tree, shrub, orchid etc.) as species impacted
		  o same locality, and
		  o under same or greater level of threat (i.e. as listed under TSC Act).

3	Supplementary measures	• Apply FBA variation rules; • Apply when suitable credits and/or biobank site unavailable or cannot be secured within BOS and construction timeframe; • Use interim method to calculate monetary contribution for supplementary measures; • Could be combination of credit purchase and land purchase.

4	Combination	• Purchase ecosystem credits and species credits, (or part thereof), if available;
		• Supplementary measure, as per above, which could be one or more of:
		  o Monetary deposit into fund
		  o Conservation actions to benefit a threatened species (in this case, Nowra Heath-myrtle).

5.3 Purchase like-for-like credits (Option 1a)

5.3.1 Ecosystem Credits

To fulfil their offsetting obligations under the SSD process, the proponent may choose to purchase and retire the ecosystem credits listed in Section **3**. At the time of writing, these credits are not available on the BioBanking Credit Register. The most likely scenario is that the required credits are generated by the proposed Offset Site, through the application of a BioBanking Agreement executed by either the proponent or by Shoalhaven City Council (subject to future agreement between these two parties). The availability of matching credits may change over the course of the determination of this SSD application and therefore purchase of like-for-like credits (Option 1a) remains a potential option available to the proponent.

One option under consideration is the transfer of the residual lands of the Offset Site to Council. Under this scenario, the proponent would settle on an agreement with Council (such as a memorandum of understanding) that sets out the type and number of credits that would be purchased from Council, once a BioBanking Agreement over the Offset Site is finalised. Once a credit price was determined by Council, the proponent would purchase the required credits and retire them from the market for the purposes of fulfilling the biodiversity offset requirement of the Project. The proponent would then be required to seek any remaining credits from the BioBanking credit market, subject to the trading rules for SSD projects set out in the Offset Policy (and discussed elsewhere in this Chapter).

The required like-for-like ecosystem credits to offset the Project and suitable alternative credit types, as produced by the Credit Calculator (see **Appendix C**), are listed in **Table 15**.

Table 15 Ecosystem credits created in the Development Site

Ecosystem Credit (PCT)	Credits Required	Available Credit Options ('Offset Options')
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes (SR549)	251	• Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion, (SR549) • Coast Grey Box - stringybark dry woodland on slopes of the Shoalhaven Gorges, southern Sydney Basin Bioregion, (SR534) • Forest Red Gum - Yellow Box woodland of dry gorge slopes, southern Sydney Basin Bioregion and South Eastern Highlands Bioregion, (SR547)
Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux (SR556)	109	• Hairpin Banksia - *Kunzea ambigua* - *Allocasuarina distyla* heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR556) • Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR557) • She-oak - Hairpin Banksia heathland on sandstone headlands of the Sydney Basin Bioregion, (SR618)
Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion (SR595)	151	• Red Bloodwood - Scribbly Gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion, (SR595) • Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateaux, Sydney Basin Bioregion, (SR597)

Ecosystem Credit (PCT)	Credits Required	Available Credit Options ('Offset Options')
		• Silvertop Ash - Red Bloodwood - Sydney Peppermint heathy open forest on moist sandstone plateaux, southern Sydney Basin Bioregion, (SR629) • Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion, (SR635) • Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion, (SR653)
Swamp mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion (SR648)	33	• Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion, (SR648) • Forest Red Gum - Woollybutt - Pithy Sword-sedge swamp woodland in dune swales near Pambula, southern South East Corner Bioregion, (SR546)
Total	**544**	

5.3.2 Species Credits

The required like-for-like species credits to offset the Project and suitable alternative credit types, as produced by the Credit Calculator (see **Appendix C**), are listed in **Table 16**. A total of 4980 species credits for Nowra Heath-myrtle are required to be purchased and retired to offset the Project.

The Offset Policy states that the variation rules cannot be applied to species listed under the EPBC Act. Consequently, the variation rules cannot be applied to Nowra Heath-myrtle, which his listed as a 'vulnerable' species under the EPBC Act. The only offset option available for Nowra Heath-myrtle, therefore, is to purchase like-for-like (i.e. Nowra Heath-myrtle) species credits.

Table 16 Species credits created at the Development Site

Species Credit Type	No. of loss	Credits Required	Available Credit Options
Nowra Heath-myrtle *Triplarina nowraensis*	332	4980	• Nowra Heath-myrtle credits

5.4 Generate Credits using the Offset Site (via BioBanking Agreement) (Option 1b)

The proponent may choose to create a BioBanking Agreement over a portion of land in order to generate the required like-for-like credits and retire these to fulfil the offset obligation. In this regard, Chapter 12 of the FBA states:

> "*12.1.1.1 Where a proponent is proposing to establish an offset site to satisfy the offset requirement, the assessor must use the BioBanking Assessment Methodology (BBAM) to:*
>
> *(a) assess the biodiversity values of the offset site, and*

(b) calculate the number and type of biodiversity credits that may be created from management actions that are or are proposed to be carried out on an offset site in accordance with the BBAM.

12.1.1.2 The number and type of credits that may be created at the offset site must be included in the BOS."

Accordingly, Section **4** of the BOS presents the results of our assessment of the biodiversity values of the Offset Site, in terms of the number and type of biodiversity credits that could be generated through the application of a BioBanking Agreement over that portion of the site, with associated management actions carried out in accordance with an approved 'Management Actions Plan'. The number and type of credits potentially generated at the Offset Site has been calculated using the BioBanking Credit Calculator (Proposal ID 0107/2015/2302B), with reference to the recently published *Credit Calculator for Major Projects and BioBanking Operational Manual* (OEH 2016).

The balance of credits required for offsetting the project and those that would be generated within the Offset Site are summarised in **Table 17**.

The creation of a biobank within the Offset Site would generate 7718 Nowra Heath-myrtle credits. If the proponent chose to use these species credits to offset the Project, the Offset Site would be able to fulfil the project offset requirement of 4980 Nowra Heath-myrtle species credits, leaving a surplus of 2624 species credits.

The creation of a biobank over the Offset Site would generate 77 ecosystem credits (see **Table 13**). Two of the three ecosystem credit types available in the Offset Site, including SR549 Grey Gum-Blue-leaved Stringybark open forest on gorge slopes (61 credits) and SR556 Hairpin Banksia-Kunzea ambigua-Allocasuarina distyla heath on coastal sandstone plateaux (2 credits), are 'Offset options' for the development impacts (see **Table 15**). However, the credits generated for SR641 Spotted gum-Blackbutt shrubby open forest on the coastal foothills (14 credits) are not offset options listed for the ecosystem credits required for the development impacts (see **Table 15**). The variation rules would need to be applied to allow future use of these credits to offset the Project impacts.

As mentioned above, the proponent proposes to transfer the Offset Site to Council and purchase the required credits from Council as the (future) biobank owner.

Table 17 BioBanking credits balance – Mundamia Development Site and Offset Site

Credit Type	Development Credits to Retire	Credits Available in Offset Site	Credits Balance
Ecosystem	544	77	-467#
Species			
Nowra Heath-myrtle	4980	7718	+2738

Note: not all ecosystem credits in the Offset Site can be used to directly offset the project, without applying the Offsets Policy 'variation rules'.

5.5 Apply Variation Rules (Not like-for-like credits) (Option 2)

In the case where the required credits are not available, and hence a 'like-for-like' offset is not achievable, proponents can apply the variation rules for matching credits. However, a hierarchy of options must be followed, with the proponent demonstrating that "all reasonable steps have been taken…to secure a matching ecosystem credit".

5.5.1 Ecosystem Credits

The consent authority may approve a variation of the offset rules for matching ecosystem credits, by allowing ecosystem credits created for a PCT from the same vegetation formation as the required ecosystem credit to be proposed as part of the BOS, where in the consent authority's opinion the BOS demonstrates that:

- all "reasonable steps" to secure a matching ecosystem credit have been taken by the proponent; and
- the required ecosystem credit is not for a PCT associated with a critically endangered ecological community (CEEC) listed on the *Threatened Species Conservation Act 1995* (TSC Act) or an ecological community listed on the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- the PCT from the same vegetation formation has a percent cleared value of the PCT in the major catchment area equal to or greater than the percent cleared of the PCT to which the required ecosystem credit relates; or
- where the required ecosystem credit is for a PCT that is associated with a CEEC/EEC, the PCT from the same formation is also associated with a CEEC/EEC.

5.5.2 Species Credits

The Offset Policy notes that the variation rules cannot be applied to critically endangered species and communities, as listed under the TSC Act, and to matters listed under the EPBC Act. Hence the variation rules cannot be applied to Nowra Heath-myrtle, which is listed under the EPBC Act.

5.5.3 Reasonable Steps

"Reasonable steps" to locate like-for-like offsets are listed in the Offset Policy and are summarised as follows:

- investigating land already owned by the proponent within the IBRA subregion or CMA, whether the Development Site or other properties;
- liaising with an OEH office and local council to obtain a list of potential sites that meet the requirements for offsetting;
- placing an Expression of Interest (EOI) for the credits wanted on the BioBanking public register (i.e. the 'Credits Wanted Register') for at least six months, whilst regularly checking the register to see if the required credits have become available;
- considering properties for sale in the "required area" (presumably within the IBRA subregion or CMA); and
- providing evidence of why offset sites are not feasible (e.g. unwillingness of a landowner to sell).

SLR, in consultation with the proponent and with OEH, has already commenced investigation of realistic offsetting alternatives and proceeding with the 'reasonable steps' listed above to identify an acceptable offset. In this regard, we note:

- At the time of writing no suitable ecosystem credits are available or have been advertised via an EOI;
- An EOI for the required ecosystem credits was published on the 'Credits Wanted' register (ID: 51) in December 2015 (date lodged 12/12/2015); the six months EOI period for the ecosystem credits lapsed in June 2016.
- An EOI was submitted in September 2016 for the required Nowra Heath-myrtle species credits, as suggested by OEH; the six month EOI period will for the species credits will expire in March 2017;

- Additional land already owned by the proponent (excluding the Offset Site), or available to be purchased by the proponent within the locality, is not currently available; and
- SLR has consulted with OEH on the availability of offset lands in the region. At the time of writing, OEH are not aware of any suitable properties that meet the requirements for this project.

5.6 Supplementary measures (Option 3)

5.6.1 Overview

Under the Offsets Policy, where a proponent can demonstrate that all "reasonable steps" have been taken to obtain like-for-like credits or a suitable offset site, they can choose to use "supplementary measures". Reasonable steps to locate like-for-like offsets are listed in the Policy and summarised as follows:

- investigating land already owned by the proponent within the IBRA subregion or CMA, whether the Development Site or other properties;
- liaising with an OEH office and local council to obtain a list of potential sites that meet the requirements for offsetting;
- placing an Expression of Interest for the credits wanted on the BioBanking public register (i.e. the 'Credits Wanted Register') for at least six months, whilst regularly checking the register to see if the required credits have become available;
- considering properties for sale in the "required area" (presumably within the IBRA subregion or CMA); and
- providing evidence of why offset sites are not feasible (e.g. unwillingness of a landowner to sell).

