



Landscape Management Plan – Tanilba Northern Dune Extension



Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay, NSW
2318

14 August 2020

Landscape Management Plan – Tanilba Northern Dune Extension

Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay, NSW 2318

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Prepared for:

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ABBREVIATIONS

AEMR	Annual Environmental Management Report
BC Act	<i>Biodiversity Conservation Act 2016</i>
BMP	Biodiversity Management Plan
CKPoM	Comprehensive Koala Plan of Management
DP	Deposited Plan
DPIE	Department of Planning and Infrastructure
EEC	Endangered Ecological Community (category of Threatened Ecological Community)
EES	Environment, Energy and Science
EMP	Environmental Management Plan
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare
HWC	Hunter Water Corporation
LGA	Local Government Area
LMP	Landscape Management Plan
LTMS	Long Term Management Strategy
OEH	Office of Environment and Heritage (NSW) – now EES
PSC	Port Stephens Council
RMP	Rehabilitation Management Plan
SEPP 44	State Environmental Planning Policy 44 – Koala Habitat Protection
Sibelco	Sibelco Australia Limited
TSC Act	<i>Threatened Species Conservation Act 1995 (repealed and replaced by the BC Act 2016)</i>

1. INTRODUCTION

Sibelco Australia (The Operator) was granted approval for the sand extraction from an area known as the Tanilba Northern Dunes Extension under the Major Project Approval (MP 09_0091) dated 8th March 2013 (the Project Approval – DP&I, 2013). Extraction from the area commenced in 2015 with final sand extraction completed by mid 2019. The extraction area is located within Lots 11, 12 and 13 DP 601306; Lot 408 DP 1041934; and Lots 1 and 2 DP 408240 (**Figure 1**) on a geological feature known as the northern dunes in Oyster Cove locality of Port Stephens Council local government area of New South Wales.

The approval effectively extended existing quarrying activities (approved under separate approvals) by less than 9 ha. This Landscape Management Plan (LMP) is intended satisfy Schedule 3, Condition 17 of the Tanilba Northern Dune Extension Project Approval (MP 09_0091) dated 8th March 2013 (the Project Approval – DP&I, 2013).

This Revision of the plan updates the plan to better reflect the current activities occurring on the site, noting that clearing and sand extraction has been completed and the site is under rehabilitation. Indicatively, the LMP notes the rehabilitation phase to continue for at least eight (8) years post extraction before suitable rehabilitation can be demonstrated. Indicatively, this means the LMP will apply to the site until 2027, unless completion criteria is achieved prior to this time.

This LMP contains the following sections:

- **Statutory requirements:** This section outlines the approvals and legislative requirements of the Tanilba Northern Dune Extension Project that are relevant to this LMP.
- **Existing environment and potential impacts:** A background of the ecological values that were identified within the extraction area and surrounding lands and the potential impacts that the project will have on these issues.
- **Rehabilitation Management Plan:** This chapter outlines the management actions required to be undertaken within rehabilitation area, including rehabilitation monitoring methodologies, completion criteria for the rehabilitation and an assessment of potential risks to successful rehabilitation.
- **Long Term Management Strategy:** The objectives and management strategies for the extraction area post-operations.
- **Reporting framework:** A summary of the reporting requirements set out by this LMP.

- **Review and Performance:** Triggers for review of this LMP and responsibilities implementation of this plan.

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- Northern Biodiversity Offset
- Southern Biodiversity Offset
- MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)
- Tanilba Northern Dune Extraction
- State Conservation

- Lot Boundaries
- Sub-arterial Road
- Local Road
- Track



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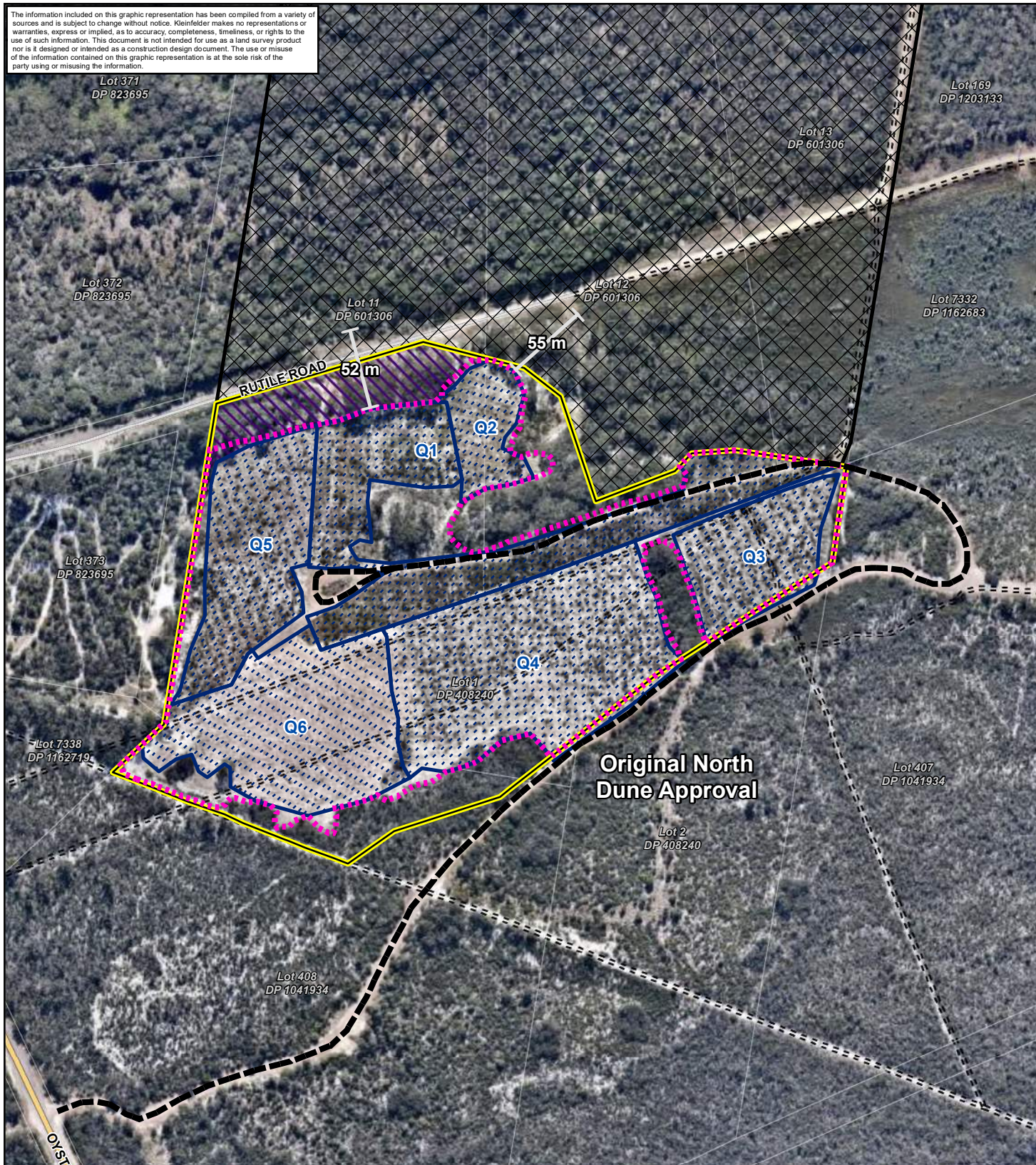
Tanilba Northern Dune Extension

Sibelco
 Tanilba Northern Dune Extension
 Oyster Cover Road, Tanilba Bay NSW

FIGURE:

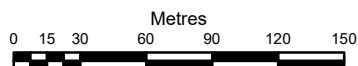
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Legend

- Northern Biodiversity Offset Area
- MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)
- MP09_0091 - Northern Dunes Extension Extraction Area (7.3 ha)
- Rehab Blocks
- Lot Boundaries
- Visual Amenity and Connectivity Buffer
- Sub-arterial Road
- Local Road
- Track
- Retained Vegetation Buffer Distance
- Northern Dunes Extension Haul Road



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Site Plan

Sibelco
Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay NSW

FIGURE:

2



1.1 SCOPE AND OBJECTIVES

This LMP is one of several management plans that have been developed to support the overriding Environmental Management Plan (EMP).

This LMP provides a framework for the management of impacts on flora and fauna during clearing, the rehabilitation of the extraction area and long term monitoring and management of the site. Given sand extraction is now completed, the core focus of the plan is rehabilitation. This Plan will require amendment should sand extraction recommence within the Project Area to ensure impacts from sand extraction are appropriately managed.

The core objectives for plan are to comply with Condition 17 of the Project Approval that requires the Operator to implement a LMP that must satisfy the conditions shown in **Table 1** below.

The Project Approval also requires the preparation of a Biodiversity Management Plan (BMP), which requires similar management actions as this LMP. For operational and administrative simplicity, these plans apply to the site as follows:

- Management measures for the extraction area (disturbance area within the application area) will be addressed in this LMP; and
- Management of the approved Biodiversity Offset Areas will be addressed in the BMP.

Table 1: Landscape Management Plan conditions (Condition 17 and 18 MP09_0091)

Condition	Condition Requirement	Section where Addressed / Comment
17	The Proponent shall prepare and implement a Landscape Management Plan for the project to the satisfaction of the Director-General. This plan must:	Letter provided to DPIE Copy of the revised LMP provided to Council and HWC for comment.
	a) Be prepared: <ul style="list-style-type: none"> • By suitably qualified person(s), approved by the Director-General; and • In consultation with Council and HWC; 	
	b) The plan must be submitted to the Director-General for approval prior to commencing quarrying operations; and	NA Extraction now completed
	c) Include: <ul style="list-style-type: none"> • A Rehabilitation Management Plan; and • A Long Term Management Strategy. 	Section 4 Section 5
18	The Rehabilitation Management Plan must include: <ul style="list-style-type: none"> a) Rehabilitation objectives for the site; 	Section 4.1

Condition	Condition Requirement	Section where Addressed / Comment
	b) A description of the measures that would be implemented to: <ul style="list-style-type: none"> Rehabilitate and stabilise the site; Minimise the removal of mature trees; and Manage the remnant vegetation and habitat on the site. 	Section 4.2
	c) Detailed performance and completion criteria for the rehabilitation and stabilisation of the site;	Section 4.5
	d) A detailed description of how the performance of rehabilitation would be monitored over time to measure achievement of the performance and completion criteria and the rehabilitation objectives	Section 4.3.4
	e) A detailed description of what measures would be implemented to rehabilitate and manage the landscape of the site, including the procedures to be implemented for: <ul style="list-style-type: none"> Progressively rehabilitating and stabilising areas disturbed by quarrying; 	Section 4.3.3
	<ul style="list-style-type: none"> Implementing revegetation and regeneration within the disturbance areas; 	Section 4.3.3 and Section 4.4
	<ul style="list-style-type: none"> Protecting areas outside the disturbance areas; 	NA – extraction completed
	<ul style="list-style-type: none"> Vegetation clearing protocols, including a protocol for clearing any trees containing hollows and the relocation of hollows from felled trees; 	NA – extraction completed Section 4.3.2
	<ul style="list-style-type: none"> Managing impacts on fauna; 	NA – extraction completed Section 4.3.2 and Section 4.3.6
	<ul style="list-style-type: none"> Controlling weeds and pests; 	Section 4.3.7
	<ul style="list-style-type: none"> Controlling access; 	Section 4.3.1
	<ul style="list-style-type: none"> Bushfire management; and 	Section 4.3.8
	<ul style="list-style-type: none"> Reducing the visual impacts of the project. 	Section 4.3.10
	f) A description of the potential risks to successful rehabilitation, and a description of the contingency measures that would be implemented to mitigate these risks; and	Section 4.7
	g) Details of who is responsible for monitoring, reviewing, and implementing the plan.	Section 1.3
19	The Long Term Management Strategy must:	
	a) Define the objectives and criteria for quarry closure and post-extraction management;	Section 5.1
	b) Investigate and/or describe options for the future use of the site;	Section 5.2
	c) Describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and	
	d) Describe how the performance of these measures would be monitored over time.	

Condition	Condition Requirement	Section where Addressed / Comment
20	<p>Prior to commencing quarrying operations, the Proponent shall lodge a rehabilitation bond for the project with the Director-General. The Proponent may lodge the rehabilitation bond in two portions. The first portion for 4.5 hectares must be lodged with the Department prior to commencing quarrying operations, with no land disturbance to exceed 4.5 hectares until the second portion of the bond is accepted by the Department.</p> <p>The sum of the bond shall be calculated at \$2.50/ m² for the area to be disturbed by quarrying operations, to the satisfaction of the Director-General.</p> <p>If rehabilitation and revegetation works have been completed in accordance with the Rehabilitation Management Plan and to the satisfaction of the Director-General, the Director-General will release the rehabilitation bond.</p> <p>If rehabilitation and revegetation works area not completed to the satisfaction of the Director-General, the Director-General will call in all parts of the rehabilitation bond, and arrange for the satisfactory completion of the relevant works.</p>	Rehabilitation bond lodged for 7.5 hectares of total quarry disturbance.

1.2 CONSULTATION AND PLAN DEVELOPMENT

As per Condition 17(a) of the Project Approval, the approved version of this management plan was developed in consultation with Port Stephens Council (PSC) and the Hunter Water Corporation (HWC).

A copy of this revised version of the management plan has been provided to PSC and HWC for comment.

Consultation documentation is included in **Appendix 1**.

1.3 ROLES AND RESPONSIBILITIES

The Operations Manager has the overall responsibility for works undertaken at the Tanilba Northern Dune Extension. The appointed Safety and Environment Coordinator, reports to the Operations Manager, and is responsible for implementation of the management measures

detailed in this management plan, engaging appropriately qualified personnel to undertake required actions, engaging stakeholders appropriately to assist with actions as relevant, and review of this LMP.

Other Mine Personnel and Contractors involved in construction and operation activities will be required to follow the directions of the Operator and abide by the requirements of this plan.

2. STATUTORY REQUIREMENTS

2.1 STATUTORY APPROVALS

Table 2 details the statutory approvals and licences relevant to the LMP for the Tanilba Northern Dune Extension.

Table 2: Statutory approvals for the Tanilba Northern Dune Extension relevant to this LMP.

Project Number	Approval Description	Date Approved	Legislation	Authority
MP 09_0091	Tanilba Northern Dune Extension Project	8 th March 2013	Part 3A EP&A Act	DPIE

The relevant conditions to this LMP of the Project Approval (MP09_0091), and included:

- Condition 17 – Landscape Management Plan;
- Condition 18 – Rehabilitation Management Plan;
- Condition 19 – Long Term Management Strategy; and
- Condition 20 – Rehabilitation Bond.

In addition to the conditions above the Operator made a series of commitments in relation to rehabilitation and biodiversity. These commitments are included within **Appendix 2**, with resulting actions incorporated within the management procedures detailed within **Section 4.3**.

2.2 LEGISLATIVE REQUIREMENTS

Key legislative requirements applicable to the project are presented in **Table 3**. Since the project was approved in 2013 several new pieces of legislation have been gazetted and some legislation repealed.

Table 3: Statutory approvals for the Tanilba Northern Dune Extension relevant to this LMP.

Legislation/ Policy	Relevance
NSW EP&A Act	Project Approval granted under Part 3A of the EP&A Act. Part 3A now repealed, any modifications to the project are pursuant to Part 4 of the EP&A Act.

Legislation/ Policy	Relevance
NSW <i>Threatened Species Conservation Act 1995</i> (TSC Act) – REPEALED.	Impact to species listed under Schedules 1 and 2 of the TSC Act were considered within the assessment and approval of the project under the TSC Act. The TSC Act has since been repealed and is replaced by the BC Act 2016.
<i>Biodiversity Conservation Act 2016</i> (BC Act 2016)	The BC Act forms part of a significant change in biodiversity conservation reforms for NSW and effectively replaced the TSC Act. The BC Act provides for the management of biodiversity across NSW including the protection of threatened plants animals and vegetation communities.
NSW <i>Native Vegetation Act 2003</i> (NV Act) – REPEALED.	Pursuant to Section 75U of the EP&A Act, authorisations to clear native vegetation is not required as approval is granted by the Minister for Planning under Part 3A.
NSW <i>Noxious Weeds Act 1993</i> - REPEALED	Noxious weed species have been identified within the Extension Area. These weeds will be treated in accordance within their Class under the act. This act was replaced by the <i>Biosecurity Act 2015</i> .
NSW <i>Biosecurity Act 2015</i>	The Biosecurity Act 2015 provides a framework for the prevention, elimination and minimisation of biosecurity risks. Relevantly for this project this relates to the management of weed and pests through the rehabilitation areas.
<i>Local Land Services Act 2013</i> (LLS Act)	Complimenting the BC Act, vegetation clearing in rural NSW is now managed under the LLS Act. The LLS Act effectively replaced the <i>Native Vegetation Act 2003</i> . Pursuant to Section 60(O) of the LLS Act rural based development with approval to clear vegetation under Part 4 or the repealed Part 3A of the EP&A Act do not require approval under the LLS Act.
State Environmental Planning Policy 44 Koala Habitat Protection	Two feed trees listed under Schedule 2 of SEPP 44 were identified within the Study Area (Extension Area and surrounds). Potential Koala habitat was identified outside the disturbance area and will not be directly impacted on by the operations.
Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act)	The project was referred to the Minister for the Environment on 2 nd August 2012 (Ref. No. 2012/6492). The project was deemed 'not controlled action', and can proceed provided it is carried out in accordance with the referral

3. EXISTING ENVIRONMENT & POTENTIAL IMPACTS

3.1 LOCAL SETTING

The Tanilba Northern Dune Extension Project comprises land owned by the Crown, the Hunter Water Corporation and the Operator, located on the Tilligerry Peninsula. The site comprises part of an elevated dune system known as the Tanilba Northern Dune. This dunal system is located to the south and east of Oyster Cove (Oyster Cove Road passes through the original dune system) and to the west of the township of Tanilba Bay (**Figure 1**). The Environmental Assessment Report (ERM, 2012) provides a detailed description of the site.

The application was granted over property located off Oyster Cove Road and Rutile Road at Oyster Cove as shown by **Figure 3** as listed below:

- Lot 11, 12 and 13 of DP 601306 owned as freehold land by the Operator Australia Limited.
- Lot 408 DP 1041934 owned by the Crown.
- Lots 1 and 2 of DP 406240 owned as freehold by the Hunter Water Corporation (HWC).

The Proposed Offset Strategy includes Lots 21, 22, 23 and 24 of DP 579700 on Lemon Tree Passage Road, this is Freehold Land owned by the Operator.

3.2 ECOLOGICAL VALUES

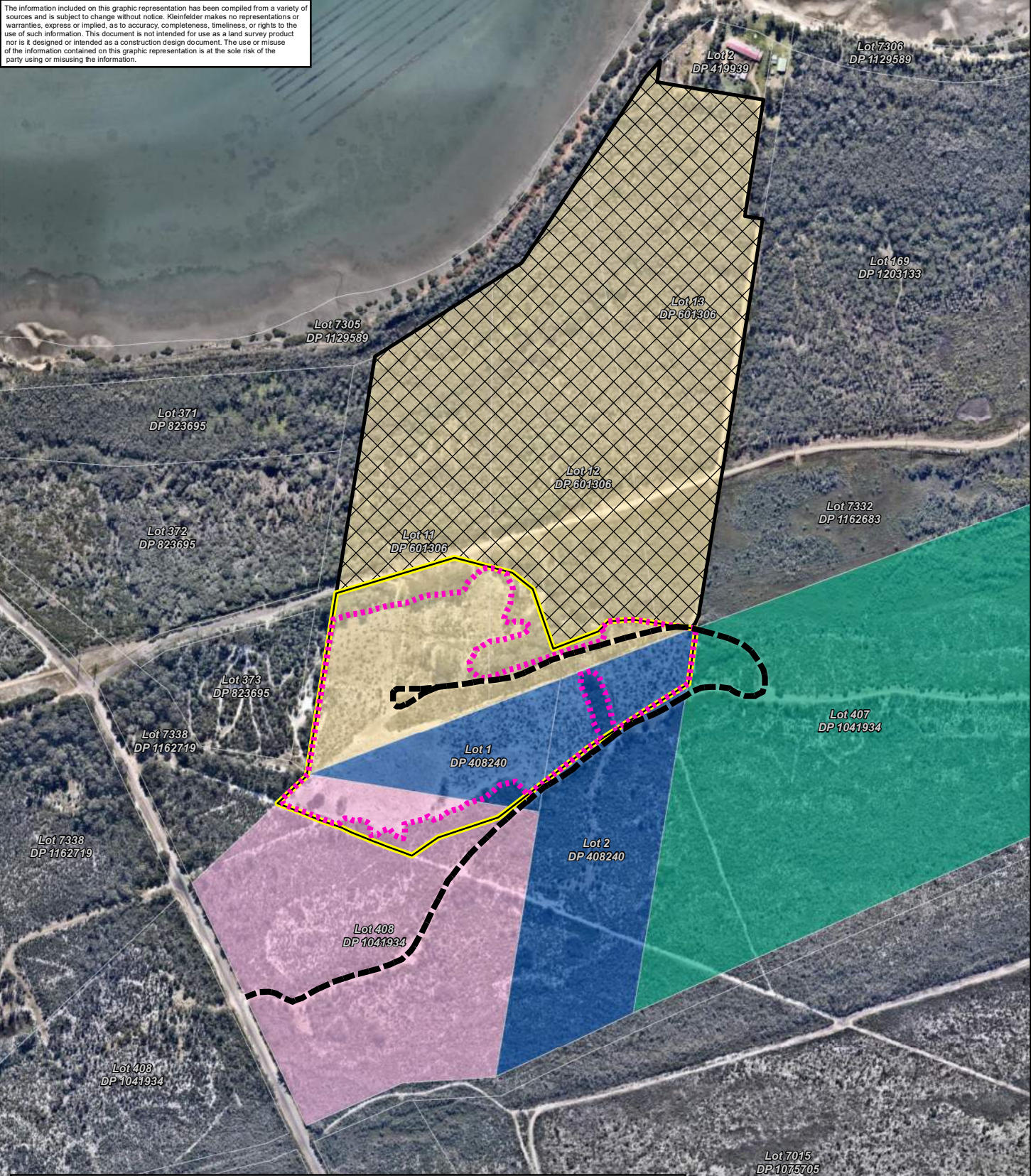
Kleinfelder (formerly Ecobiological) carried out an ecological assessment of the lands associated with the Tanilba Northern Due Extension and surrounding areas (study area shown in **Figure 1**) in 2007 and 2009.

3.2.1 Vegetation Communities

A total of eight vegetation communities and two variations were mapped within the study area (extraction area, northern offset and additional areas to the west).

Vegetation communities within the study area are outlined in **Table 4**, **Figure 4**, and are discussed in the following sections.

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Legend

Northern Offset Area / Biodiversity Management Area

MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)

MP09_0091 - Northern Dunes Extension Extraction Area (7.3 ha)

Lot Boundaries

Northern Dunes Extension Haul Road

Land Ownership

Sibelco Freehold Land

Leased from Hunter Water Corporation (HWC)

Leased from Crown Land

Leased from Crown (HWC Management)

Metres

0 1530 60 90 120 150

N

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Land Ownership & Extraction Area

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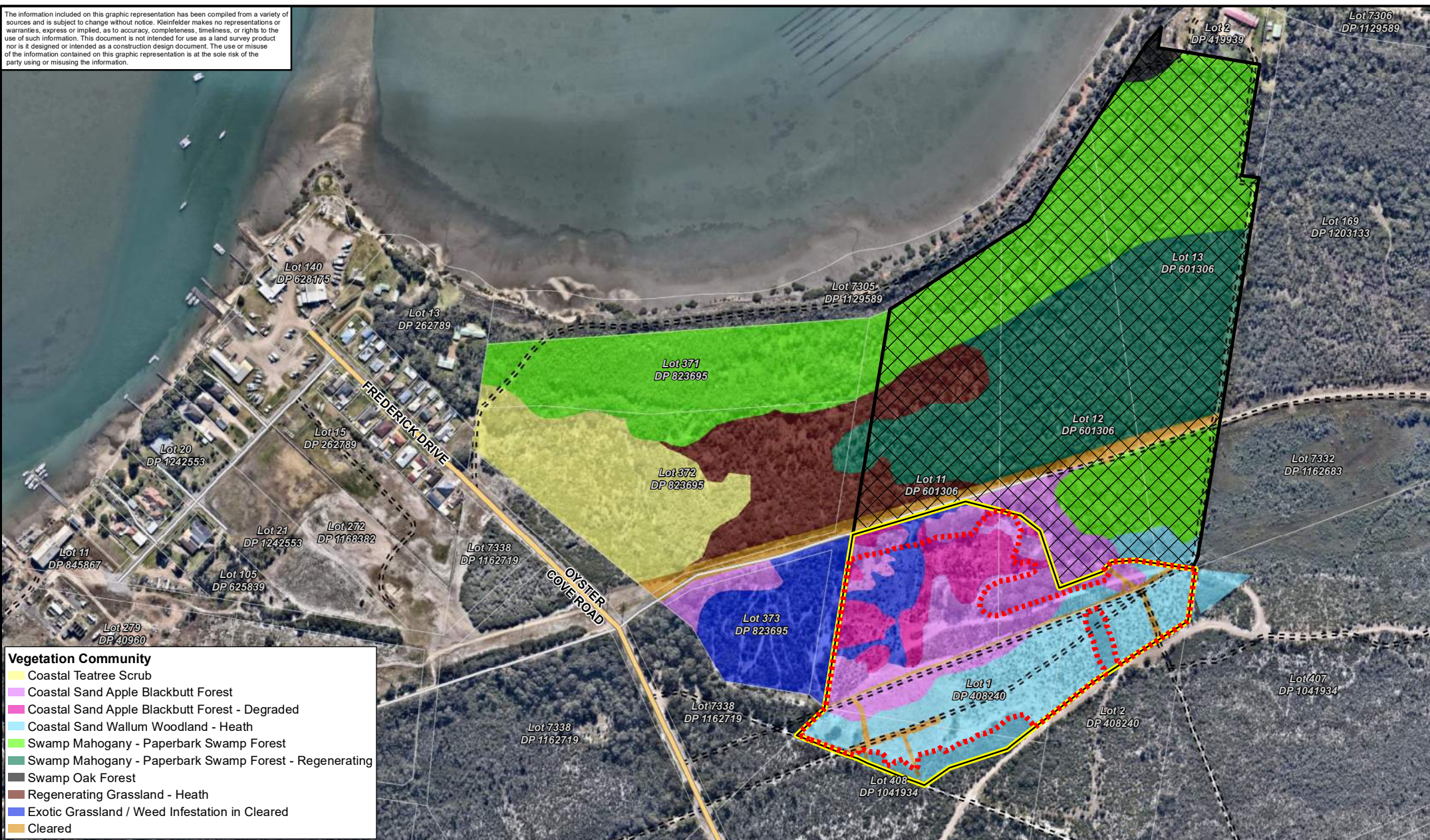
Tanilba Northern Dune Extension

Oyster Cover Road, Tanilba Bay NSW

FIGURE:

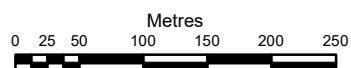
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Vegetation Community	
	Coastal Teatree Scrub
	Coastal Sand Apple Blackbutt Forest
	Coastal Sand Apple Blackbutt Forest - Degraded
	Coastal Sand Wallum Woodland - Heath
	Swamp Mahogany - Paperbark Swamp Forest
	Swamp Mahogany - Paperbark Swamp Forest - Regenerating
	Swamp Oak Forest
	Regenerating Grassland - Heath
	Exotic Grassland / Weed Infestation in Cleared
	Cleared

	Northern Biodiversity Offset Area
	MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)
	MP09_0091 - Northern Dunes Extension Extraction Area (7.3 ha)
	Lot Boundaries
	Sub-arterial Road
	Local Road
	Track



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Vegetation Communities Within the Study Area (Extraction Area & Northern Offset)

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Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay NSW

FIGURE:

4

Table 4: Vegetation communities within the study area (surveyed by Kleinfelder, 2007 and 2009 as part of Flora and Fauna Impact Assessment)

Vegetation Community	Area (ha)			
	Extraction Area	Northern Offset Area	Southern Offset Area	Total
Coastal Sand Apple – Blackbutt Forest	2.7 ha	0.8 ha	5.1 ha	8.6 ha
Coastal Sand Apple – Blackbutt Forest – Degraded	1.4 ha	-	-	1.4 ha
Coastal Sand Wallum Woodland – Heath	3.8 ha	0.3 ha		4.3 ha
Swamp Mahogany – Paperbark Swamp Forest	-	8.0 ha	4.3 ha	8.3 ha
Swamp Mahogany – Paperbark Swamp Forest - Regenerating	-	7.2 ha	-	7.2 ha
Swamp Oak Rushland Forest	-	0.2 ha	-	0.2 ha
Regenerating Grassland – Heath	-	1.1 ha	-	1.1 ha
Exotic Grassland/ Weed Infestation in Cleared	0.6 ha	-	-	0.6 ha
Cleared	-	0.7 ha	-	0.7 ha
Total per area	8.5 ha	18.3 ha	9.4 ha	

3.2.1.1 Coastal Sand Apple – Blackbutt Forest

This community is located on the higher dunes within the proposed extraction area. It is a tall open forest to 25-30 m, with dense shrubby layer to 3-4 m, and the herbaceous ground stratum is sparse.