5.6.2 Fund Deposit

The *NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014a) allows for the option of converting credits to dollars and the subsequent deposit of the calculated monetary value to a NSW Government Fund. A formula for calculating the monetary contribution of supplementary measures is provided in the Offset Policy.

In the case of the Project at Mundamia, if the required ecosystem credits (whether like-for-like or other approved credits under the variation rules) or a suitable offset site do not become available during the period of the EOI, then the proponent will negotiate a suitable monetary amount to substitute for the offset credit requirement. Considering the offsetting options presented in this Chapter, the options for applying supplementary measures would include:

- Convert the entire ecosystem credit requirement to a monetary value, according to the Offset Policy, as agreed with OEH, on the assumption that no like-for-like credits (or other credits approved under the variation rules) become available during the EOI period and that the residual lands are not converted into an Offset Site under a BioBanking Agreement; or
- Convert any remaining ecosystem credits to a dollar value, after transfer of credits generated at the Offset Site, on the assumption that a BioBanking Agreement is placed over the Offset Site and that the residual ecosystem credits do not become available during the EOI period.

The NSW Offset Fund is not yet operational and there no set date for when the Fund will be available to proponents of SSD projects. Consequently, it is uncertain as to whether the application of this supplementary measure will be available to the proponent. However, the conditions of approval for the project could be drafted in such a way as to allow sufficient time for the proponent to either (i) find the required credits on the Credit Register or (ii) if the credits do not become available in the timeframe, provide for deposit of the equivalent monetary value of the credits into the Fund (should it become operational in this time).

5.7 Combination of Variation Rules and Supplementary measures (Option 4)

A fourth offsetting option is a combination of supplementary measures, variation rules and credit purchases, as follows:

- Purchase and retirement of the some of the biodiversity credits required (or equivalent as permitted as per the Variation Rules) should they become available over the required period; with
- Supplementary measures, being a monetary contribution equivalent to the remainder of the credits not purchased. The amount calculated is deposited into a NSW Government fund, or invested in another approved conservation fund.

5.8 Staging of Credit Purchases

As noted in Section **1.3**, the proposed subdivision and development of the site will be progressed in stages, with 11 stages identified. The proposed boundaries of the stages are shown in **Figure 9**.

In terms of the timing of credit purchases, the Offsets Policy states that "Proponents will generally have to secure offsets before development commences". Should the proponent wish to secure the offset after the commencement of construction, they must enter into a voluntary planning agreement (VPA) prior to the granting of project approval. The VPA would mandate the offset requirement to be carried out. This will involve the proponent providing security to ensure the offset requirement is fulfilled.

5.8.1 Ecosystem Credits

The removal of native vegetation required within each stage has been calculated in GIS as part of the preparation of this BOS. The vegetation removal (in hectares) for each vegetation zone was converted into a number of corresponding ecosystem credits using ratios calculated for each zone (based on the credit results for the Development Site attached in **Appendix C**). The ecosystem credits required to be purchased and retired to offset development impacts for each stage of the proposed development are listed in **Table 18**.

Table 18 Ecosystem credits required per development stage

Stage	Credit Type	No. Credits
1	SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	12
2	SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	12
5	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	4
6	SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	23
6	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	29
7	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	93
7	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	5
8	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	41
8	SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	81

Stage	Credit Type	No. Credits
8	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	27
9	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	4
9	SR595 Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux	28
9	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	33
9	SR648 Swamp Mahogany swamp sclerophyll forest on coastal lowlands, Sydney Basin and South East Corner	5
10	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	29
10	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	1
10	SR648 Swamp Mahogany swamp sclerophyll forest on coastal lowlands, Sydney Basin and South East Corner	24
11	SR549 Grey Gum - Blue-leaved Stringybark open forest on gorge slopes	59
11	SR556 Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux	13
11	SR648 Swamp Mahogany swamp sclerophyll forest on coastal lowlands, Sydney Basin and South East Corner	3
	Grand Total	**544**

For simplicity, the credit purchases for the 11 stages are proposed to occur in five tranches, A to E, as listed in **Table 19**.

A set of maps has been produced showing the vegetation clearing required within each stage and these are provided in **Appendix E**.

Table 19 Ecosystem credits to retire at each combined Development Stage

Combined Stage (Tranche)	Development Stage	Total Ecosystem Credits To Retire
A	1, 2	24
B	3, 4	0
C	5, 6	56
D	7, 8	247
E	9, 10 and 11	217
	Total Credits:	**544**

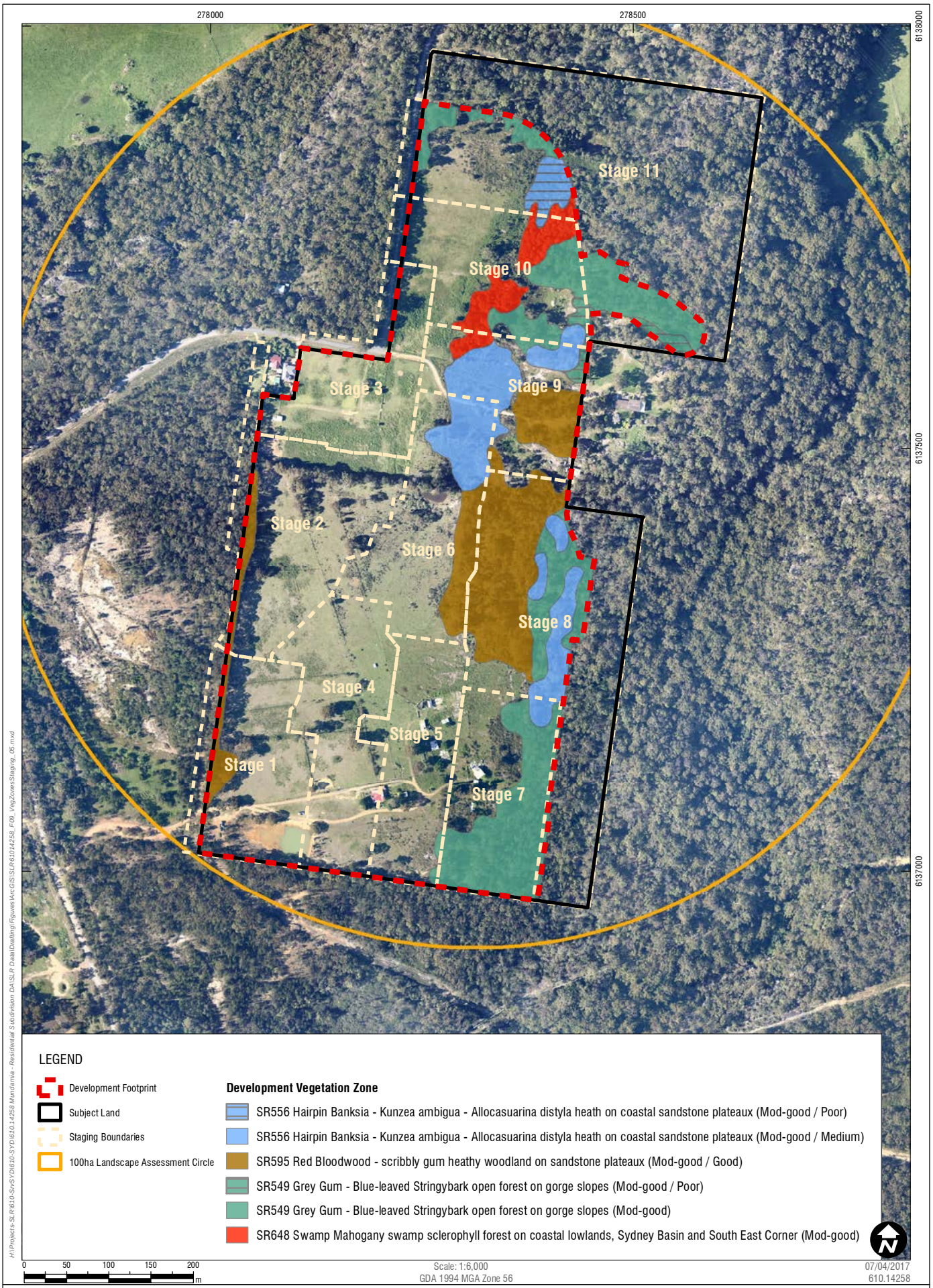
5.8.2 Species Credits (Nowra Heath-myrtle)

The clearing of Nowra Heath-myrtle stems required for each development stage has been calculated in GIS, as discussed in Section **2.4** and is listed in **Table 20**. The total requirement for Nowra Heath-myrtle species credits is 4980. These credits would be purchased and retired as the development progresses, according to the staging plan in **Table 20.** The staging boundaries and species polygons for Nowra Heath-myrtle within the Development Site are shown in **Figure 6**.

A map showing the patches and ramets of Nowra Meath-myrtle within each development stage is provided in **Appendix E.**

Table 20 Nowra Heath-myrtle removal within the Development Site (by stage)

Stage	Total Stems	Credits per stem	Species Credits
7	31	15	465
8	13	15	195
9	0	15	0
10	160	15	2400
11	128	15	1920
	332	**Total:**	**4980**



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Proposed Development Staging Boundaries

FIGURE 9

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary and Conclusions

The assessment conducted for this BOS has calculated a biodiversity offset according to the FBA by applying BioBanking methodology and credit calculations. The impacts on biodiversity of the construction and operation of the Project have been calculated in terms of biodiversity credits as follows:

- 544 ecosystem credits for four plant community types, as described in Section **3.2**; and
- 4980 species credits for Nowra Heath-myrtle, as described in Section **3.3.**

As described in Section **4** of this BOS, the proponent has access to residual lands within the site (that adjoin the Development Site) that contain the some of the ecosystem credit types as those required for offsetting (i.e. 'like-for-like' offsets). A BioBanking Agreement placed over the Offset Site would generate 77 ecosystem credits (across three PCTs) and 7718 Nowra Heath-myrtle species credits. Consequently, the proposed Offset Site would allow for partial offsetting of the ecosystem requirement, with a residual of 478 ecosystem credits still required. Importantly, the Offset Site does not contain two of the ecosystem credit types found with the Development Site: Red Bloodwood-Scribbly Gum heathy woodland (SR595) or Swamp mahogany swamp sclerophyll forest (SR648), which would have to be sought on the Credit Register (or elsewhere).

Conversely, the Offset Site would provide the full amount of Nowra Heath-myrtle species credits required for offsetting the development, but with a surplus of species credit created. Accordingly, the recommended approach to biodiversity offset for the Project is Option 4, as described in Section **5.7**, which would involve:

- Establish a BioBanking Agreement over the Offset Site, and use the resultant biodiversity credits to offset the Project impacts.
- Retire the required the ecosystem credits and species credits to offset the Project, subject to the proposed staging of works. As the Project would be developed in stages, the credits required for offsetting, as set out in this BOS, would be retired according to the impacts and credit requirement of each stage. The proposed staging of credit purchases is outlined in Section **5.8**.
- Where possible, offset credits would be retired prior to commencement of construction. Where this is not possible, a Voluntary Planning Agreement (VPA) between the proponent and NSW Planning & Environment would be entered into and approved prior to the commencement of development. The VPA would state the offset credit requirement.
- Submit an EOI for the remaining ecosystem credits on the 'Credit Wanted' register (on the BioBanking web site) following approval of the BOS. An EOI was submitted in December 2015, as noted above.
- Monitor the availability of required ecosystem credits on the Credit Register and purchase and retire credits if and when available, for a period of at least six months.