Angophora costata (Smooth-barked Apple) and *Eucalyptus pilularis* (Blackbutt) co-dominant canopy layer, merging with a higher abundance of *Corymbia gummifera* (Red Bloodwood) closer to the Coastal Sand Wallum Woodland – Heath ecotones. The shrubby mid stratum is dominated by *Monotoca elliptica* (Tree Broom-heath), *Leptospermum trinervium* (Flaky-barked Tea Tree) and *Banksia serrata* (Old-man Banksia), and common shrub species include *Acacia ulicifolia* (Prickly Moses), *Acacia longifolia* (Sydney Golden Wattle), *Dillwynia retorta* and *Leucopogon* species. The ground layer was sparse and typically comprised *Pteridium esculentum* (Common Bracken), *Dianella caerulea* (Blue Flax-lily), *Eriostemon australasius* and scattered *Gonocarpus teucroides* (Raspwort) and *Hibbertia* species.

Areas of the Coastal Sand Apple – Blackbutt Forest were mapped separately as degraded due to the high level of disturbance and weed abundance within these areas.

3.2.1.2 Coastal Sand Wallum Woodland – Heath

This community is found along the southern lower lying parts of the extraction area. This community varied from low woodland (to 8 m tall) with a dense shrubby mid stratum consisting of heath species to 3 m and an open shrub layer to 1 m. The ground stratum was moderate to sparse throughout. The Wallum Heathland had similar composition without the Woodland tree canopy.

The canopy species include *Eucalyptus piperita* (Sydney Peppermint) and *Corymbia gummifera* (Red Bloodwood). The dominant mid stratum species are *Banksia aemula* (Wallum Banksia), *Leptospermum trinervium* (Flaky-barked Tea Tree), *Monotoca elliptica* (Tree Broom-heath) and *Xanthorrhoea glauca* with *Melaleuca nodosa* (Prickly-leaved Tea Tree) becoming more common in the low heath. The wallum community has a low heathy shrub stratum dominated by scattered regrowth of *B. aemula* and *L. trinervium*, with a moderate ground cover of *Leucopogon* species, *Woollsia pungens*, Fabaceae species (*D. retorta*, *Aotus ericoides* and *Acacia suaveolens* (Sweet Wattle)) and sedges including *Caustis recurvata*, *Hypolaena fastigiata* and *Leptocarpus tenax*.

3.2.1.3 Swamp Mahogany – Paperbark Swamp Forest

This vegetation community occurs across the majority of the offset area to the north of the extraction area.

The community is dominated by *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) in the canopy with a dense groundcover of *Pteridium esculentum* (Common Bracken) and *Imperata cylindrica* (Blady Grass) on the higher grounds, where recent fires have occurred, and a higher abundance of ferns on the wetter areas, including *Blechnum indicum* (Swamp Water Fern) and *Hypolepis muelleri* (Hard Ground Fern). Some areas had semi-permanent water holes and subsequently had reeds and other water specific species.

A large area of regenerating Swamp Mahogany – Paperbark Swamp Forest occurs in the central section of the study area where sand extraction has historically occurred.

This community forms part of the *Swamp Sclerophyll Forest of Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions* EEC, listed under the TSC Act

3.2.1.4 Swamp Oak Forest

A small area of this community is located in the north eastern corner of the study area; within in the northern biodiversity offset area. This community is dominated by *Casuarina glauca* (Swamp Oak) with *Parsonsia straminea* (Common Silkpod) vine. The mid layer was absent and the ground cover had a dense layer of *Kennedia rubicunda* (Dusty Coral Pea) and *P. esculentum*. The sedges, herbs, grasses and ferns associated with this vegetation community were typical salt tolerant species including *Juncus kraussii* subsp. *australiensis* (Sea Rush).

This community forms part of the *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions* EEC, listed under the TSC Act.

3.2.1.5 Regenerating Grassland – Heath

Within the study area where sand extraction has historically occurred and the native regrowth is not in high abundance, these areas tended to be dominated by grass species including *Eragrostis curvula* (African Lovegrass), *Poa labillardieri* (Tussock), *Melinis repens* (Red Natal Grass) and *Digitaria sanguinalis* (Summer Grass). Some scattered trees included *A. costata*, *Leptospermum laevigatum* (Coast Teatree) and *Banksia integrifolia* (Coast Banksia). Few shrub species were found in the grassland areas.

3.2.1.6 Exotic Grassland / Weed Infestations in Cleared Areas

A portion of the proposed extraction area in the north-west has been disturbed as a result of previous construction for former dwellings on Lots 12 and 13 and a maintenance shed on Lot 11 used in association with strip mining on adjoining lands to the north.

The weed composition is typical of disturbance with exotic tussocks in the grasslands, and a pine plantation extending into the Apple Blackbutt community. The weed composition in the disturbed areas is outcompeting native regrowth.

3.2.1.7 Coastal Teatree Scrub

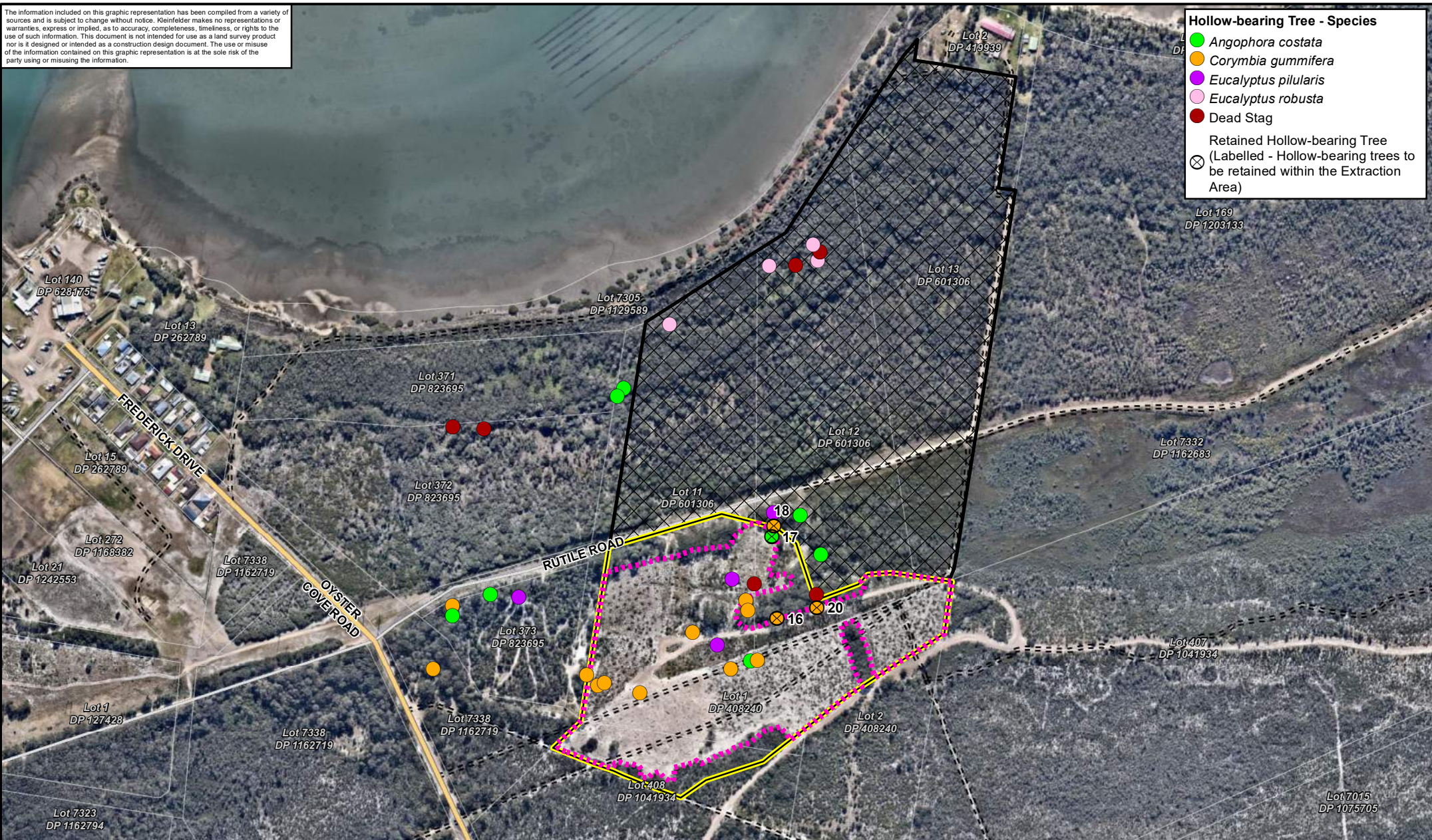
Coastal Teatree Scrub community located adjacent to Oyster Cove Road is dominated by *L. laevigatum* with some scattered *B. integrifolia* and *A. longifolia*. This section of the study area is outside the extraction area and will not be in the offset strategy.

3.2.2 Fauna Habitat

A range of habitat types have been identified within the extension area, including the following:

- **Woodland and Heath Vegetation:** The majority of the Coastal Sand Apple – Blackbutt community appears to be a remnant, while only a portion of the Coastal Sand Wallum Woodland – Heath appears to be remnant. Both communities are structurally diverse with three to four habitat layers present and a high presence of Hollow-bearing Trees which provide foraging and breeding habitat for a range of amphibian, reptile, mammal and bird species;
- **Swamp Vegetation:** The remnant Swamp Mahogany – Paperbark Swamp Forest in the north of the study area is structurally diverse with three to four habitat layers, a dense ground cover and multiple Hollow-bearing Trees. The regenerating area of Swamp Forest has a sparser vegetation cover, lacks dense ground cover and hollow-bearing trees. These areas provide a range of foraging and breeding habitats for common and threatened species that occur in the locality;
- **Hollow-bearing Trees:** A total of 36 Hollow-bearing Trees were identified within the study area (**Figure 5**), within the extraction area:
 - There are a total of 17 Hollow-bearing Trees with 38 hollows (20 small, 16 medium and two large);
 - Hollow-bearing Trees 16, 17, 18 and 20 (**Figure 5**) will be retained within the extraction area, these trees contain 12 hollows (seven small, four medium and one large); and
 - Total hollows to be removed from the extraction area is 26 (13 small, 12 medium and one large) within 13 trees.
- **Koala Habitat:** Vegetation mapping confirmed the vegetation running along the northern boundary of the study area (outside extraction area) as preferred Koala habitat as defined under SEPP 44 (**Figure 6**). Preferred Koala feed trees were also recorded within the regenerating Swamp Mahogany Paperbark – Swamp Forest and in a small patch of Swamp Mahogany forest to the south of the existing powerline easement. The Coastal Sand Apple – Blackbutt Forest was determined to represent Supplementary Koala habitat and the Coastal Sand Wallum Woodland Heath community, marginal habitat (Port Stephens Koala Habitat Mapping; Port Stephens Council, 2007). Historical records from the NPWS Atlas suggest that the proposed extraction area forms part of a movement corridor and it has therefore been mapped as Preferred Linking Habitat over Supplementary and Marginal Habitat. There are no preferred Koala food trees within the proposed extraction area; and

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- Hollow-bearing Tree - Species**
- *Angophora costata*
 - *Corymbia gummifera*
 - *Eucalyptus pilularis*
 - *Eucalyptus robusta*
 - Dead Stag
- Retained Hollow-bearing Tree
(Labelled - Hollow-bearing trees to be retained within the Extraction Area)
- ⊗

■ Northern Biodiversity Offset Area

■ MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)

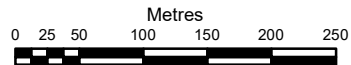
■ MP09_0091 - Northern Dunes Extension Extraction Area (7.3 ha)

□ Lot Boundaries

— Sub-arterial Road

— Local Road

== Track



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DRAWN BY: BDeane

DATA SOURCE:
NSW DFSI - 2019
Nearmap - 2019

Hollow-bearing Trees Within the Study Area

Sibelco
Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay NSW

FIGURE:

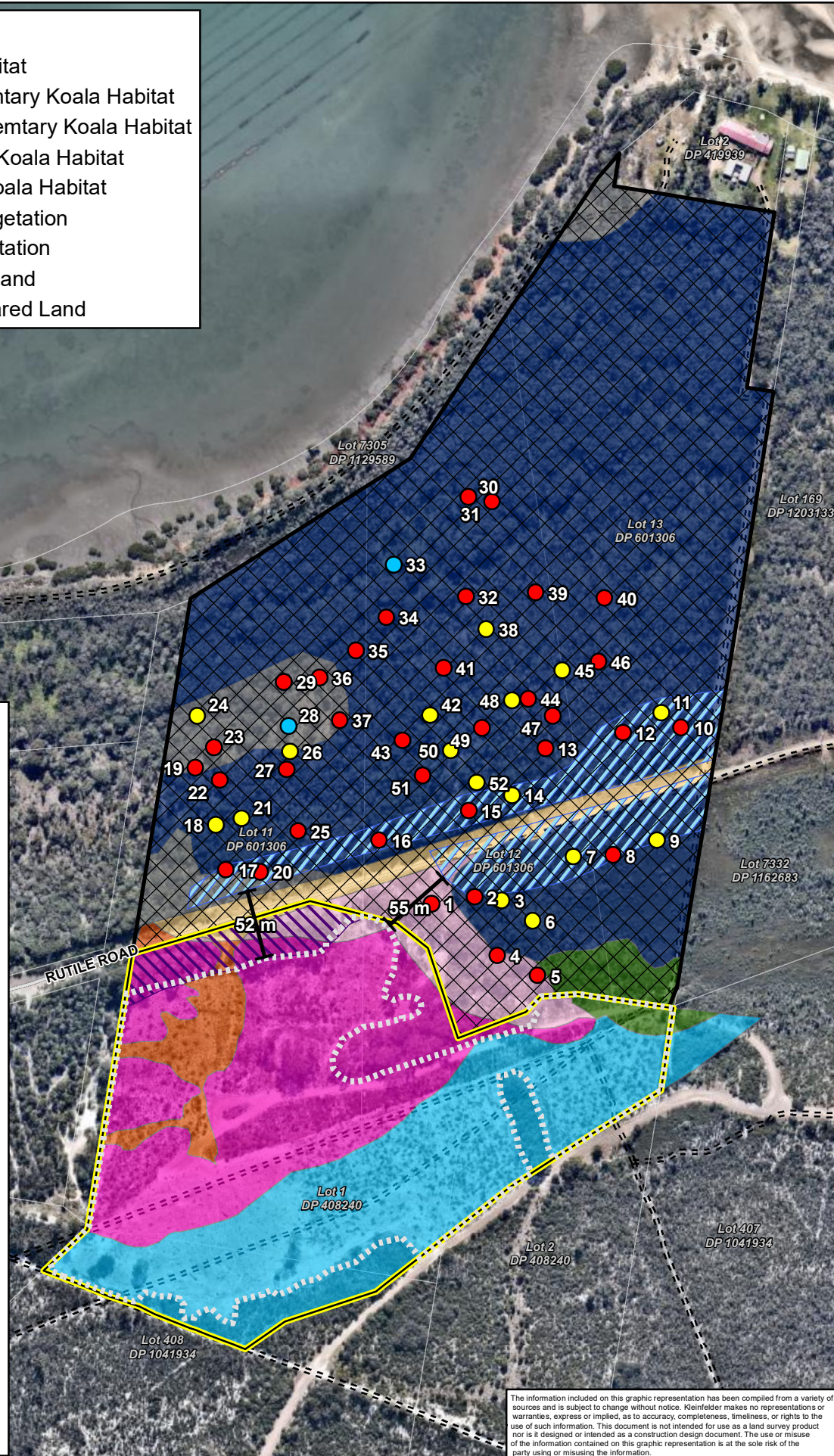
5

Koala Habitat

- Preferred Koala Habitat
- Link over Supplementary Koala Habitat
- Buffer over Supplementary Koala Habitat
- Buffer over Marginal Koala Habitat
- Link over Marginal Koala Habitat
- Buffer over Other Vegetation
- Link over Other Vegetation
- Buffer over Cleared Land
- Link over Mainly Cleared Land