6.2 Next Steps

Actions proposed to fulfil the offset requirement for the project will involve:

- monitor the availability of matching ecosystem credits during the advertisement period (as required by OEH), including regularly checking the credit register for ecosystem credits that match the required type and number of credits, including 'variation credits' from the same vegetation formations (as listed in **Table 14**);
- consult regularly with the OEH BioBanking Team and the Wollongong office of OEH on the availability of suitable credits during the advertisement (EOI) period;
- during the advertisement period, purchase like-for-like credits, if they become available; or

- if like-for-like credits are not available at the end of the advertisement (EOI) period, either:
  - apply variation rules and purchase ‘variation credits’ (excluding Nowra Heath-myrtle credits); or
  - apply supplementary measures and calculate suitable monetary fund deposit.

As noted in Section **5.8**, the proponent is required to secure offsets prior to construction or alternatively sign a voluntary planning agreement, which sets out the offset requirement, prior to project approval.

7 REFERENCES

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APPENDIX A
Subdivision Layout Plan

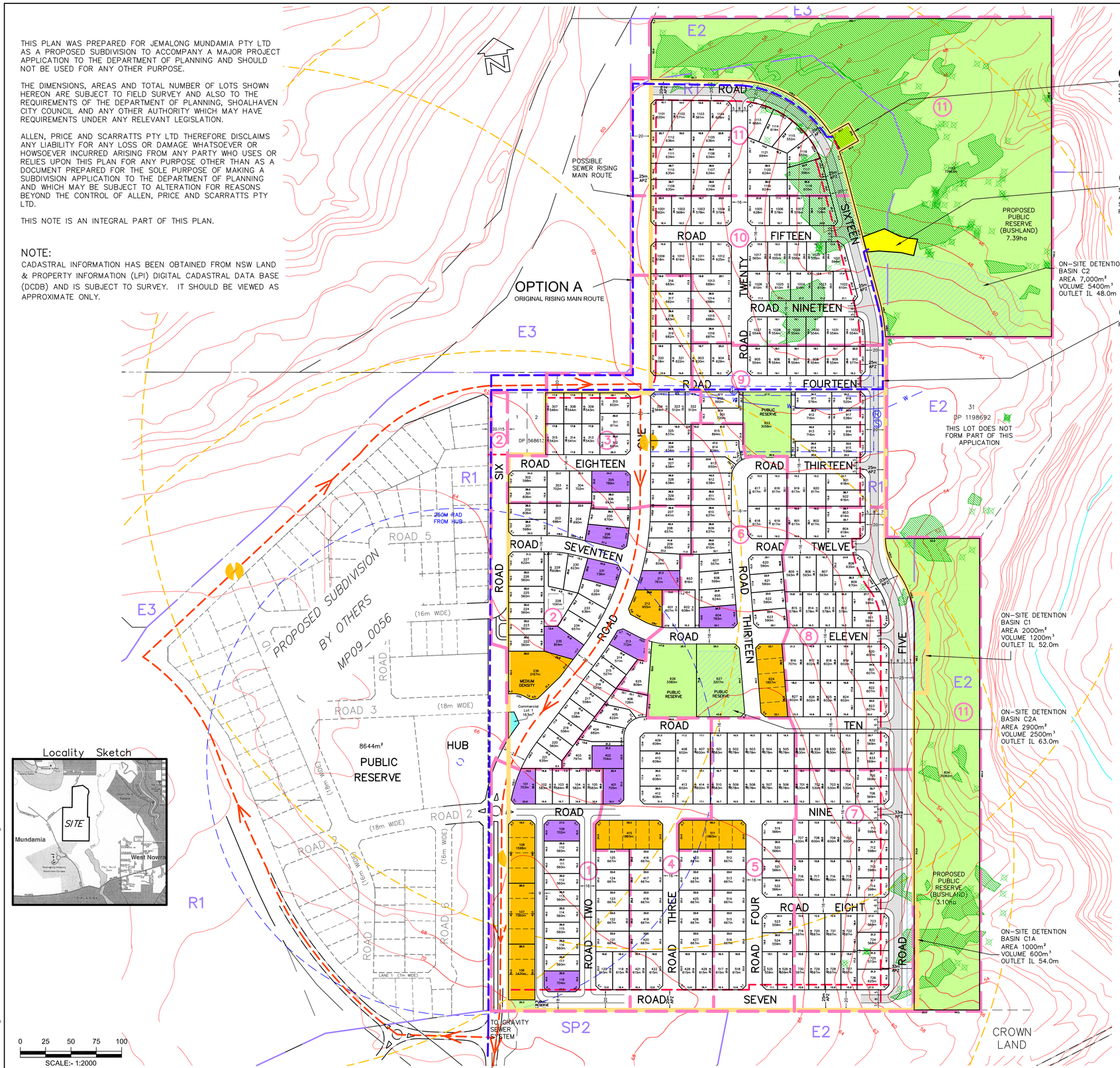
THIS PLAN WAS PREPARED FOR JEMALONG MUNDAMIA PTY LTD AS A PROPOSED SUBDIVISION TO ACCOMPANY A MAJOR PROJECT APPLICATION TO THE DEPARTMENT OF PLANNING AND SHOULD NOT BE USED FOR ANY OTHER PURPOSE.

THE DIMENSIONS, AREAS AND TOTAL NUMBER OF LOTS SHOWN HEREON ARE SUBJECT TO FIELD SURVEY AND ALSO TO THE REQUIREMENTS OF THE DEPARTMENT OF PLANNING, SHOALHAVEN CITY COUNCIL AND ANY OTHER AUTHORITY WHICH MAY HAVE REQUIREMENTS UNDER ANY RELEVANT LEGISLATION.

ALLEN, PRICE AND SCARRATTS PTY LTD THEREFORE DISCLAIMS ANY LIABILITY FOR ANY LOSS OR DAMAGE WHATSOEVER OR HOWSOEVER INCURRED ARISING FROM ANY PARTY WHO USES OR RELIES UPON THIS PLAN FOR ANY PURPOSE OTHER THAN AS A DOCUMENT PREPARED FOR THE SOLE PURPOSE OF MAKING A SUBDIVISION APPLICATION TO THE DEPARTMENT OF PLANNING AND WHICH MAY BE SUBJECT TO ALTERATION FOR REASONS BEYOND THE CONTROL OF ALLEN, PRICE AND SCARRATTS PTY LTD.

THIS NOTE IS AN INTEGRAL PART OF THIS PLAN.

NOTE:
CADASTRAL INFORMATION HAS BEEN OBTAINED FROM NSW LAND & PROPERTY INFORMATION (LPI) DIGITAL CADASTRAL DATA BASE (DCDB) AND IS SUBJECT TO SURVEY. IT SHOULD BE VIEWED AS APPROXIMATE ONLY.



COMMERCIAL
DUAL OCCUPANCY
MULTI DWELLING HOUSING
APZ LINE
PROPOSED BUS ROUTE SHOWING DIRECTION OF TRAVEL
PROPOSED BUS STOP
500m WALKING DISTANCE FROM PROPOSED BUS STOP
R1 ZONING LINE
DENOTES LOCATION OF NOWRA HEATH MYRTLE BY SLR– FIG. 8
DENOTES LOCATION OF NOWRA HEATH MYRTLE PATCHES BY SLR FIG. 8
PROPOSED SEWER RISING MAIN ROUTE BY SCC
(11) STAGING
DEVELOPABLE AREA
DENOTES EASEMENTS OF DP 1198692 TO BE PROGRESSIVELY EXPUNGED AS WORKS PROGRESS

EASEMENTS CREATED IN DP 1198692

(W) DENOTES EASEMENT FOR WATER OVER EXISTING LINE OF PIPE (APPROX. POSITION) (DP 1198692)
(R) RIGHT OF WAY 75 WIDE (DP 1198692)
(S) EASEMENT FOR SUPPLY OF SERVICES 75 WIDE (DP 1198692)
(E) EASEMENT FOR OVERHEAD POWERLINES 9 WIDE (DP 1198692)

RESIDENTIAL STAGING

1	25 LOTS	+ P.R.
2	36 LOTS	
3	29 LOTS	
4	29 LOTS	
5	26 LOTS	
6	25 LOTS	+ 2xP.R.
7	30 LOTS	
8	33 LOTS	
9	22 LOTS	+ P.R.
10	32 LOTS	
11	21 LOTS	+ 2xP.R.
TOTAL	308 LOTS	+ 4xP.R.

LOT YIELD

RESIDENTIAL LOTS	288	
DUAL OCCUPANCY	12	(24 DWELLINGS)
MULTI DWELLING LOTS	8	(34 DWELLINGS)
TOTAL	308	(346 DWELLINGS)
PUB. RES.	4	
PUB.RES.–BUSHLAND	2	
COMMERCIAL LOT	1	

OVERALL SITE AREA 41.39 ha

OVERALL DEV. AREA 30.027 ha

JEMALONG PUBLIC RESERVE	9,905m²
SCC PUBLIC RESERVE	8,644m²
TOTAL	18,549m²

RESERVE AREA REQUIRED
JEMALONG
346 DWELLINGS x 2.5 People x 12m² = 10,380m²

SCC
103 LOTS x 2.5 People x 12m² = 3,090m²

TOTAL 13,470m²

PUBLIC RESERVE (BUSHLAND)–NTH	7.39ha
PUBLIC RESERVE (BUSHLAND)–STH	3.10ha
TOTAL	10.49ha

JEMALONG DEVELOPMENT AREA PER HECTARE
30.02ha/346 dwellings = 11.52 dwellings per hectare

Locality Sketch

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE

SEWER PUMPING STATION OPTIONS

BASED ON PROPOSED SUBDIVISION DRAWING - 25489 -11 REV 15 (20.02.2017)

RATIO:	DATUM:	SURVEY		REV	DESCRIPTION	BY	DATE
1:2000 (AT A1 ORIGINAL)	ORIGIN:	DESIGN	MJP				
		DRAWN	DGS				
	DATE OF PLAN: 01.03.2017	CHECK'D					

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PLAN SHOWING SPS OPTIONS ON PROPOSED SUBDIVISION OF LOT 30 DP 1198692 (PREVIOUSLY LOT 3 DP 568613 & LOT 384 DP 755952) AT MUNDAMIA GROWTH AREA FOR JEMALONG MUNDAMIA PTY LTD

DRAWING STATUS
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER 25489-24 | SHEET 1 OF 1 | REVISION 00

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APPENDIX B
Minimum information required for the Biodiversity Offset Strategy

Report section	Information	Maps & data	Location in BOS
Offset site identification	Offset site(s) details, including: • location • general description of offset area • land-use history • lot and DP numbers.	• Location of offset site relative to Development Site • Offset site boundary map • Cadastral map of offset site	Chapter 4
Improvement in biodiversity values at an offset site	Ecosystem credits and species credits created at an offset site, including: • future site value score for each vegetation zone at the offset site • change in landscape value score • averted loss at the offset site • number of ecosystem credits created for the improvement in biodiversity values for each vegetation zone at an offset site	• Table of PCTs at the offset site and the number of ecosystem credits created • Table of species and populations at the offset site and the number of species credits created	Chapter 4

Report section	Information	Maps & data	Location in BOS
Improvement in biodiversity values at an offset site	• number of species credits created for each threatened species that occurs on the offset site • management actions proposed for the offset site to improve biodiversity values, including full disclosure of existing obligations and management actions and the credit adjustments relating to these • justification for any variation to the offset rules as outlined in Subsection 10.5.7. • Credit profiles for ecosystem credits and species credits at the offset site.	• Full biodiversity Credit Calculator output • Submitted proposal in the Credit Calculator • Table of credit type and matching credit profile • Biodiversity credit report from the Credit Calculator	Chapter 4

Report section	Information	Maps & data	Location in BOS
Rehabilitation site identification	Biodiversity credits to be created on land identified for ecological rehabilitation and other information about the proposed ecological rehabilitation including: • completion/relinquishment criteria in accordance with FBA Paragraph 12.2.1.5 • the rehabilitation objectives for ecological rehabilitation works in accordance with FBA Paragraph 12.2.1.6 • for each PCT, specify the increase in the site attribute score that will be achieved for each site attribute set out in Table 2 • the total number of biodiversity credits proposed to be created for the ecological rehabilitation for each PCT that is the target of the rehabilitation in accordance with FBA Section 12.2.	• Table of PCTs at the offset site and the number of ecosystem credits created • Full biodiversity Credit Calculator output • Submitted proposal in the Credit Calculator	Not applicable (relates only to mining projects)
Supplementary measures	Identification of ecosystem and species credits that are proposed to be converted to a supplementary measure, including: • entity to which the proposed supplementary measure would apply and quantum of credits • justification for proposed use of supplementary measures, in accordance with the guidance in FBA Paragraphs 10.5.4.3 and 10.5.7.5. • calculation of the amount of money to be spent on supplementary measures must be based on the estimated costs (following the method described in the NSW Biodiversity Offsets Policy for Major Projects) and a description of the actions proposed to be funded • proposed supplementary measure • statement of biodiversity outcome resulting from proposed supplementary measure.		Section 5.6

Report section	Information	Maps & data	Location in BOS
Summary	Summary of biodiversity offset measures and how these match to credit requirements created by the Development Site. A management plan detailing management actions and the vegetation zones to which they will apply in accordance with BBAM Section 12.9.		Executive Summary Chapter 6

APPENDIX C

BioBanking Credit Report – Development Impacts

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0107/2016/2436MP
Proposal name :	Mundamia Impacts (SSD 7069) v4.0
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	27/04/2017 09:35

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
Circle 2	14.80	SR556_Moderate/Good_Poor	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good_Poor	Yes	dmz1	0.31	40.67	0.00	40.67	0	9	Spotted-tailed Quoll	44.44	2.60	9
Circle 2	14.80	SR556_Moderate/Good_Medium	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good_Medium	No	dmz2	1.98	71.78	0.00	71.78	0	100	Spotted-tailed Quoll	55.56	2.60	100
Circle 2	14.80	SR595_Moderate/Good	Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	Moderate/Good	Yes	dmz3	3.16	58.68	0.00	58.68	0	151	Masked Owl	58.33	3.00	151
Circle 2	14.80	SR549_Moderate/Good_Poor	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good_Poor	Yes	dmz4	0.26	54.17	0.00	54.17	0	12	Masked Owl	41.67	3.00	12
Circle 2	14.80	SR549_Moderate/Good	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good	Yes	dmz5	4.01	74.48	0.00	74.48	0	239	Masked Owl	91.67	3.00	239
Circle 2	14.80	SR648_Moderate/Good_Medium	Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	Moderate/Good_Medium	Yes	dmz6	0.74	54.00	0.00	54.00	0	33	Powerful Owl	25.00	3.00	33

BioBanking Credit Calculator

Species credits

Proposal ID :	0107/2016/2436MP
Proposal name :	Mundamia Impacts (SSD 7069) v4.0
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	27/04/2017 09:35

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
Triplarina nowraensis	Nowra Heath Myrtle	1.50	No		332.00	0.00	Yes	4,980

Biodiversity credit report

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

Date of report: 27/04/2017 Time: 9:36:27AM Calculator version: v4.0

Major Project details

Proposal ID:	0107/2016/2436MP
Proposal name:	Mundamia Impacts (SSD 7069) v4.0
Proposal address:	George Evans Rd Mundamia NSW 2540
Proponent name:	Jemalong Mundamia
Proponent address:	c/- Allen Price & Skarratts 75 Plunkett Street Nowra NSW 2541
Proponent phone:	(02) 4421-6544
Assessor name:	Jeremy Pepper
Assessor address:	Level 3 10 Kings Road New Lambton NSW 2305
Assessor phone:	02 4037 3200
Assessor accreditation:	0107

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	4.27	251.00
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	2.29	109.00
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	3.16	151.00
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion	0.74	33.00
Total	10.46	544

Credit profiles

1. Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion, (SR549)

Number of ecosystem credits created	251
IBRA sub-region	Ettrema

Offset options - Plant Community types	Offset options - IBRA sub-regions
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion, (SR549) Coast Grey Box - stringybark dry woodland on slopes of the Shoalhaven Gorges, southern Sydney Basin Bioregion, (SR534) Forest Red Gum - Yellow Box woodland of dry gorge slopes, southern Sydney Basin Bioregion and South Eastern Highlands Bioregion, (SR547)	Ettrema and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion, (SR595)

Number of ecosystem credits created	151
IBRA sub-region	Ettrema

Offset options - Plant Community types	Offset options - IBRA sub-regions
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion, (SR595) Silvertop Ash - Red Bloodwood - Sydney Peppermint heathy open forest on moist sandstone plateaux, southern Sydney Basin Bioregion, (SR629) Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion, (SR635) Sydney Peppermint - Smooth-barked Apple - Red Bloodwood shrubby open forest on slopes of moist sandstone gullies, eastern Sydney Basin Bioregion, (SR653)	Ettrema and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR556)

Number of ecosystem credits created	109
IBRA sub-region	Ettrema

Offset options - Plant Community types	Offset options - IBRA sub-regions
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR556) Hairpin Banksia - Slender Tea-tree heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR557) She-oak - Hairpin Banksia heathland on sandstone headlands of the Sydney Basin Bioregion, (SR618)	Ettrema and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion, (SR648)

Number of ecosystem credits created	33
IBRA sub-region	Ettrema

Offset options - Plant Community types	Offset options - IBRA sub-regions
Swamp Mahogany swamp sclerophyll forest on coastal lowlands of the Sydney Basin Bioregion and South East Corner Bioregion, (SR648) Forest Red Gum - Woollybutt - Pithy Sword-sedge swamp woodland in dune swales near Pambula, southern South East Corner Bioregion, (SR546)	Ettrema and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Nowra Heath Myrtle	Triplarina nowraensis	332.00	4,980

APPENDIX D

BioBanking Credit Report – Offset Site

BioBanking Credit Calculator

Ecosystem credits

Proposal ID : 0107/2015/2302B

Proposal name : Mundamia Biobank

Assessor name : Jeremy Pepper

Assessor accreditation number : 0107

Tool version : v4.0

Report created : 27/04/2017 16:14

Assessment circle name	Landscape score	TS subzone number	Vegetation zone name	Vegetation type name	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
biobank 1	14.50	SR635_Moderate/Good_1	SR549_Moderate/Good	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good	OMZ4	7.31	72.92	84.38	11.46	59
biobank 1	14.50	SR635_Moderate/Good_1	SR549_Moderate/Good	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good	OMZ4	7.31	72.92	84.38	11.46	59
biobank 1	14.50	SR635_Moderate/Good_1	SR549_Moderate/Good	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good	OMZ4	7.31	72.92	84.38	11.46	59
biobank 1	14.50	SR635_Moderate/Good_1	SR549_Moderate/Good	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good	OMZ4	7.31	72.92	84.38	11.46	59
biobank 1	14.50	SR635_Low_1	SR549_Moderate/Good_Poor	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good_Poor	OMZ3	0.20	57.99	79.17	21.18	2
biobank 1	14.50	SR635_Low_1	SR549_Moderate/Good_Poor	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good_Poor	OMZ3	0.20	57.99	79.17	21.18	2
biobank 1	14.50	SR635_Low_1	SR549_Moderate/Good_Poor	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good_Poor	OMZ3	0.20	57.99	79.17	21.18	2
biobank 1	14.50	SR635_Low_1	SR549_Moderate/Good_Poor	Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Moderate/Good_Poor	OMZ3	0.20	57.99	79.17	21.18	2

Assessment circle name	Landscape score	TS subzone number	Vegetation zone name	Vegetation type name	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
biobank 1	14.50	SR556_Moderate/Good_1	SR556_Moderate/Good	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good	OMZ1	0.24	76.00	96.00	20.00	2
biobank 1	14.50	SR556_Moderate/Good_1	SR556_Moderate/Good	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good	OMZ1	0.24	76.00	96.00	20.00	2
biobank 1	14.50	SR556_Moderate/Good_1	SR556_Moderate/Good	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good	OMZ1	0.24	76.00	96.00	20.00	2
biobank 1	14.50	SR556_Moderate/Good_1	SR556_Moderate/Good	Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Moderate/Good	OMZ1	0.24	76.00	96.00	20.00	2
biobank 1	14.50	SR641_Moderate/Good_1	SR641_Moderate/Good	Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Moderate/Good	OMZ6	1.60	78.12	93.75	15.63	14
biobank 1	14.50	SR641_Moderate/Good_1	SR641_Moderate/Good	Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Moderate/Good	OMZ6	1.60	78.12	93.75	15.63	14
biobank 1	14.50	SR641_Moderate/Good_1	SR641_Moderate/Good	Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Moderate/Good	OMZ6	1.60	78.12	93.75	15.63	14
biobank 1	14.50	SR641_Moderate/Good_1	SR641_Moderate/Good	Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Moderate/Good	OMZ6	1.60	78.12	93.75	15.63	14

BioBanking Credit Calculator

Species credits

Proposal ID :	0107/2015/2302B
Proposal name :	Mundamia Biobank
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	27/04/2017 16:14

Scientific name	Common name	Species TG value	Biobank on identified population?	Number found?	Units	Number of credits
Triplarina nowraensis	Nowra Heath Myrtle	1.50	No	1,087.00	indiv	7,718

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 27/04/2017 Time: 4:15:36PM Calculator version: v4.0