Legend

- MP09_0091 - Northern Dunes Extension Extraction Area (7.3 ha)
- MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)
- Northern Biodiversity Offset Area
- Visual Amenity and Connectivity Buffer
- Habitat containing calling Wallum Froglets
- Lot Boundaries
- Sub-arterial Road
- Local Road
- Track
- Nestbox Location and Type**
 - Bat
 - Glider
 - Possum



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0 20 40 80 120 160 200
Metres



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DRAWN BY: BDeane

DATA SOURCE:
NSW DFSI - 2019
Nearmap - 2019

Koala Habitat Mapping & Calling Wallum Froglet Habitat Within the Study Area

Sibelco
Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay NSW

FIGURE:

6



- Wallum Froglet Habitat:** Large areas of habitat contain calling Wallum Froglets occurs within the study area. One area was identified in the north within Swamp Mahogany Paperbark – Swamp Forest around Big Swan Bay, and a second area within the Swamp Mahogany Paperbark – Swamp Forest (regenerating and remnant) on either side of Rutile Road (**Figure 6**). Buffers of approximately 50 m will be retained between the extraction area and these areas of habitat within the offsets (with the inclusion of the visual amenity buffer).

3.2.2.1 Threatened and Migratory Species

No threatened flora species were recorded within the Tanilba Northern Dune Extension.

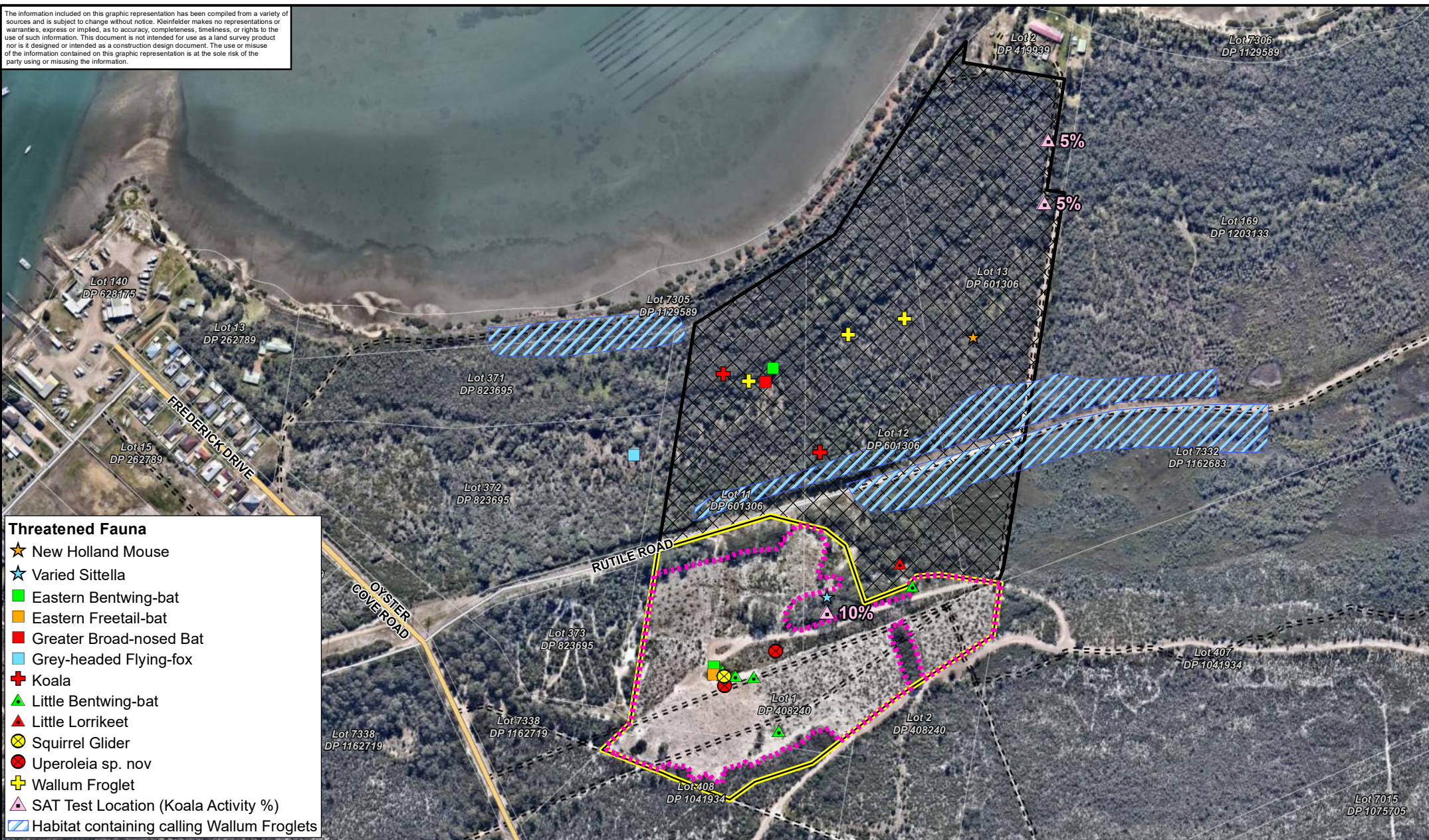
A total of 11 threatened fauna species were recorded during field surveys in 2007 and 2009 within the study area (**Table 5** and **Figure 7**). Three migratory terrestrial species with suitable habitat within the extraction area listed under the EPBC Act were recorded in the study area; *Monarcha melanopsis* (Black-faced Monarch), *Rhipidura rufifrons* (Rufous Fantail) and *Haliaeetus leucogaster* (White-bellied Sea-Eagle).

Table 5: Threatened fauna species recorded during 2007 and 2009 field surveys

Scientific Name	Common Name	TSC Act**	EPBC Act
Amphibians			
<i>Crinia tinnula</i>	Wallum Froglet	V	-
<i>Uperoleia mahonyi</i> ***	Mahony's Toadlet	E	-
Birds			
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-
Mammals			
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-
<i>Phascolarctos cinereus</i>	Koala	V; EP*	V
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-
E = Endangered, V = Vulnerable, EP = Endangered Population			
* Koalas are listed as Vulnerable throughout NSW under the TSC Act, the Koala population at Hawks Nest and Tea Gardens (including the Northern Dune site) is listed as an Endangered Population under the Act.			
** TSC Act repealed, replaced by the <i>Biodiversity Conservation Act 2016 (BC Act 2016)</i>			
*** The project was approved prior to this species becoming listed as endangered under the BC Act 2016.			

A previously undescribed amphibian species (*Uperoleia sp. nov.*) was captured in the extraction area during fauna surveys within Coastal Sand Apple – Blackbutt Forest, this species has since the Project Approval and preparation of the earlier version of this plan has been named Mahony's Toadlet and listed as endangered under the BC Act 2016. A study and report (Clulow 2009) was commissioned by Sibelco (formerly Unimin Australia Ltd) to determine a preliminary distribution of the species in the Tomago and Myall Lakes Sandbed systems (which are local to where the species was discovered). This study found that this species is well distributed throughout the Tomago and Tomaree sandbeds, and that it appears to be reasonably abundant where it occurs.

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- Threatened Fauna**
- ★ New Holland Mouse
 - ★ Varied Sittella
 - Eastern Bentwing-bat
 - Eastern Freetail-bat
 - Greater Broad-nosed Bat
 - Grey-headed Flying-fox
 - ✚ Koala
 - ▲ Little Bentwing-bat
 - ▲ Little Lorikeet
 - ⊗ Squirrel Glider
 - ⊗ Uperoleia sp. nov.
 - ✚ Wallum Froglet
 - ▲ SAT Test Location (Koala Activity %)
 - ▨ Habitat containing calling Wallum Froglots

- ▨ Northern Biodiversity Offset Area
- ▨ MP09_0091 - Northern Dunes Extension Application Area (9.0 ha)
- ▨ MP09_0091 - Northern Dunes Extension Extraction Area (7.3 ha)
- ▨ Sub-arterial Road
- ▨ Local Road
- ▨ Track
- ▨ Lot Boundaries

Metres
0 25 50 100 150 200 250



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DATE DRAWN: 29/11/2019 13:06 Version 1
DRAWN BY: BDearne

DATA SOURCE:
NSW DFSI - 2019
Nearmap - 2019

Threatened Fauna Species Within the Study Area

Sibelco
Tanilba Northern Dune Extension
Oyster Cover Road, Tanilba Bay NSW

FIGURE:

7

3.3 POTENTIAL IMPACTS TO BIODIVERSITY

3.3.1 Original Direct Impacts

Direct impacts prior to commencement of sand extraction within the Tanilba Northern Dune Extension Area are summarised in **Table 6**. As the extraction will not remove sand greater than 0.7 m above the predicted water table, it has been determined that there will not be direct impact to groundwater quality or to the hydrology of the surrounding area.

Table 6: Summary of direct impacts of the Tanilba Northern Dune Extension sand extraction project

Impact	Threatened and significant species directly affected
<p>Clearing of 8.2 ha of native vegetation which comprises:</p> <ul style="list-style-type: none"> Coastal Sand Apple – Blackbutt Forest (4.2 ha) and Coastal Sand Wallum Woodland – Heath (4 ha); Removal of 13 Hollow-bearing Trees; Koala Habitat: <ul style="list-style-type: none"> Supplementary Koala Habitat (Coastal Sand Apple – Blackbutt Forest); Marginal Koala Habitat (Coastal Sand Wallum Woodland – Heath); and 0.5 ha of Koala Habitat Buffer. 	<p>Species recorded within the extraction area:</p> <ul style="list-style-type: none"> Koala (from scats); Squirrel Glider; Insectivorous bats (four species); <i>Mahony's toadlet</i>; and Varied Sittella. <p>Migratory species recorded within the extraction area:</p> <ul style="list-style-type: none"> Black-faced Monarch. <p>Additional species recorded within study area:</p> <ul style="list-style-type: none"> Koala (sighted); New Holland Mouse; Grey-headed Flying-fox; Little Lorikeet; and Wallum Froglet. <p>Additional migratory species recorded within study area:</p> <ul style="list-style-type: none"> Rufous Fantail; and White-bellied Sea-Eagle
<p>Short to medium term interruption to existing wildlife corridor</p>	<p>Species likely to be impacted are:</p> <ul style="list-style-type: none"> Koala; Squirrel Glider; <i>Mahony's toadlet</i>; Insectivorous bats; Varied Sittella; and Migratory species with suitable breeding and foraging habitat within the proposed extraction area (i.e. Black-faced Monarch, Rainbow Bee-eater, Rufous Fantail, Satin Flycatcher).

3.3.2 Current Direct Impacts

Direct impacts relevant to the Project now that sand extraction has been completed within the Tanilba Northern Dune Extension Area are summarised in **Table 7**.

Table 7: Summary of direct impacts of the Tanilba Northern Dune Extension sand extraction project

Impact / activities	Threatened and significant species directly affected
Revegetation activities associated with the 8.2 ha of native vegetation.	<ul style="list-style-type: none"> Direct impacts are considered to be similar to those defined above for pre-mining, with a lesser degree of severity as the revegetation improves, and improves the habitat for these species.
Management of nest boxes as per the BMP.	
Removal of gravel and decompaction of gravel access / haul roads.	
Weed and pest management.	
Adjustment of the final landform levels and perimeter to improve the final landform.	

3.3.3 Indirect Impacts

Potential indirect impacts of the sand extraction project within the extension area, now that extraction is complete and the site is under rehabilitation include:

- Progressive improvement of fauna breeding habitat;
- Progressive improvement of shade/ shelter;
- Progressive reduction of erosion, sedimentation, noting the sand results in minimal runoff;
- Weed management and progressive improvement of biotic edge effects;
- Use of biocides, pollution (oil/chemical spills); and
- Rubbish dumping where access is not controlled and progressive reduction of human activity.

4. REHABILITATION MANAGEMENT PLAN

4.1 REHABILITATION OBJECTIVES

The aim of this Rehabilitation Management Plan (RMP) is to progressively re-establish original vegetation community types after sand extraction and completion of landform rehabilitation. The plan sets out to achieve a standard of tree and shrub growth, and recovery in species richness and abundance, as close as possible to that of the original vegetation, within the limits of current best practice techniques, final landform and a reasonable period of post-extraction monitoring.

To achieve this aim the RMP will have the following objectives:

- Establish a stable and sustainable native vegetation cover, free of erosion;
- Establish the original vegetation community types, although at different proportions due to lowered post-extraction landform;
- Establish the structural components and dominant species of vegetation, comparable with pre-extraction vegetation at similar elevations; and
- Establish similar species composition to pre-extraction at similar elevations.