Biobank details

Proposal ID:	0107/2015/2302B
Proposal name:	Mundamia Biobank
Proposal address:	George Evans Rd Mundamia NSW 2540
Proponent name:	Allen Price & Scarratts
Proponent address:	75 Plunkett Street Nowra NSW 2541
Proponent phone:	(02) 4421-6544
Assessor name:	Jeremy Pepper
Assessor address:	Level 3 10 Kings Road New Lambton NSW 2305
Assessor phone:	02 4037 3200
Assessor accreditation:	0107

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	7.51	61.00
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	0.24	2.00
Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	1.60	14.00
Total	9.35	77

Credit profiles

1. Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion, (SR641)

Number of ecosystem credits created	14
IBRA sub-region	Illawarra

2. Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion, (SR549)

Number of ecosystem credits created	59
IBRA sub-region	Illawarra

3. Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion, (SR549)

Number of ecosystem credits created	2
IBRA sub-region	Illawarra

4. Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion, (SR556)

Number of ecosystem credits created	2
IBRA sub-region	Illawarra

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Nowra Heath Myrtle	Triplarina nowraensis	1,087.00	7,718

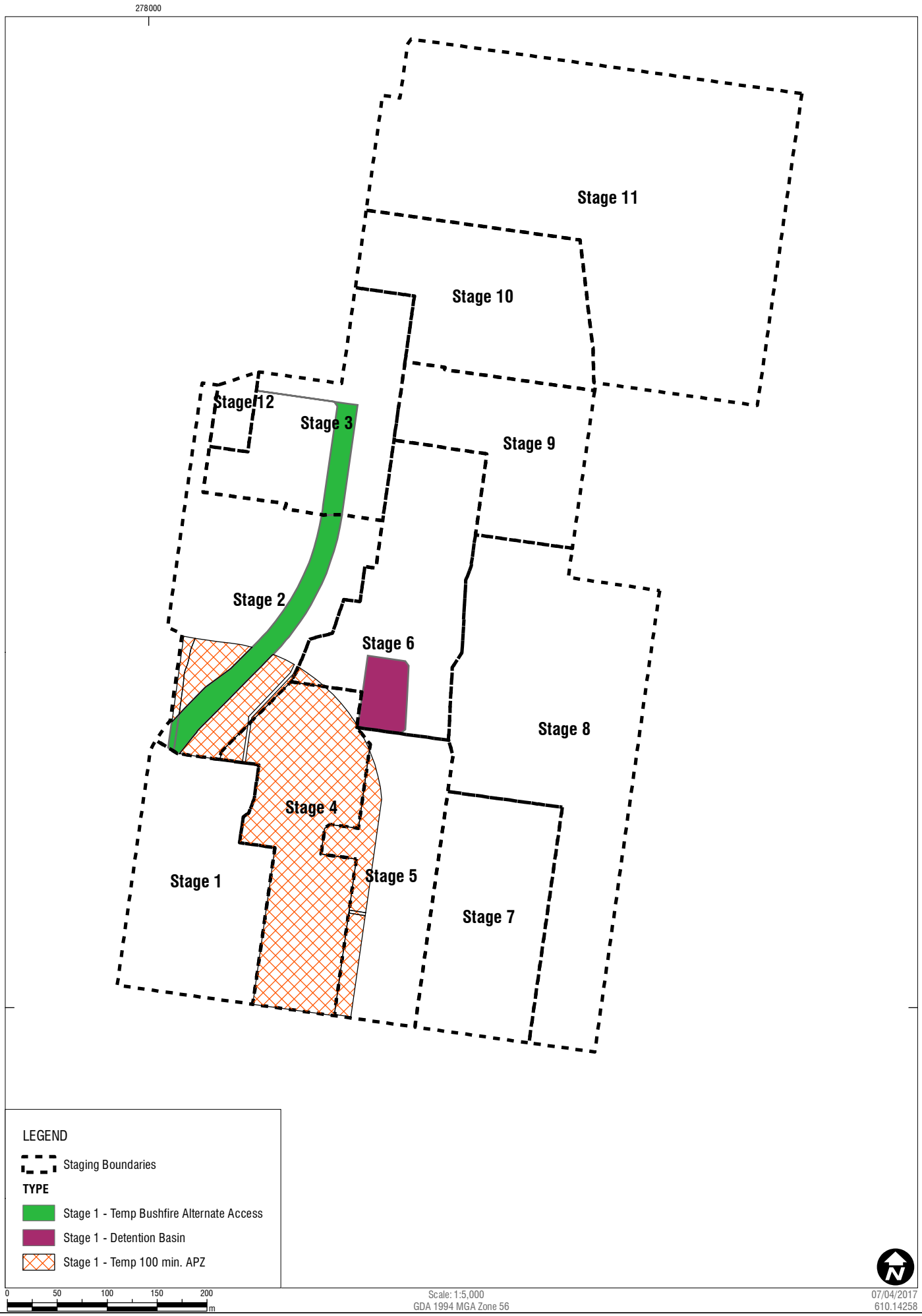
Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Exclude miscellaneous feral species
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Feral and/or over-abundant native herbivore control
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Fox control
Grey Gum - Blue-leaved Stringybark open forest on gorge slopes, southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion	Slashing
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Control of feral pigs
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Exclude commercial apiaries
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Exclude miscellaneous feral species
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Hairpin Banksia - Kunzea ambigua - Allocasuarina distyla heath on coastal sandstone plateaux, Sydney Basin Bioregion	Fox control
Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Exclude commercial apiaries
Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Exclude miscellaneous feral species
Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Feral and/or over-abundant native herbivore control
Spotted Gum - Blackbutt shrubby open forest on the coastal foothills, southern Sydney Basin Bioregion and northern South East Corner Bioregion	Fox control

APPENDIX E

Staging Plans (Vegetation and Nowra Heath-myrtle removal)



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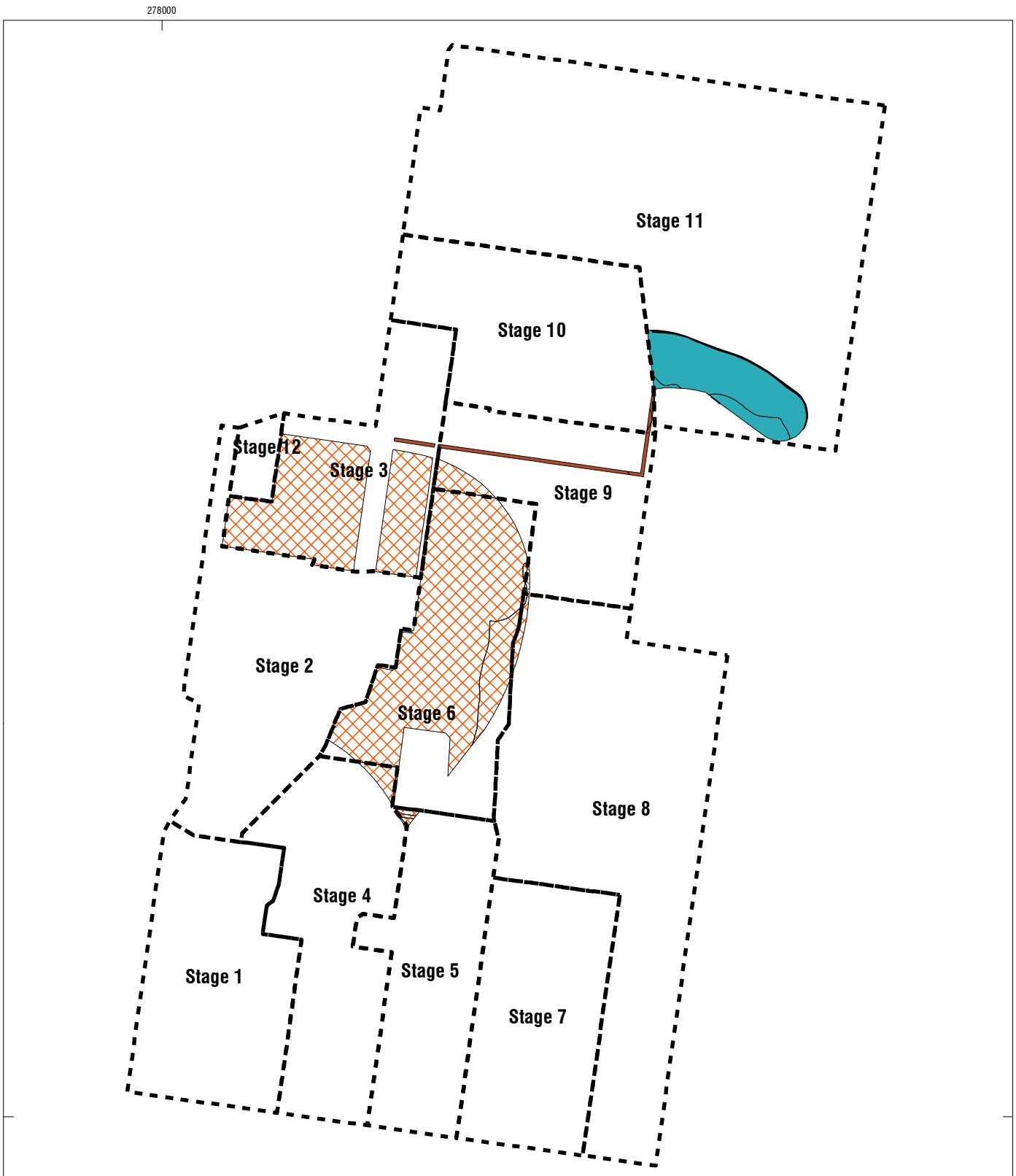