Efforts will also be made to re-establish all other structural components of the vegetation including canopy, sub-canopy, understorey, groundcover, and litter, though not necessarily in the same proportions as pre-extraction vegetation at similar elevations, and within the above limits.

4.2 REHABILITATION PLAN

4.2.1 Stages of Rehabilitation

The quarrying within the Tanilba Northern Dune Extension utilised progressive rehabilitation methods based on experience gained in the adjacent Northern Dunes south of the site. This involved direct topsoil replacement onto exhausted areas to aid in revegetation from the topsoil seedbank and stabilisation of disturbed areas. Quarrying was completed in a stages of a maximum of three hectares of disturbance at any one time; one hectare undergoing sand extraction, a second hectare undergoing clearing and the third undergoing rehabilitation.

4.2.2 Final Landform and Vegetation

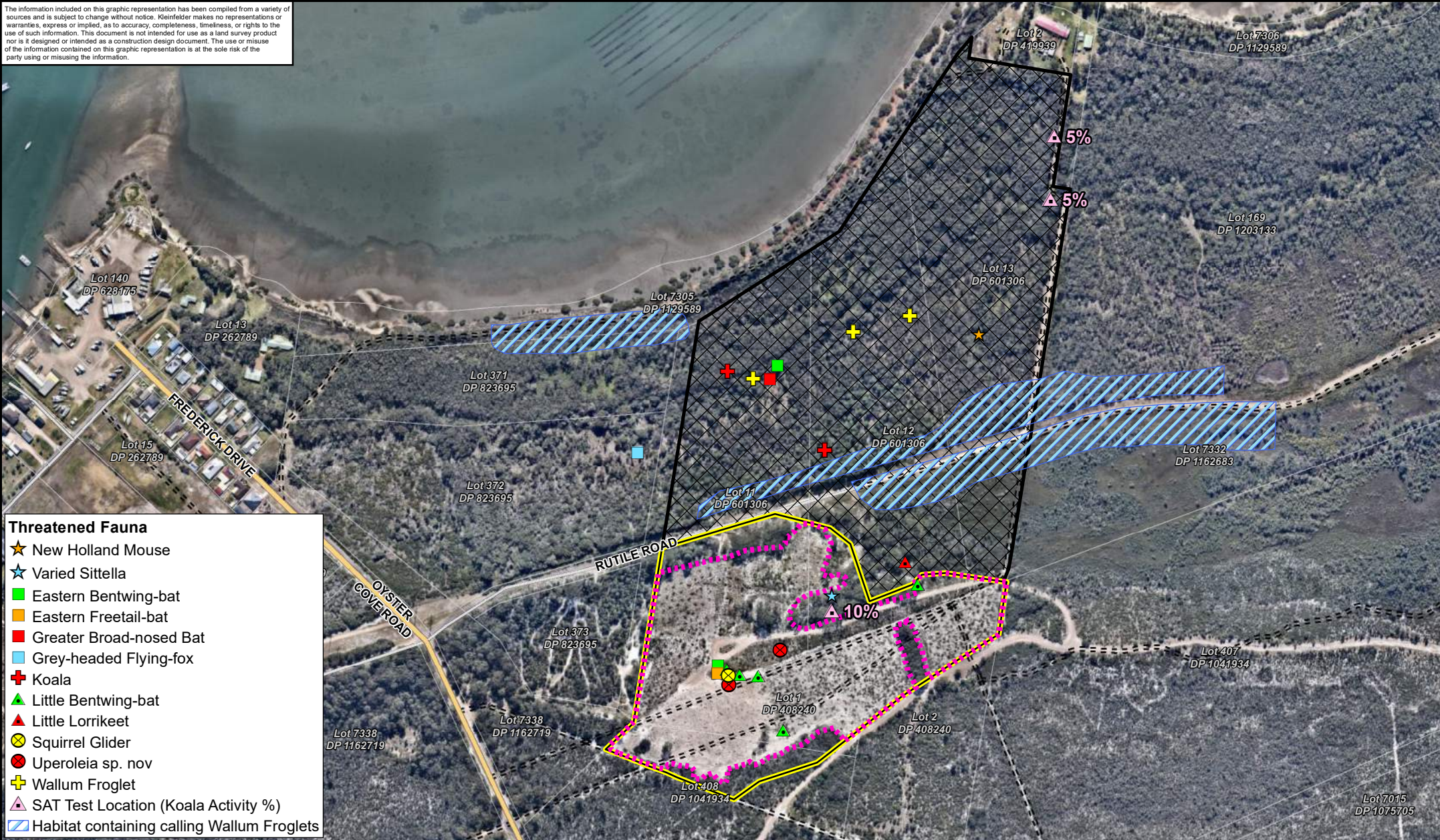
Due to the lowering of the final landform of the disturbance area, the majority of the site will be returned to Coastal Sand Wallum Woodland – Heath. There may be some scope for rehabilitation of the Coast Sand Apple – Blackbutt community (that also occurs within the disturbance area) in areas that have a higher final landform; also areas of this community may be retained within vegetation islands (patches of retained vegetation within the extraction area).

The final land use plan of the extraction area, including the offset immediately to the north of the site is shown in **Figure 8**.

The final revegetation plan will incorporate as many mature trees as possible. This will occur through the retention of a visual amenity barrier along the north of the disturbance area (six large trees to be retained), the retention of Hollow-bearing trees 16, 17, 18 and 20 (**Figure 5**) within the site, and where possible mature trees will be retained within vegetation islands.

Vegetation within the north east of the application area are too close to the water table and do not contain any significant silica resources. These areas of remnant vegetation will be retained within the Northern Biodiversity Offset and managed in accordance with the BMP.

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4.3 MANAGEMENT MEASURES

Management measures for the successful rehabilitation of the Tanilba Northern Dune Extension Area are outlined in

Table 8. The Operator will be responsible for ensuring that all management measures required for the rehabilitation management plan are implemented. Management measures under this Plan will required amendment prior to any sand extraction operations recommencing within the Project Area to ensure impacts from sand extraction are appropriately managed.

Table 8: Management measures and responsibilities for the rehabilitation of the Northern Dune Extension Area

Item	Action	Trigger/ Timing	Reporting
4.3.1 General Management Measures			
A.	<u>Inductions</u> The site induction will include the following: <ul style="list-style-type: none"> • All people entering the site will be made aware of environmentally sensitive habitat and surrounding vegetation and that access to these areas is limited to authorised people only; • Procedures to reduce weed spread; and • General fire awareness and response procedures. 	During site inductions for staff and contractors	Nil
B.	<u>Controlling Site Access</u> <ul style="list-style-type: none"> • Only authorised personnel are allowed to enter the site; all contractors must undergo site induction prior to entering the site; • Road access to the extension area will occur via the existing haul road to the Tanilba Northern Dune site off Oyster Cove Road. When truck hauling operations are not being conducted this access point is locked; and • The boundaries of the extraction area will be protected through installing locked gates (or similar) at access points, delineation barriers (felled trees, sand mounds, fencing) and the retention of vegetation along boundaries to control access to the area. Monitoring and maintenance of this boundary will occur during regular inspections of the site (bi-annual monitoring, Section 4.6.1). 	At all times	Nil

Item	Action	Trigger/ Timing	Reporting
C.	<u>Hydrocarbon Spills</u> The procedure for handling hydrocarbon spills is outlined in the EMP. The plan provides for an emergency response strategy to effectively minimise, manage, record and remediate any hydrocarbon spills, so as to minimise environmental impacts.	In the event of a hydrocarbon spill	AEMR
4.3.2 Vegetation Pre-clearing, Clearing, Fauna Management and Topsoiling Protocol			
i.	In the unlikely event that significant remnant vegetation requires clearing and topsoil stripping Protocols under section 4.3.2 will be implemented.		
A.	<u>Targeted surveys for <i>Uperoleia sp. nov.</i></u> In the event that significant remnant vegetation clearing is required for rehabilitation purposes, targeted surveys for the novel species of <i>Uperoleia</i> will occur within the proposed clearing area prior to clearing. Surveys will include: <ul style="list-style-type: none"> Active searches (transects and meanders) for two person hours on two separate nights (total four person hours). Ideally, surveys will be conducted in spring, summer or autumn after a suitable rain event (> 50 mm in 48 hours). During the surveys if <i>Uperoleia sp. nov.</i> is identified the following will occur: <ul style="list-style-type: none"> Record habitat type in which the species is identified; Call will be recorded or the individuals will be photographed for positive identification; and The individual will be relocated to an area of similar habitat outside the proposed clearing area. 	In spring, summer or autumn after suitable rain (> 50 mm in 48 hours) prior to clearing remnant vegetation	AEMR
B.	<u>Weeds</u> During pre-clearing surveys, areas of weed infestation will be delineated to allow for separate stockpiling of this soil.	Prior to clearing remnant vegetation	Nil
C.	<u>Fauna Habitat</u> At least one week prior to any vegetation clearing a survey of habitat trees will be conducted in the planned clearing area: <ul style="list-style-type: none"> Habitat trees (containing hollows or nests) will be clearly marked using flagging tape or spray paint and watched at dusk to determine whether any of the hollows are in use by fauna. Any occupied trees will be marked accordingly to indicate the presence of fauna species; Hollow-bearing Trees (Figure 8) are being retained, these trees will be marked to allow easy identification; and Pre-clearing surveys will also be conducted to check for the presence of any Koalas within the proposed extraction area, any trees that Koalas are identified in will be marked to indicate occupation. 	At least one week prior to clearing remnant vegetation	AEMR

Item	Action	Trigger/ Timing	Reporting
D.	<p><u>Protection of Retained Vegetation</u></p> <ul style="list-style-type: none"> • The Operational Area: The extraction area boundary will be surveyed and clearly marked prior to clearing: <ul style="list-style-type: none"> ○ This boundary will also include a five metre buffer of screening vegetation along the northern perimeter of the extension area along Rutile Road to reduce the visual impacts to the north (towards Oyster Cove); and ○ Pant operators and all required site personnel will be made aware of where the boundary is and instructed not to clear outside the boundary to protect surrounding vegetation. • Vegetation Islands: Patches of natural vegetation (approximately 10 m x 10 m) will be maintained in shallow mining areas (sand depths less than two metres) at the edges of deeper sands. These areas will be identified and marked prior to clearing based on the following criteria: <ul style="list-style-type: none"> ○ The islands will represent a range of community types within the extension area; ○ The vegetation will include significant botanical or ecological attributes such as older Grass Trees, mature canopy species, less common species and species that are difficult or slow to re-establish; ○ At a minimum Hollow-bearing Trees 16, 17, 18 and 20 will be retained within the extraction area (Figure 8), preferably within vegetation islands. Where possible other habitat trees will also be retained within the vegetation islands; ○ Their location will be scattered throughout the extraction area, although limited to areas of sand depths less than two metres; and ○ The total area of retained vegetation will be no less than 2% of the total extension area, to achieve this patches will be retained at an average density of not less than two per hectare. 	Prior to remnant vegetation clearing	Nil
E.	<p><u>Seed Harvesting</u></p> <ul style="list-style-type: none"> • Seed Collection: Collection of seed by hand should be conducted prior to vegetation clearing within the disturbance area and surrounds to utilise available seed resources; and • Brush Matting: Where possible, individual plant species (especially <i>Leptospermum</i>, <i>Melaleuca</i> and <i>Eucalyptus</i> species) within the disturbance area will be harvested when they are bearing mature seed (rather than immediately prior to clearing). <p>See Section 4.4 for details of seed harvesting and utilisation.</p>	Up to 12 months prior to clearing remnant vegetation (dependent upon species)	AEMR

Item	Action	Trigger/ Timing	Reporting
F.	<p><u>Clearing Protocol</u></p> <ul style="list-style-type: none"> • A fully qualified, experienced and licenced ecologist will supervise clearing and encourage movement of any displaced animals into adjoining vegetation (see Protocol D below for details of fauna displacement); • Ideally, no clearing should occur during the early evening or at night (when fauna species are most likely to be on the move and are more vulnerable to injury); • Any available plant material that can be collected for brush matting will be cut ahead of the mining face and spread over areas that have been re-distributed with topsoil; and • Large organic debris, and where possible, other vegetation cleared from the operational area will be stockpiled and either spread on rehabilitated areas immediately after re-distribution of topsoil or utilised within the offset areas requiring revegetation. 	During remnant vegetation clearing	AEMR
G.	<p><u>Protection of Threatened Fauna</u></p> <p>As multiple threatened species have been identified within the surrounding the study area the following measures will be implemented to minimise impacts to these species:</p> <ul style="list-style-type: none"> • During pre-clearing surveys active searches for Koalas will be conducted and any trees containing Koalas will be marked. If prior to clearing commencing the Koala/s have not relocated from the site the following methodology will be followed: <ul style="list-style-type: none"> ○ Surrounding vegetation will be cleared, no vegetation will be felled onto the occupied tree; ○ The occupied tree will be left standing two nights to encourage self-relocation; ○ If by this time the Koala/s have not self-relocated they will be retrieved from the tree prior to felling and relocated to a safe location outside the disturbance area, if possible with a preferred Koala feed tree (see Table 10, Section 4.4.2). • Peak breeding season of the novel <i>Uperoleia</i> sp. is most likely to be during summer (based on breeding cycle of other <i>Uperoleia</i> sp.); this is when the species is most active and tadpoles will be present. Clearing during summer will be avoided to limit the potential impacts of clearing on the species; • Additionally, the habitat tree clearing protocol (outlined in Protocol E below) will serve to mitigate impacts on other threatened species (Microchiropteran bats, birds, and arboreal mammals) that have previously been recorded in the extension area. 	During remnant vegetation clearing	AEMR