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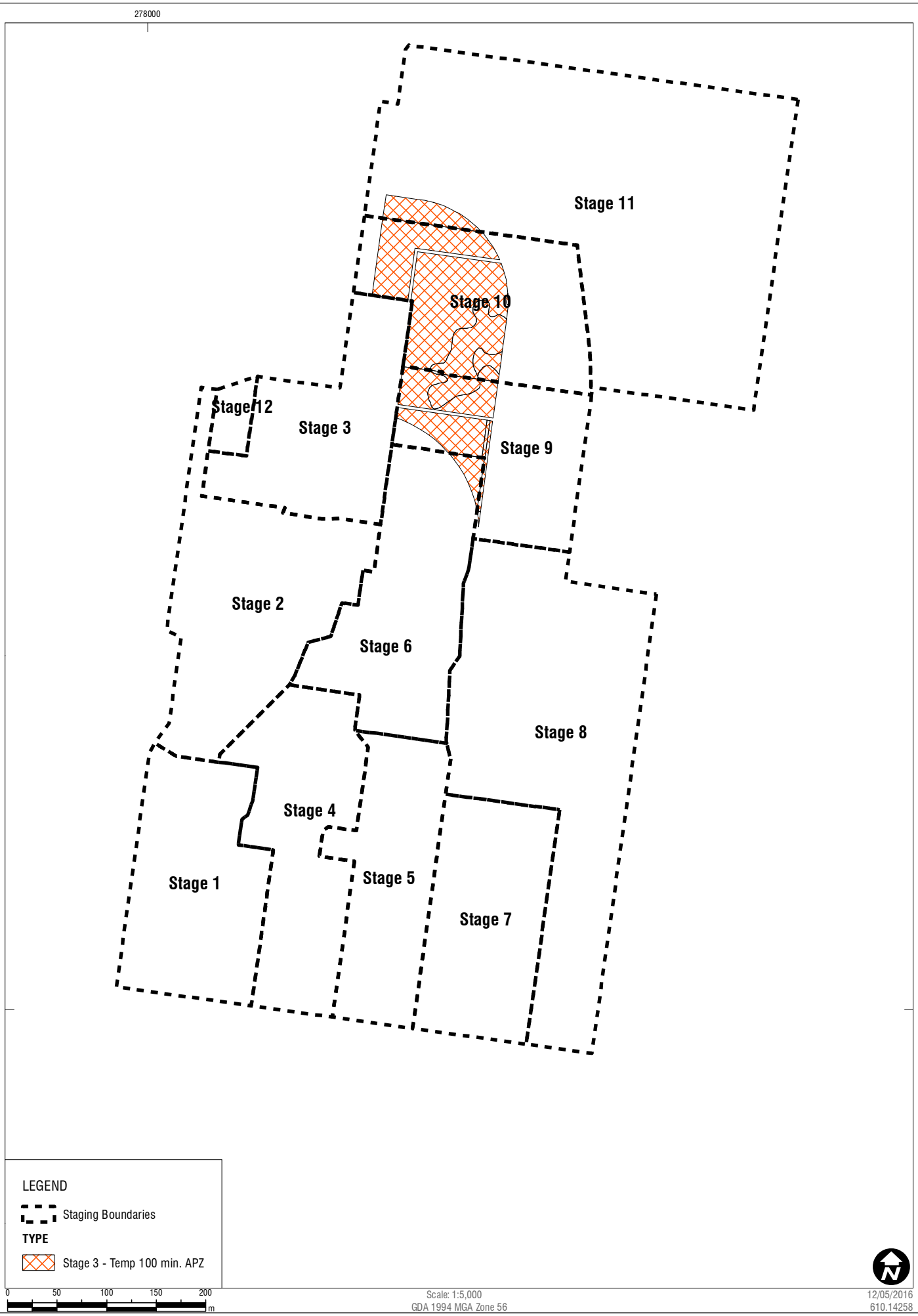

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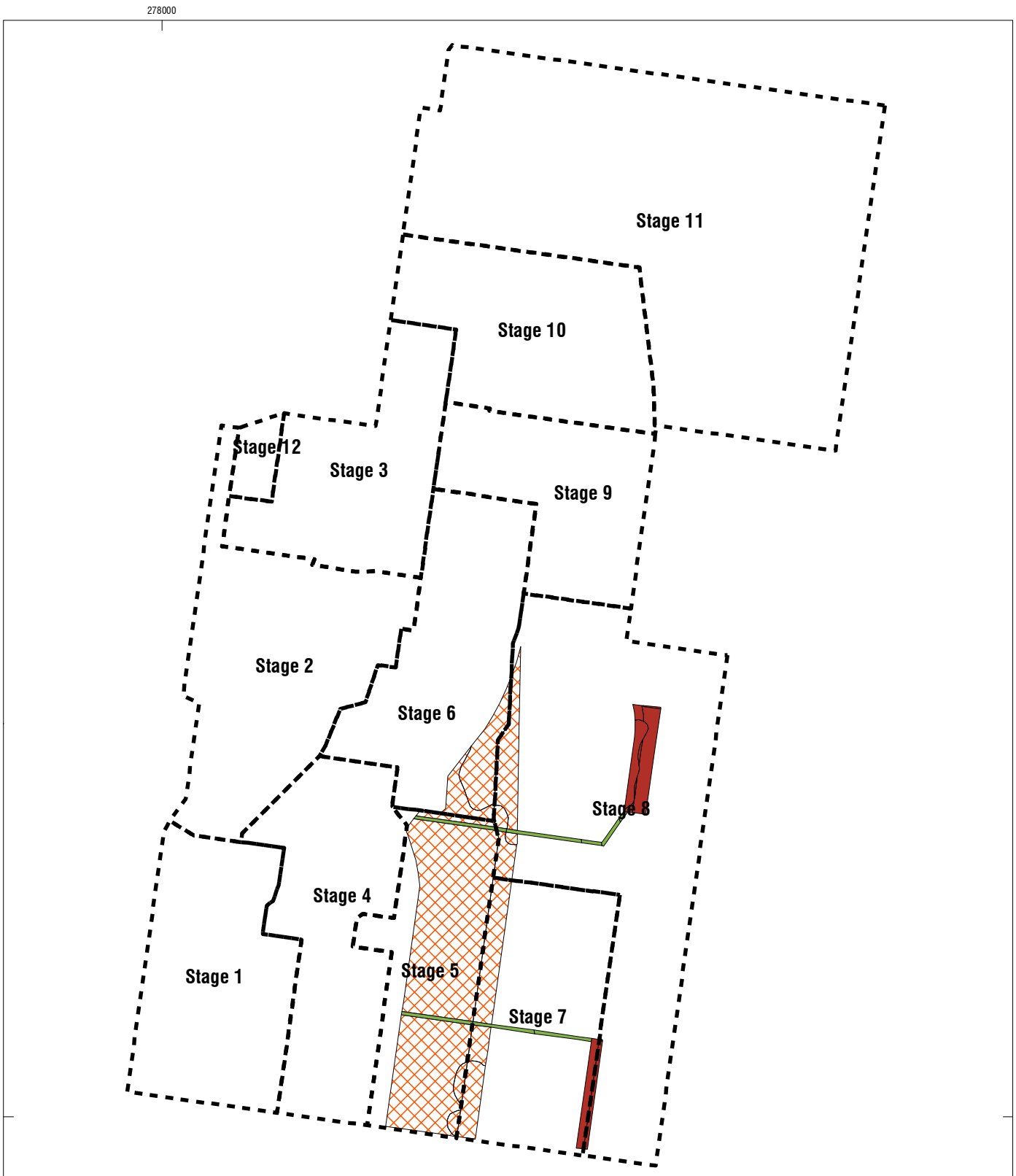

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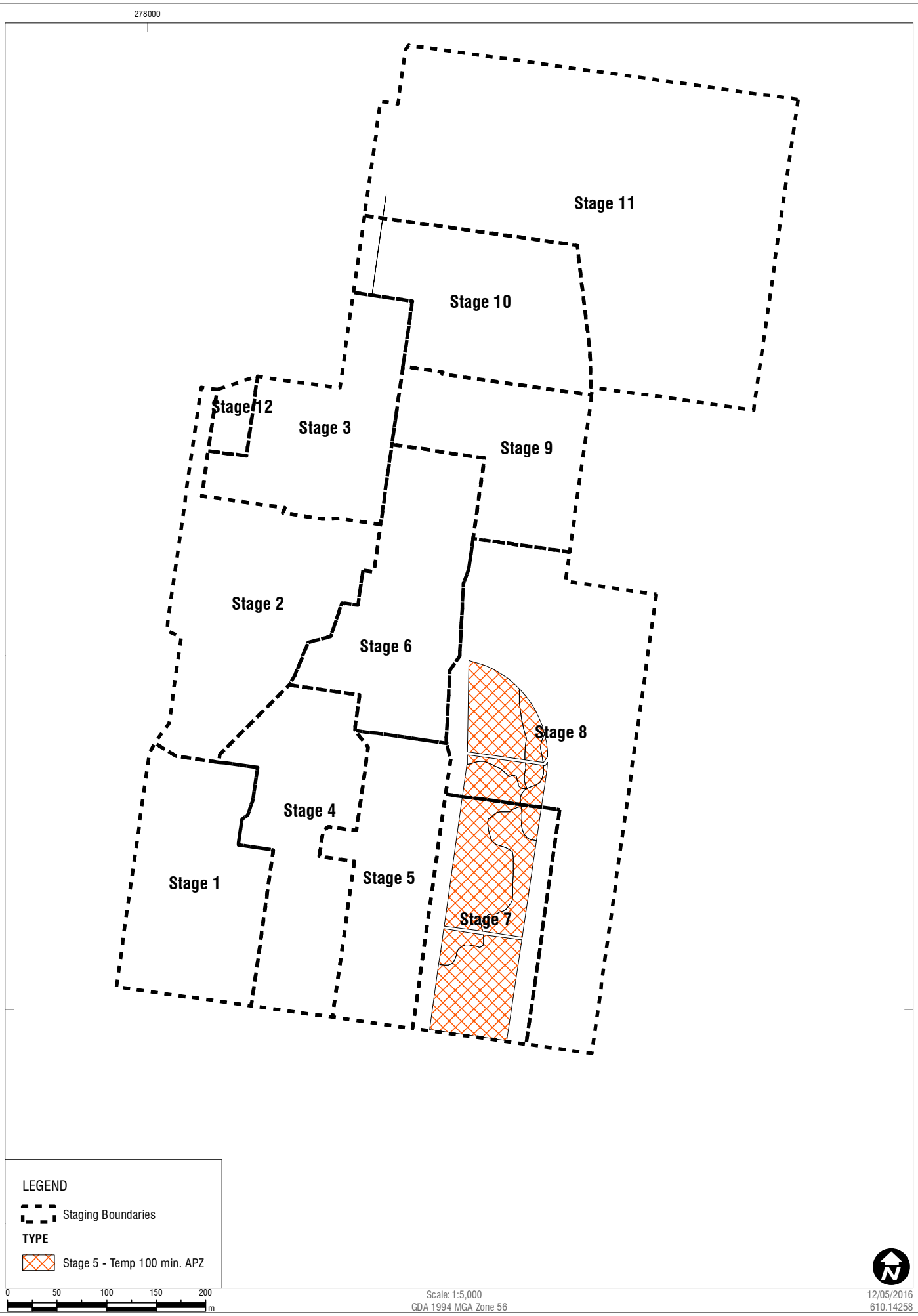