Item	Action	Trigger/ Timing	Reporting
H.	<p><u>Habitat Tree (Containing Hollows or Nests) Removal Protocol</u></p> <p>Hollow trees (<u>Containing Hollows or Nests</u>) will be left standing for two nights after the surrounding vegetation has been cleared to encourage any native fauna species utilising the habitat hollows/nests to self-relocate. The actual felling of any habitat trees (<u>Containing Hollows or Nests</u>) will be attended by a suitably experienced fauna ecologist in order to ensure the safety of any fauna found to be in the hollows or nests.</p> <p>On all occasions, trees (<u>Containing Hollows or Nests</u>) will be 'soft felled' by an experienced machine operator. The recommended soft felling procedure is as follows:</p> <ul style="list-style-type: none"> • The tree (<u>Containing Hollows or Nests</u>) is given several moderate nudges with an excavator to give a warning to any occupying native fauna; • The tree (<u>Containing Hollows or Nests</u>) is then carefully watched and native fauna given an opportunity to self-relocate before the tree is actually felled; • The tree (<u>Containing Hollows or Nests</u>) is soft felled with the rate of the trees fall controlled by the machinery operator to minimise impact; • All hollows or nests will be inspected for native fauna species and if any are found, the animal should be relocated at an appropriate time of day (i.e. dusk for nocturnal species). If the animal is injured, it should be taken to a local veterinarian (see Protocol D below); • Hollows should be cut from the tree at least one metre beyond the deepest point of the hollow and then stored in a dry safe place in size related categories, or transported to the offset areas for erection; and • Erection of the hollows or nest boxes will occur within the offset areas in accordance with the Nest Box Installation and Monitoring Protocol outlined in the BMP. 	<p>During felling of habitat trees (<u>Containing Hollows or Nests</u>) in remnant vegetation</p>	AEMR

Item	Action	Trigger/ Timing	Reporting
I.	<p><u>Fauna Displacement Protocol</u></p> <p>Displacement of fauna may occur as part of the clearing process. All clearing will be supervised by a suitable qualified, experienced and licenced ecologist, the following protocol should be followed in case of an injured animal:</p> <ul style="list-style-type: none"> • If possible any fauna fleeing the clearing area should be captured and relocated or directed to a safe area outside the extraction zone during the tree removal process; • All fauna are to be handled in such a way as to prevent injury to the animal or the handler; • Once the animal is safely handled it should be relocated or caged in a hessian bag or box and released at an appropriate time of day; • Any microbats or other nocturnal species captured during the tree removal process should be held in cotton or hessian bags and released at dusk on the same day as capture if possible; • If any animal is injured during the construction process, a veterinarian should be contacted immediately for professional advice on the best course of action; and • If any native animal is injured during other operational/ construction processes while an ecologist, environmental representative or animal handler is not present, they must be contacted immediately. 	When fauna are encountered during clearing of remnant vegetation	AEMR
J.	<p><u>Transplanting</u></p> <p>During clearing, where possible mature <i>Xanthorrhoea</i> species (Grass Trees) will be transplanted to rehabilitation areas using the following methodology:</p> <ul style="list-style-type: none"> • The plants will be excavated with a front-end loader (or similar) retaining as much soil around the roots as possible; and • The Grass Tree will then be moved to a prepared hole, water in where possible, and burnt. Burning the shirt of dead leaves and some of the lower green leaves is important to stimulate new growth and flowering. 	During clearing of remnant vegetation and rehabilitation	AEMR
K.	<p><u>Topsoil Stripping and Stockpiling</u></p> <ul style="list-style-type: none"> • Stripping will normally be conducted by a bulldozer to an average depth of 30 cm (actual depth will be determined by the Safety and Environment Coordinator in consultation with operating personnel); • Once an area has been stripped a survey of stockpiles will determine the volume of topsoil reclaimed and available for rehabilitation; • Topsoil stockpile locations will be determined by the Safety and Environment Coordinator to minimise dust generation, stockpile erosion and sediment run-off; • Long-term stockpiles (longer than 6 months) will not exceed a height of three metres, short-term stockpiles (up to six-months) may be of greater dimension, depending on the optimal requirements of the particular situation; and • Vegetation usually regenerates naturally on the stockpiles (germination of the seedbank), where native vegetation does not establish on the stockpiles it will be established (seeding/ planting) to maintain soil biological activity. 	During topsoil stripping and stockpiling	AEMR & Topsoil inventory

Item	Action	Trigger/ Timing	Reporting
L.	Throughout the life of the quarrying within the extension area a topsoil inventory will be maintained to determine the volume of topsoil reclaimed and available for subsequent landform rehabilitation.	During topsoil stockpiling	Topsoil inventory
M.	<u>Redistribution of Topsoil</u> <ul style="list-style-type: none"> Topsoil is to be transferred and respread directly over the previous mined area/cleared area as soon as it is mined out and no longer required for access (exhausted area); Direct topsoil transfer from an area will be utilised to facilitate the natural regeneration of plant species and limit the degradation of soil microbes; Consideration will be given to segregation of topsoils stripped from different landscape units and subsequent replacement in the appropriate situation in the final landscape; and Topsoil will be re-distributed at an average depth of 30 cm. 	Where topsoil was stripped and stockpiled following clearing of remnant vegetation	AEMR & Topsoil inventory
4.3.3 Progressive Rehabilitation of Disturbed areas			
A.	<u>Haulage Road Revegetation.</u> Haulage roads that are no longer in use will be remediated as follows: <ul style="list-style-type: none"> Inspected by an ecologist/suitably trained person prior to treatment to map weed presence and identify vegetation for retention. A minimum of one weed treatment should be applied to identified weed infestation areas. Remove gravel from the surface. Gravel should be reapplied to long term access roads with the Operator lease areas, under Excavated Natural Material (ENM) Exemptions, having regard to potential for weed spread (i.e. placement of gravel from an area of previous weed infestation should not be applied to areas of low weed levels). Rip underlying soils to a nominal 300mm depth. Seed and plant within the area consistent with planting protocols. 	Road Decommissioning	AEMR
B.	<u>Seeding and Planting</u> The methodology for revegetation is outlined in Section 4.4 , and will include the following: <ul style="list-style-type: none"> Organic Screening: Organic material sourced from the processing plant will be redistributed over the rehabilitation to provide organic matter, legume seeds and erosion control; Direct Seeding: Locally sourced seed will be used, and will be sown in the soil rather than broadcast; Brush Matting: Plant material will be and spread in a thick layer over re-topsoiled areas; and Propagation and Replanting: Seeds collected will be supplied to a local nursery for propagation and planting programs will occur in autumn. 	Post topsoil spreading	AEMR

Item	Action	Trigger/ Timing	Reporting
4.3.4 Rehabilitation Monitoring			
A.	<p><u>Bi-annual Vegetation Monitoring</u></p> <p>Six months after each rehabilitation area (blocks Q1 to Q6 as shown by Figure 8) has been re-distributed within topsoil bi-annual monitoring will commence. Bi-annual monitoring will occur in summer and winter for a period of three years (six survey events):</p> <ul style="list-style-type: none"> During the bi-annual monitoring data will be collected from a series of 2 m x 2 m plots that are evenly distributed over the rehabilitation area. Data collected will include the following: <ul style="list-style-type: none"> Species composition; Plant/ species density; Stratum proportions (structural development); Overall growth; Cover; and Presence of fire resistant species. During each monitoring event inspections of the rehabilitation will also be conducted to identify any weeds, signs of feral pests, erosion issues, die-off and site access issues. Any weeds and/or pests will be mapped and documented in the rehabilitation monitoring report with recommendations for control. <p>See Section 4.6.1 for the bi-annual monitoring protocol.</p>	Bi-annually in Summer and Winter for three years (initial monitoring 6-months post topsoil spreading)	AEMR
B.	<p><u>Post 3-year Vegetation Monitoring</u></p> <p>Post three years rehabilitation blocks will have monitoring conducted annually until all completion criteria are met and approved by the Secretary.</p> <ul style="list-style-type: none"> Post three year monitoring will consist of one permanent 20 m x 20 m quadrat per hectare of rehabilitation with six 2 m x 2 m plots randomly distributed within the quadrat. Data collected within the 2 m x 2 m plots will be as the bi-annual monitoring (Item A above), and data collected from the 20 m x 20m quadrat will be as follows: <ul style="list-style-type: none"> Total species richness; Average height; Species cover abundance; Reproductive status and any evidence of second generation plants (succession) will be recorded for each species; and General comments; including notes on litter deposition and structural formation. A photographic record of each quadrat will occur during the post 3-year annual monitoring; and Inspections of the rehabilitation will be conducted at each survey to identify any weeds, signs of feral pests, erosion issues, die-off and site access issues. Any weeds and/or pests will be mapped and documented in the rehabilitation monitoring report with recommendations for control. 	Annually until rehabilitation is considered satisfactory by the Planning Secretary	AEMR

Item	Action	Trigger/ Timing	Reporting
C.	<u>General Rehabilitation Inspections</u> <u>Inspections of the rehabilitation area will be conducted to ensure relevant management measures within this Plan have been implemented and are effective consistent with EHS monthly inspection procedure detailed in the EMP. Outcomes of the monthly inspections will be summarised in the AEMR.</u> <u>Vegetation re-establishment will be monitored consistent with monitoring protocols 4.3.4A and B.</u>	Monthly	AEMR
4.3.5 Site Stabilisation, Erosion and Stormwater Control			
A.	Where additional rehabilitation is required using heavy machinery, the extent of the works area will be clearly delineated to minimise disturbance to non-target areas.	Pre-work surveys	Nil
B.	The use of best practice erosion and sediment control measures will occur as required to minimise the impacts of soil disturbance on surrounding vegetation/ habitat. Procedures outlined in the Soil and Water Management Plan will be followed.	As required	AEMR
C.	Rehabilitated areas will be inspected to ensure control measures identified in this Plan are effective and identify remedial action(s) if required.	During Rehabilitation Monitoring (4.3.4)	AEMR
4.3.6 Additional Measures for Threatened Species Protection			
These mitigation measures are in addition to those outlined in the pre-clearing and clearing protocols			
A.	<u>Koala Protection</u> <ul style="list-style-type: none"> Staff and contractors will be made aware of the possibility of encountering Koalas during work activities. All staff and contractors will be made aware of the identified Koala habitat surrounding the extraction area and that the extraction area is a potential movement corridor for the species. This will be achieved by placing a map of the identified Koala habitat at the Operator's site office in view of staff and contractors and through inductions and Toolbox Talks; Speed limits of 20 km/ hr are signposted and enforced across the site; and 	At all times	Nil
	<ul style="list-style-type: none"> Where appropriate habitat for Koala feed trees (Table 10 in Section 4.4.2) occurs in the final landscape, these species will be re-introduced into the rehabilitation area to encourage Koalas into the post extraction landscape. 	During revegetation	AEMR

Item	Action	Trigger/ Timing	Reporting
B.	<u>Wallum Froglet</u> <ul style="list-style-type: none"> The design of the sand extraction activities allows for the retention of a vegetation buffer around the habitat for the Wallum Froglet. With the retention of the visual amenity buffer, there will be a minimum vegetation buffer of approximately 50 m between the disturbance area and the areas of identified habitat for the species (shown in Figure 6); and, As outlined in Section 4.3.5, site stabilisation and erosion control will occur as required across the disturbance area to mitigate against potential offsite impacts to habitat from soil disturbance. 	50m vegetation buffer maintained at all times; Erosion control as required.	Nil
C.	<u>Indirect impact to Fauna</u> The use of herbicides, pesticides, insecticides and biocides within all areas (extraction area and offsets) will be limited so to reduce the impacts on threatened species, their habitat and food resources. When chemicals are to be used, techniques that limit the quantity being used will be utilised and less harmful chemicals will be preferred. Weed and pest control to be conducted by a suitably qualified person/contractor.	At all times	AEMR
4.3.7 Weed and Pest Control			
A.	Weed and pest management will be implemented within the extension area to reduce competition, encourage growth of native species and protect locally occurring fauna species, control measures will include: <ul style="list-style-type: none"> During monitoring of the rehabilitation, inspections will be conducted, by a suitably qualified contractor, to identify any weeds, including non-local native species, and pests within the site; Weed and pest management will be conducted by a suitably qualified contractor with a focus on the recommendations made in the AEMR (as a result of rehabilitation monitoring as outlined in 4.3.4); and Control of weeds will predominantly be through manual removal to limit the use of chemicals. Chemical controls will only be utilised where there are significant outbreaks. 	Inspections during rehabilitation monitoring (4.3.4); and weed and pest control annually as required based on inspection	AEMR
B.	<u>Vehicles</u> <ul style="list-style-type: none"> Before any machinery/ vehicle (other than haul trucks) enters the extension area, it must be cleaned to remove all soil and plant material so to limit the introduction and spread of weeds and soil pathogens; Any haul truck that has been operating on a site other than the Tanilba Northern Dune will be cleaned to remove soil and plant material prior to joining the hauling operation; and 	Prior to entering site	Nil

Item	Action	Trigger/ Timing	Reporting
	<ul style="list-style-type: none"> Vehicle access to the rehabilitation will be restricted to authorised personnel. 	At all times	
C.	Once access tracks are no longer required they will be re-vegetated as they can provide a vector for weeds.	As required	AEMR
4.3.8 Bushfire Management			
A.	A separation distance of 10 m will be maintained between stockpiles of combustible material and remnant vegetation.	At all times	Nil
B.	Operations and the site will be managed to minimise the likelihood of ignition sources through good 'housekeeping' (for example, all waste in bins).	At all times	Nil
C.	Bushfire risk must be reviewed by contractors working within the site to both avoid ignition of fires and evacuate in the event of fire.	At all times	Nil
D.	Any work areas (e.g. involving vehicles and machinery) will be equipped with firefighting measures to assist in the management of any fires on site. Fire extinguishers in all machinery, trucks and vehicles, water cart (as contracted).	At all times	Nil
4.3.9 Rubbish Removal			
A.	While the Operator will work to restrict access where feasible this cannot always be controlled. As such the Operator will make all reasonable and practical efforts to ensure the rehabilitation area is free from rubbish and on an annual basis, the Operator will undertake rubbish removal activities within those areas identified during Rehabilitation Monitoring.	As required and annually	AEMR
4.3.10 Visual Impacts			
B.	Visual impacts of the project are progressively reducing as rehabilitation advances, a 5m buffer of screening vegetation was retained as a visual amenity buffer along the northern edge of the extraction area where the site occurs adjacent to Rutile Road. The LMP and BMP provide for the management of this area through restriction of clearing and management of weeds.	At all times	AEMR

4.4 REVEGETATION METHODOLOGY

As the final landform across the extraction area will be lower than the pre-mining landscape, Coastal Sand Wallum Woodland – Heath will be the target vegetation community across the site. There will be some scope for other vegetation communities (primarily Coast Sand Apple – Blackbutt Forest) in higher areas of the final landform. Therefore, specific species mixes will be required for different landforms within the extraction area.

To aid in the re-establishment of native vegetation over the extraction area a combination of methods will be utilised. Initially topsoil will be distributed over the exhausted areas; a significant number of species will naturally regenerate from the topsoil seedbank. Where certain species are lacking (i.e. major structural species), or are known to not readily regenerate from the topsoil a number of methods will be utilised to re-introduce these species. The revegetation strategy will consist of a schedule that defines species and target plant densities for respective vegetation types in accordance with baseline survey data and recommendations from monitoring events.