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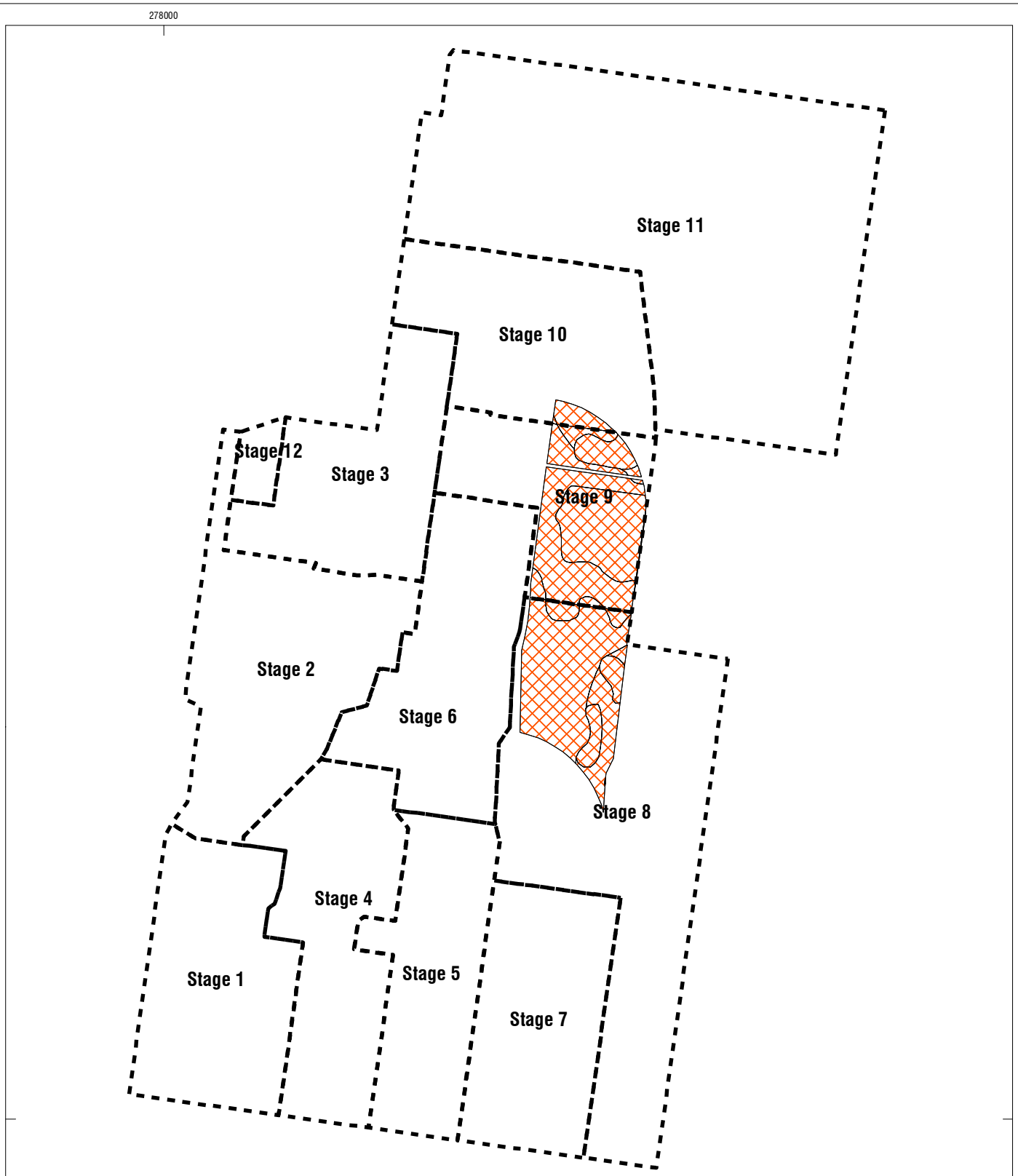

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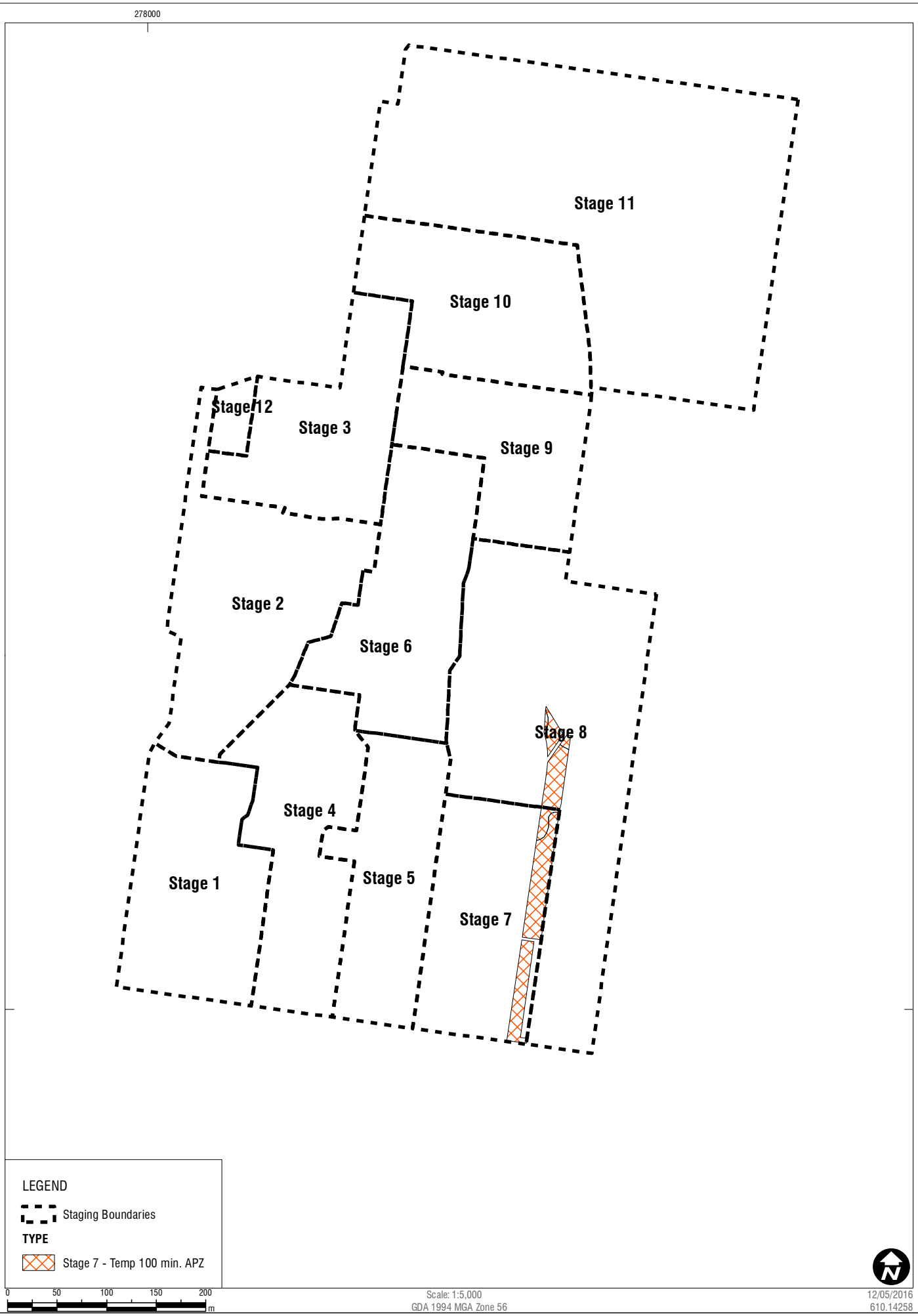

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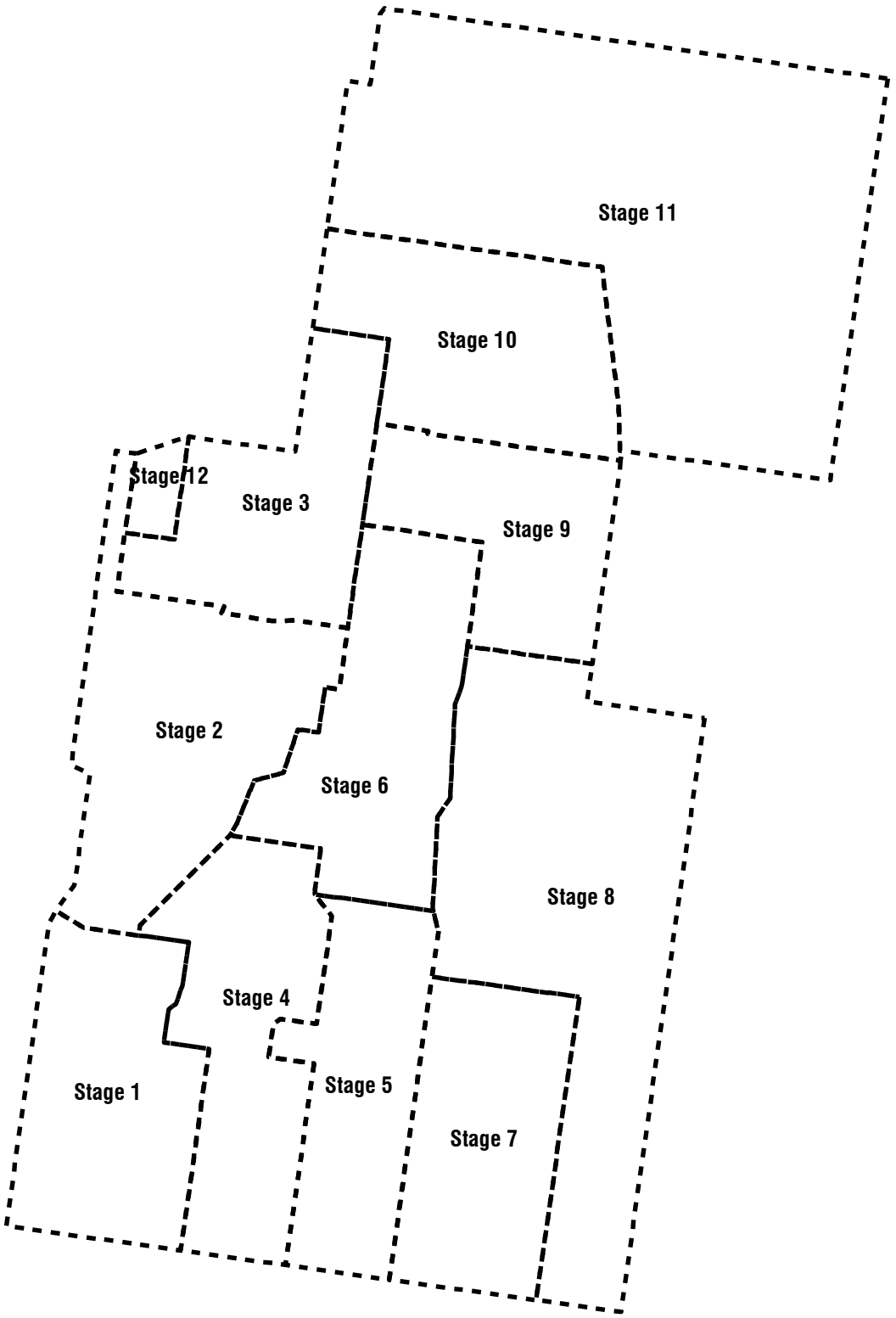