Given that vegetation rehabilitation is vulnerable to climatic and other ecological factors (including human intervention), and regeneration of native species follows a pattern of succession over time, rehabilitation areas will be monitored (refer to **Section 4.6**) and supplemented where necessary for up to 8-years after initial planting or until the completion criteria have been achieved to the satisfaction of the Planning Secretary

4.4.1 Species Selection and Revegetation Method

The recommended choice of rehabilitation methods for particular plant species is summarized in **Table 9**. This Table will be used as a guide to vegetation rehabilitation. Actual methods of rehabilitation may be modified or varied in response to the results of monitoring surveys as detailed in **Section 4.6**.

Habitat types are abbreviated as follows:

- **HS:** Heathy Scrub: Coastal Sand Wallum Woodland – Heath
- **F:** Forest: Coastal Sand Apple – Blackbutt Forest

Methods of re-establishment, in order of preference, are listed below and are abbreviated as follows:

- **R** Regenerates from topsoil
- **B** Brush matting
- **D** Direct Seeding
- **M** Mature Specimens retained in mine path
- **P** Propagation
- **O** Organic Screenings
- **T** Transplanted specimens

Table 9: Species recorded in the Tanilba Northern Dune Extension for potential revegetation

Scientific Name	Common Name	Habitat	Mode of Re-establishment
<i>Acacia baueri</i>	Tiny Wattle	HS	R, P
<i>Acacia suaveolens</i>	Sweet Wattle	HS/ F	R
<i>Acacia terminalis</i>	Sunshine Wattle	F	R
<i>Acacia ulicifolia</i>	Juniper Wattle	HS / F	R, O
<i>Actinotus helianthi</i>	Flannel Flower	HS / F	R
<i>Amperea xiphoclada</i>	Broom Spurge	HS	R
<i>Angophora costata</i>	Smooth barked apple	F	M, P, D
<i>Banksia aemula</i>	Wallum Banksia	HS / F	P, D
<i>Boronia pinnata</i>	Pinnate Boronia	HS / F	R
<i>Bossiaea ensata</i>	Sword Bossiaea	HS / F	R
<i>Bossiaea heterophylla</i>	Variable Bossiaea	HS / F	R
<i>Calytrix tetragona</i>	Fringe Myrtle	HS	R, P
<i>Caustis pentandra</i>	Thick Twist rush	HS	R
<i>Caustis recurvata</i>	Curly sedge	HS	R
<i>Corymbia gummifera</i>	Red Bloodwood	HS / F	P, B, M
<i>Dianella caerulea</i>	Paroo Lily	F	R, T
<i>Dillwynia retorta</i>	Small leaf Parrot pea	HS / F	R, O
<i>Eriostemon australasius</i>	Wax Flower	HS / F	R, T
<i>Eucalyptus capitellata</i>	Brown Stringybark	F	P, B
<i>Eucalyptus pilularis</i>	Blackbutt	F	P, B, M
<i>Eucalyptus piperita</i>	Sydney Peppermint	HS / F	P, B, M
<i>Eucalyptus robusta</i>	Swamp Mahogany	SF	P, B
<i>Eucalyptus signata</i>	Scribbly Gum	F	P, B
<i>Euryomyrtus ramosissima</i>	Rosy Baeckea	HS / F	R

Scientific Name	Common Name	Habitat	Mode of Re-establishment
<i>Gompholobium virgatum</i>	Glory pea	HS / F	R, O
<i>Hakea teretifolia</i>	Dagger Hakea	HS / F	P
<i>Hardenbergia violacea</i>	Purple Coral pea	F	R, O, P
<i>Hibbertia fasciculata</i>	-	HS / F	R
<i>Hibbertia linearis</i>	Guinea Flower	HS / F	R
<i>Hypolaena fastigiata</i>	Tassel Rope rush	HS / F	R
<i>Isopogon anemonifolius</i>	Drumstick cone bush	HS	R, P
<i>Leptocarpus tenax</i>	Slender Twine rush	HS	R, T
<i>Leptomeria acida</i>	Sour Currant bush	HS	R
<i>Leptospermum trinervium</i>	Paperbark Tea tree	HS / F	P, B
<i>Leptospermum polygalifolia</i>	Yellow Tea Tree	HS / F	P, B
<i>Lepyrodia scariosa</i>	Scale rush	HS	R
<i>Leucopogon ericoides</i>	Pink Beard Heath	HS / F	R
<i>Leucopogon juniperinus</i>	Long flower Beard Heath	HS	R
<i>Leucopogon virgatus</i>	Common Beard Heath	HS / F	R
<i>Lomandra glauca</i>	Pale Mat rush	HS / F	T, R
<i>Melaleuca nodosa</i>	Ball Honey Myrtle	HS	P, B, R
<i>Melaleuca sieberi</i>	Sieber's Paperbark	HS	P, B
<i>Monotoca scoparia</i>	Prickly Broom heath	HS / F	R
<i>Persoonia lanceolata</i>	Geebung	HS / F	R
<i>Pimelea linifolia</i>	Slender Rice Flower	HS / F	R
<i>Pteridium esculentum</i>	Austral Bracken	F	R
<i>Ricinocarpos pinifolius</i>	Wedding Bush	HS / F	R
<i>Tetralthea thymifolia</i>	Black eyed Susan	HS / F	R
<i>Woolfsia pungens</i>	Woolfsia	HS / F	R
<i>Xanthorrhoea glauca</i> ssp. <i>glauca</i>	Austral Grass Tree	HS / F	T, P, D
<i>Xanthorrhoea latifolia</i> ssp. <i>latifolia</i>	Forest Grass Tree	HS / F	T, P, D

4.4.1.1 Direct Seeding

Locally sourced seed will be used, and will be sown in the soil rather than broadcast. Harvesting of mature seed and direct sowing into re-topsoiled areas at the most appropriate time of year (usually autumn or spring) will be undertaken for species that typically do not readily regenerate from the soil seedbank, such as *Eucalyptus*, *Angophora*, *Banksia* and *Xanthorrhoea*.

Common pioneer (i.e. *Acacia* species and *Actinotus helianthi*) will usually regenerate in abundance and direct seeding is not required. If for any reason they don't germinate within areas of the rehabilitation; they can be introduced in this way.

4.4.1.2 Brush Matting

Rehabilitation will be facilitated by spreading brush matting composed of plant material cut ahead of the mining face and spread in a thick layer over the rehabilitation areas. Large branches and whole plants are preferred for matting because they will not move in the wind. Brush matting facilitates direct seeding, provides a protected microclimate for developing seedlings, and adds nutrients to the soil.

Where possible individual plant species (especially *Leptospermum*, *Melaleuca* and *Eucalyptus* species) will be harvested when they are bearing mature seed rather than immediately prior to clearing. Bradysporous (seed retaining) species are best harvested and spread in autumn whereas geosporous (seed shedding) species are best harvested immediately prior to annual seed release in late spring.

4.4.1.3 Propagation and Replanting

The focus of propagation is twofold:

- Dominant structural species that have difficulty establishing naturally or recalcitrant species, and
- Species that are desired for establishment in strategic locations or densities to achieve the revegetation objective.

Seed will be collected locally and supplied to a wholesale nursery for propagation, or alternatively, will be propagated at the Operator's nursery. Planting programs will occur in autumn for optimum seedling establishment success.

4.4.2 Food Trees for Koalas

All canopy species identified within the extraction area are potentially important to Koalas in the Port Stephens LGA; these have been identified from multiple sources (**Table 10**). A focus on the revegetation of species that are preferred Koala feed trees will occur where appropriate habitat for these species occurs in the final landform. This will aim to encourage Koalas into the post extraction landscape.

Table 10: Tree species important for Koalas within the Tanilba Northern Dune Extension Area (extraction area and offsets)

Scientific Name	Common Name	Source
<i>Angophora costata</i>	Smooth-barked Apple	Potentially important in LGA (CKPoM)
<i>Corymbia gummifera</i>	Red Bloodwood	Potentially important in LGA (CKPoM)
<i>Eucalyptus capitellata</i>	Brown Stringybark	Potentially important in LGA (CKPoM)
<i>Eucalyptus pilularis</i>	Blackbutt	Potentially important in LGA (CKPoM)
<i>Eucalyptus piperita</i>	Sydney Peppermint	Potentially important in LGA (CKPoM)
<i>Eucalyptus robusta</i>	Swamp Mahogany	Preferred feed tree in LGA (CKPoM) Primary feed tree on North Coast (Recovery Plan) Feed tree (SEPP 44)
<i>Eucalyptus signata</i>	Scribbly Gum	Feed tree (SEPP 44)

4.5 PERFORMANCE INDICATORS AND COMPLETION CRITERIA

As stated in **Section 4.1** the objective of the rehabilitation for the site is:

“to progressively re-establish original vegetation community types to achieve a standard of tree and shrub growth, and recovery in species richness and abundance, as close as possible to that of the original vegetation, within the limits of current best practice techniques, and a reasonable period of post-extraction monitoring.”

“As close as possible”, recognises the fact that the final landform will be lower in elevation than the original topography resulting in re-vegetated communities being at different proportions when compared with original vegetation community types.

4.5.1 Baseline Data

The desired outcome for the vegetation rehabilitation of the sand extraction areas is to achieve a vegetative structure and content similar to the pre-cleared extraction area, with consideration to species preference on account of the modified depth to groundwater. . The vegetation community representative of the pre-cleared extraction area was Coastal Sand Wallow Woodland – Heath.

The target figures for the ideal parameters assessed during monitoring have been determined from two 20 m x 20 m (400 m²) sample plots located in the undisturbed vegetation either side of the approved extraction area (Tanilba Northern Dune, near Block A). The baseline target figures are outlined in **Table 11**, and the species composition of the baseline quadrats is shown in **Table 12**. These data will define the ideal species composition and richness, ecosystem

structural components, and dominant species for the rehabilitation of the Tanilba Northern Dune Extension Area.

Table 11: Baseline quadrat survey data (for evaluation of performance and completion criteria)

Parameter	Baseline Data (determined through extrapolation of monitoring quadrats)
Cover (%)	80
Fire resistant species (plants per 4 m ²)	1
Average height (cm)	230
Number of plants (plants per 4 m ²)	40
Number of species (plants per 4 m ²)	12
Structural Proportions	
Ground stratum proportion (%)	27
Shrub stratum proportion (%)	61
Midstorey stratum proportion (%)	7
Overstorey stratum proportion (%)	5
Key Species	
<i>Banksia aemula</i> (plants per ha) – Midstorey	2,600
<i>Corymbia gummifera</i> (plants per ha) – Overstorey*	80
<i>Eucalyptus piperita</i> (plants per ha) – Overstorey*	30
<i>Leptospermum trinervium</i> (plants per ha) – Midstorey	1,360
<i>Melaleuca nodosa</i> (plants per ha) – Overstorey*	2,800
* Any overstorey species important to Koala, as shown within Table 10, may be substituted for the overstorey shown, where habitat is suitable.	

Table 12: Species composition of baseline survey quadrats (for evaluation of performance and completion criteria)

Species	Stratum*	Cover Abundance (c.a)**
<i>Acianthus fornicatus</i>	G	1
<i>Schizaea dichotoma</i>	G	1
<i>Banksia oblongifolia</i>	M	1
<i>Dampiera stricta</i>	G	1
<i>Darwinia leptantha</i>	S	1
<i>Dillwynia retorta</i>	S	1
<i>Hibbertia linearis</i>	S	1
<i>Leucopogon esquamatus</i>	S	1
<i>Lomandra glauca</i>	G	1
<i>Petrophile pulchella</i>	S	1
<i>Platysace linearifolia</i>	S	1
<i>Pseudanthus orientalis</i>	S	1
<i>Schoenus ericetorum</i>	G	1
<i>Acacia suaveolens</i>	S	2 (

Species	Stratum*	Cover Abundance (c.a)**
<i>Acacia ulicifolia</i>	S	2
<i>Amperea xiphoclada</i>	G	2
<i>Baeckea imbricata</i>	S	2
<i>Boronia pinnata</i>	S	2
<i>Bossiaea ensata</i>	S	2
<i>Bossiaea heterophylla</i>	S	2
<i>Cassytha glabella</i>	G	2
<i>Conospermum taxifolium</i>	S	2
<i>Dianella</i> sp.	G	2
<i>Entolasia stricta</i>	G	2
<i>Eriostemon australasius</i>	S	2
<i>Hibbertia fasciculata</i>	S	2
<i>Hypolaena fastigiata</i>	G	2
<i>Isopogon anemonifolius</i>	S	2
<i>Juncus continuus</i>	G	2
<i>Lepidosperma</i> sp.	G	2
<i>Leptocarpus tenax</i>	G	2
<i>Leptomeria acida</i>	S	2
<i>Leptospermum polygalifolium</i>	M	2
<i>Leucopogon ericoides</i>	S	2
<i>Leucopogon virgatus</i>	S	2
<i>Persoonia lanceolata</i>	S	2
<i>Pimelea linifolia</i>	S	2
<i>Ricinocarpos pinifolius</i>	S	2
<i>Tetratheca thymifolia</i>	S	2
<i>Themeda australis</i>	G	2
<i>Calytrix tetragona</i>	S	3
<i>Caustis recurvata</i>	G	3
<i>Corymbia gummifera</i>	O	3
<i>Euryomyrtus ramosissima</i>	S	3
<i>Harmogia densifolia</i>	S	3
<i>Leptospermum trinervium</i>	M	3
<i>Monotoca scoparia</i>	S	3
<i>Woolisia pungens</i>	S	3
<i>Eucalyptus piperita</i>	O	4
<i>Leptospermum juniperinus</i>	S	4
<i>Melaleuca nodosa</i>	O	4
<i>Xanthorrhoea glauca</i>	S	4
<i>Banksia aemula</i>	M	5
G=Ground; S=Shrub; M=Midstorey; O=Overstorey.		
1 = <5% cover and few individuals or sparse occurrence. 2 = <5% cover many individuals. 3 = 5 to <25% cover.		4 = 25% to <50% cover. 5 = 50% to <75% cover. 6 = 75% to <100% cover.

4.5.2 Performance Indicators

At each stage of monitoring the rehabilitation will be compared to the performance indicators outlined in **Table 13**. If the rehabilitation areas are not meeting these performance indicators specific management measures will be outlined in the AEMR.