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LEGEND

Staging Boundaries

0 50 100 150 200 m

Scale: 1:5,000
GDA 1994 MGA Zone 56

12/05/2016
610.14258

Sheet Size : A4

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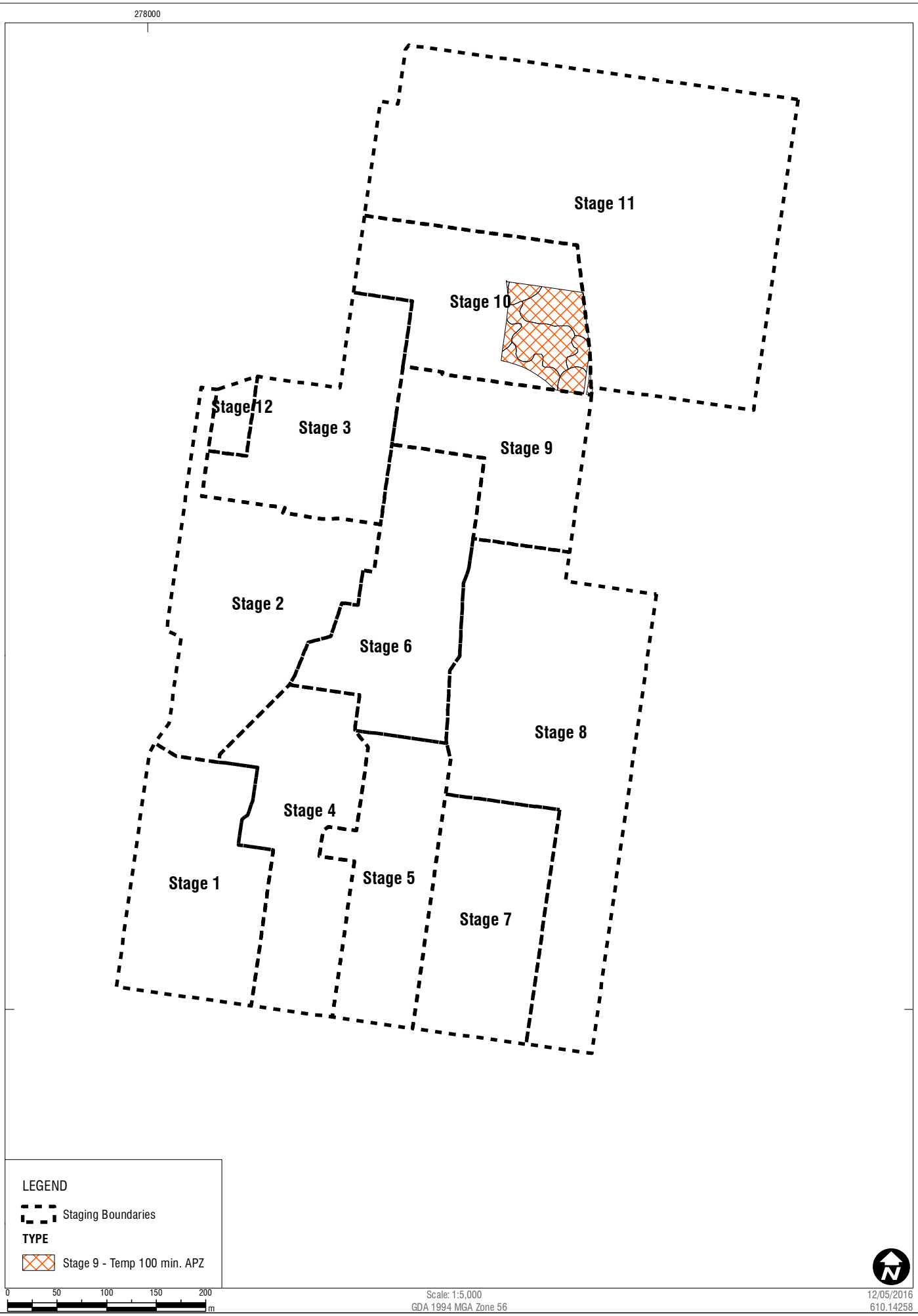
STAGE 8



STAGE 9

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SLR

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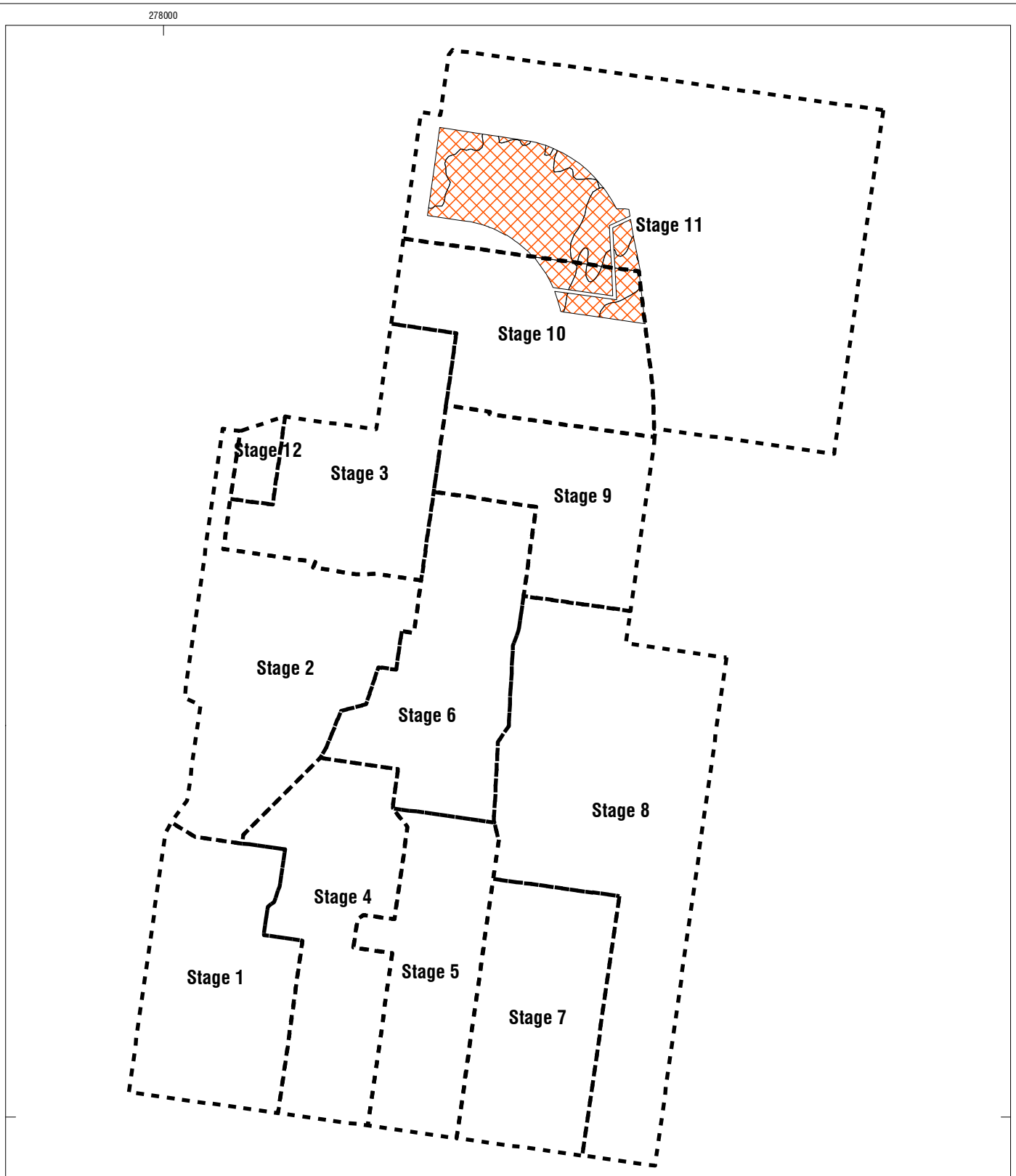

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STAGE 10

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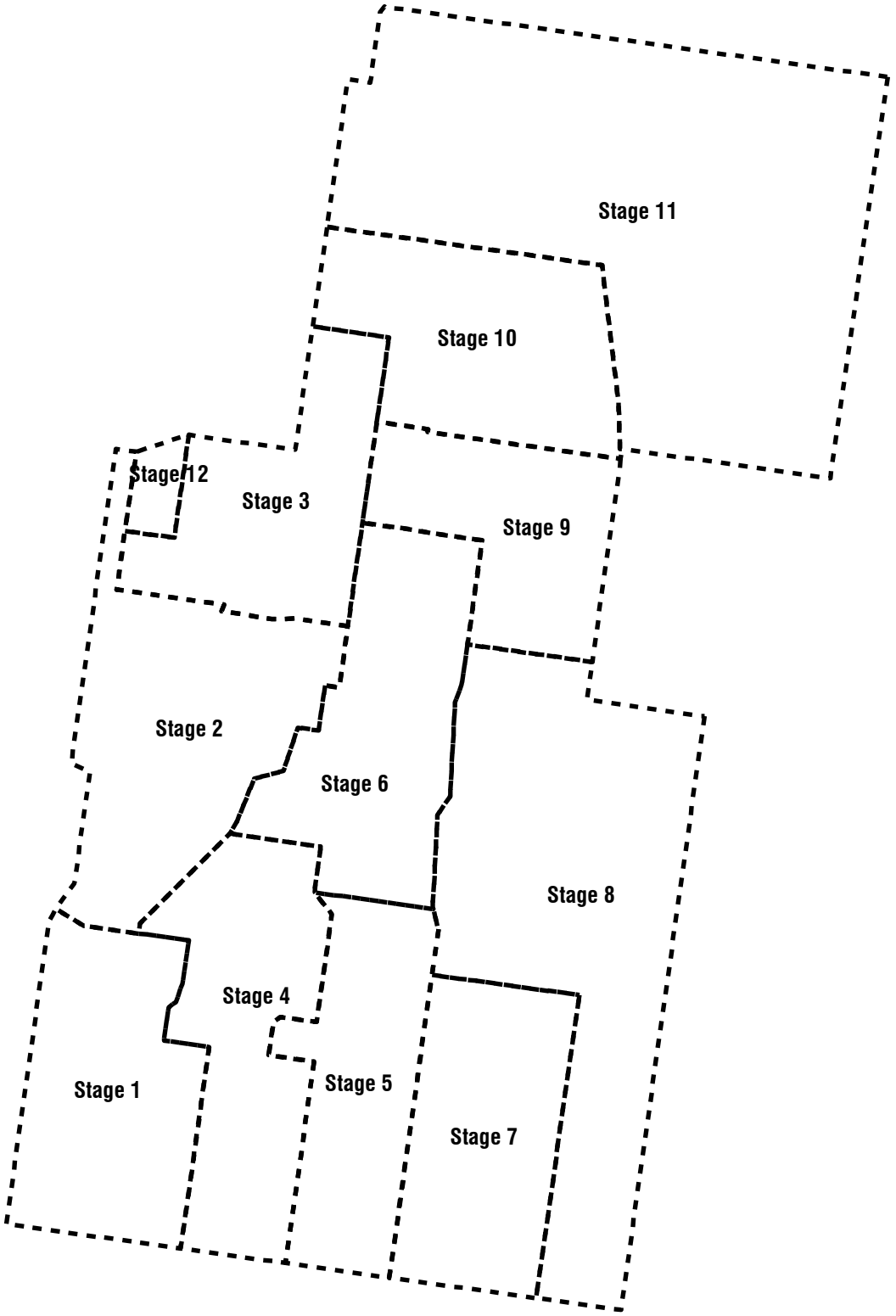

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LEGEND

Staging Boundaries

0 50 100 150 200 m

Scale: 1:5,000
GDA 1994 MGA Zone 56

12/05/2016
610.14258

Sheet Size : A4

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STAGE 11