Table 13: Performance indicators for Tanilba Northern Dune Extension rehabilitation

Year	Aims for Each Strategic Ecosystem Development Stage	Performance Indicators
1	<p>Monitoring will be on a bi-annual basis until achieving the early pioneer stage, with the following features:</p> <p>Topsoil stabilized by primary colonizers (e.g. acacias & pea species);</p> <p>Key species present and densities increasing towards target numbers (outlined in Table 11);</p> <p>No significant erosion problems; and</p> <p>Weed and pest control program in place as outlined in sections 4.3.4 and 4.3.7.</p>	<p>Early pioneer stage appearing: Small seedlings (< 5 cm) regenerating from topsoil, < 5% surface cover;</p> <p>At least 25 transplanted mature Grass Trees per hectare;</p> <p>Brush-matting evident.</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
2		<p>Natural regeneration of pioneer species covering 20% of ground surface, average 20 cm tall;</p> <p>Seedlings developing under brush-matting;</p> <p>Planted trees and shrubs in predetermined numbers according to revegetation strategy, 20 - 30 cm tall;</p> <p>No significant erosion problems;</p> <p>Noxious or significant environmental weeds control programme in place; and</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
3		<p>All structural species present in predetermined density, 30 - 90 cm tall;</p> <p>Shrub layer and ground cover strata evident;</p> <p>Natural regeneration covering 40 – 60% of surface, average 50 – 80 cm tall;</p> <p>No significant erosion problems;</p> <p>Weed control programme in place and weeds successfully controlled; and</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
4		<p>Structural species in or on trajectory to achieve predetermined density, average 1 m tall;</p> <p>Mature pioneer stage evident; cover 60 - 80%, average 80 cm;</p> <p>No significant erosion problems;</p> <p>Weed control programme in place and weeds successfully controlled; and</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
5		<p>Decline in pioneer community, coinciding with emergence in canopy species;</p> <p>Canopy layer emerging above shrub layer;</p> <p>No significant erosion problems;</p> <p>Weed control programme in place and weeds successfully controlled; and</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>

Year	Aims for Each Strategic Ecosystem Development Stage	Performance Indicators
6	<p>Annual monitoring event to determine development of mature pioneer stage characterised by:</p> <p>Continuing maturation of vegetation species;</p> <p>Key species present at target densities, or showing increase towards target numbers (outlined in Table 11);</p> <p>Continuing differentiation of structural layers (canopy, sub-canopy, shrub layer);</p> <p>No significant erosion problems; and</p> <p>Weed and pest control program in place as outlined in sections 4.3.4 and 4.3.7</p>	<p>Structural species in or on trajectory to achieve predetermined density;</p> <p>Canopy layer continuing to increase in height, emerging above shrub layer;</p> <p>No significant erosion problems;</p> <p>Weed control programme in place and weeds successfully controlled; and</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
7	<p>Annual monitoring event to determine development of mature pioneer stage characterised by:</p> <p>Continuing maturation of vegetation species;</p> <p>Key species present at target densities, or showing increase towards target numbers (outlined in Table 11);</p> <p>Continuing differentiation of structural layers (canopy, sub-canopy, shrub layer);</p> <p>No significant erosion problems; and</p> <p>Weed and pest control program in place as outlined in sections 4.3.4 and 4.3.7</p>	<p>Structural species in or on trajectory to achieve predetermined density;</p> <p>Canopy layer continuing to increase in height, above shrub layer;</p> <p>No significant erosion problems;</p> <p>Weed control programme in place and weeds successfully controlled; and</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
8*	<p>Final scheduled monitoring event to determine development of early stages of mature vegetation assemblage characterised by:</p> <p>Increase in dominant shrub and tree species;</p> <p>Development of structural layers; and</p> <p>Species composition similar to pre-mining</p>	<p>Overstorey and midstorey species increasing in height and percentage cover;</p> <p>Overstorey and midstorey species density stable;</p> <p>Key overstorey and midstorey species present at densities comparable to pre-mining at similar elevations;</p> <p>Increase in differentiation of structural layers, including litter; and</p> <p>Overstorey layer evident above shrub layer.</p> <p>Rehabilitation area will be (as far as reasonably practicable) free from rubbish.</p>
<p>*Note – in the event that rehabilitation has not yet achieved the completion criteria (Table 14) by year 8, annual rehabilitation monitoring and weed and pest control (as outlined in sections 4.3.4 and 4.3.7) will continue until rehabilitation achieves the completion criteria to the satisfaction of the Planning Secretary.</p>		

4.5.3 Completion Criteria

At the monitoring frequency stated in section 4.6 the rehabilitation will be assessed against the completion criteria set out in **Table 14**. Each rehabilitation block will be assessed against these completion criteria to determine eligibility of operational areas for release from further rehabilitation or monitoring, and if the rehabilitation bond can be released (Condition 20).

The Completion Criteria will be independently audited to assess whether those Release Criteria are in fact reasonable performance indicators for the Extraction Operations in respect of the objectives of this rehabilitation management plan.

Table 14: Completion criteria for Tanilba Northern Dune Extension rehabilitation

Completion Indicator	Completion Criteria	Comment on Current Status
Vegetation islands retained within the extraction area.	Minimum of two vegetation islands per hectare within the extraction area (equivalent to minimum 2% vegetation retained within the extraction area).	Satisfied. Planned extraction was 9.0 ha, actual extraction was less than 7.5 ha, over 16% retained across three areas on the site.
Topsoil coverage across the rehabilitation area.	100% topsoil cover.	Satisfied.
Similar species composition to pre-extraction at similar topographic levels.	Species composition of the rehabilitation similar to that outlined in Table 12 .	Subject to further monitoring.
Species richness of overstorey species 100% compared to baseline data.	<i>Corymbia gummifera</i> , <i>Eucalyptus piperita</i> and <i>Melaleuca nodosa</i> present on average across the rehabilitation as measured within the 20 x 20 m quadrat.	Subject to further monitoring.
Introduction of koala feed trees	<i>Eucalyptus robusta</i> or <i>Eucalyptus signata</i> species present within the rehabilitation area	Subject to further monitoring.
Species richness of common midstorey 100% compared to baseline data.	<i>Banksia aemula</i> , and <i>Leptospermum trinervium</i> present on average across the rehabilitation as measured within the 20 x 20 m quadrat.	Subject to further monitoring.
Canopy average height.	Canopy at or on trajectory to be ≥ 1.5 m tall ($\pm 10\%$).	Subject to further monitoring.
Midstorey average height.	Midstorey at or on trajectory to be ≥ 1 m tall ($\pm 10\%$).	Subject to further monitoring.
Shrub layer average height.	Shrubs at or on trajectory to be ≥ 90 cm tall ($\pm 10\%$).	Subject to further monitoring.
Structural components for shrub, midstorey and overstorey present at densities comparable to baseline data.	Structural proportions of the rehabilitation comparable to Table 11 .	Subject to further monitoring.
Key species (> 1.5m) present at densities comparable to baseline data.	Canopy species (<i>Corymbia gummifera</i> , <i>Eucalyptus piperita</i> and <i>Melaleuca nodosa</i>) and midstorey species (<i>Banksia aemula</i> , and <i>Leptospermum trinervium</i>) present at densities comparable to, or on trajectory to Table 11 .	Subject to further monitoring.
Litter development.	Early litter development evident.	Subject to further monitoring.
Final landform is safe and stable	Sloping batter not to exceed 1(vertical):3(horizontal), with the top of batter positioned to maintain a minimum buffer setback of at least 5 meters to the edge of the electricity road easement	Final landform is established
Presence of rubbish and illegal dumping	The rehabilitation area is free from Sibelco generated rubbish and where reasonable and feasible the rehabilitation area is free of all rubbish.	Ongoing
Presence of pests	Pest species have been reasonably and feasibly minimised within the rehabilitation area	Subject to further monitoring

Completion Indicator	Completion Criteria	Comment on Current Status
Presence of weeds	No listed or noxious weed species a present within the rehabilitation area	Subject to further monitoring

4.6 VEGETATION MONITORING PROTOCOL

Monitoring of the rehabilitation of native vegetation over time will occur to assess progression against performance indicators, completion criteria and rehabilitation objectives. Monitoring will also be used to identify any weed and pest problems, erosion and die-off of species within the rehabilitation.

4.6.1 Bi-annual Vegetation Monitoring

4.6.1.1 Plot monitoring

Each block will have points overlaid in a grid fashion at approximately 15 m intervals using a GIS program; these points represent a single sample plot, each 2 x 2 m (4 m²). The plot points will be confirmed in the field during the first monitoring event, to ensure each point occurs within the extraction area. These confirmed points will be retained and used for following monitoring events until completion after 3 years.

The pre-confirmed 2 x 2 m quadrat locations will be uploaded on to hand held GPS unit and a qualified ecologist will visits each of these quadrat locations using the GPS. Once the point is located, four 2 m poles will be laid on the ground around the point to define the sample area and the data outlined in **Table 15** will be collected at each point.

Table 15: Details of data collected at each survey

Parameter	Details	Description
Species	The total number of different species of plant present.	A measure of biodiversity/ species composition
Plants	The total number of each species present.	A measure of plant/ species density.
Stratum proportions – ground, shrub, midstorey and overstorey species	The proportion of species which will become ground, shrub, midstorey and overstorey layers.	A measure of the stage of vegetation development and community structure
Height	The average height of all plants in the plot.	An indicator of overall growth.

Parameter	Details	Description
Cover	An estimate of the total plot area having plant cover-percentage of area.	A measure of the total green cover for the rehabilitation area.
Fire resistant species	The proportion of fire resistant species to total species present.	An indicator of the potential resilience of the new vegetation to a fire event.

4.6.1.2 Inspection

During all monitoring events an inspection of each block for weeds, signs of feral pests, erosion, die-off and site access issues will occur. Any significant problems will be mapped.

4.6.1.3 Reporting

Data will be collected bi-annually and reported on annually. These data will be compared to the baseline information and any previous surveys events to assess the progression of the rehabilitation. Additionally, the rehabilitation will be assessed against the performance indicators outlined in **Table 13**. If the rehabilitation blocks are not meeting these performance indicators, specific management measures (i.e. revegetation measures, weed and pest control and/ or measures for erosion control) will be outlined in the AEMR.

4.6.2 Post 3-year Vegetation Monitoring

4.6.2.1 Quadrat Monitoring

One permanent 20 m x 20 m quadrat will be established per hectare of rehabilitation. This quadrat will be used to give a broad scale indication of the rehabilitation structure and diversity. The quadrat location will be in an area that is representative of rehabilitation within the block. The data collected from each quadrat will include:

- Total species richness;
- Average height;
- Species cover abundance based on the modified Braun-Blanquet cover abundance scale:
 - o 1 < 5% cover, few individuals or sparse occurrence;
 - o 2 < 5% cover, many individuals;
 - o 3 5 – 25% cover;
 - o 4 25 – 50% cover;
 - o 5 50 – 75% cover; and
 - o 6 75 – 100% cover.

- Reproductive status and any evidence of second generation plants (succession) will be recorded for each species; and
- General comments; including notes on litter deposition and structural formation.

The timing/frequency of post 3-year vegetation monitoring is outlined in section 4.3.4.

4.6.2.2 Plot Monitoring

Within the 20 m x 20 m quadrats, six 2 m x 2 m plots will be surveyed (methods as **Section 4.6.1**). The location of each of these plots within the 20 m x 20 m will be selected at random each year.

4.6.2.3 Photographic Record

A permanent photographic monitoring point will be established in one corner of each quadrat. A panoramic photograph will be taken at each survey to allow a visual assessment of the rehabilitation progression in future monitoring events.

4.6.2.4 Inspection

During all monitoring events an inspection of each block for weeds, signs of feral pests, erosion, die-off and site access issues will occur. Any significant problems will be mapped.

4.6.2.5 Reporting

The survey data from the post 3-year monitoring will be compared against the baseline data, previous survey events and the performance indicators to assess the progression of the rehabilitation. Any recommendations for revegetation, weed and pest control and any mitigation measures for erosion issues will be outlined in the AEMR. In addition, the eight year survey data will be assessed against the completion criteria (outlined in **Table 14**) to determine whether the rehabilitation block can be released from further rehabilitation and monitoring.

4.7 RISK ASSESSMENT

Table 16 outlines the potential risks to successful rehabilitation that have been identified and the measures that have been implemented to ensure successful rehabilitation.

Table 16: Potential risks to rehabilitation success and management measures to mitigate these risks

Risks	Contingency Measures	Section
Erosion	Best practice erosion and sediment control measures will be used (as outlined in the Soil and Water Management Plan).	4.3.5
	Progressive rehabilitation will occur to limit exposed areas.	4.3.3
	Monitoring will identify any areas of erosion and recommended appropriate mitigation measures.	4.6
Plant species mix not in accordance with final land use	Only species outlined in Section 4.4.1 will be seeded and planted into the rehabilitation area.	4.3.3 and 4.4.1
	Only seed collected from the disturbance area and surroundings (through seed collection or brush matting) will be used on the rehabilitation.	
Failure of seeded/ planted species	The most appropriate revegetation method for each species will be used.	4.4.1
	Seeds will be sown rather than broadcast to limit loss, and direct seeding will be avoided in summer.	4.4.1.1
	Material for brush matting will be collected at the most appropriate time depending upon the species.	4.4.1.2
	Tubestock will be planted during autumn to maximise survival rates.	4.4.1.3
	Biannual monitoring will identify areas containing any failed plantings which can then be replanted if necessary.	4.6.1
Structural layers of mature vegetation not developing	Bi-annual and post three year monitoring will identify any areas deficient in key structural components and outlined additional plantings/ seeding required.	4.6
Invasive species and pests impacting on rehabilitation development	Vehicle hygiene to be maintained before accessing the site.	4.3.7
	Monitoring will identify and weed or pest problems and recommend actions as required.	4.3.7 and 4.6
Bushfire impacts	Bushfire measures will be implemented to manage potential bushfire impacts.	4.3.8
Unauthorised access impacting on development of rehabilitation	Access to the site will be controlled at all times.	4.3.1
Extreme natural weather events (drought or flood)	If any extreme weather events occur the regular monitoring events will detect impacts (erosion and plant die-off) and recommend appropriate mitigations measures.	4.6

5. LONG TERM MANAGEMENT STRATEGY

5.1 OBJECTIVES AND CRITERIA FOR CLOSURE

The rehabilitation aim for the extraction area is to re-establish the original vegetation community types; although at different proportions due to variations in landform. Hence, the long-term objective of the extraction area is that the native vegetation established across the site is a self-sustaining ecosystem that provides habitat to flora and fauna, and also serves as fauna habitat corridor.

Post extraction management is expected to occur up to at least Year 8 (or upon satisfaction of the Planning Secretary), where revegetation and monitoring is undertaken consistent with section 4.3 and 4.6 of this Plan. At Year 8, based on previous rehabilitation it is anticipated that the completion criteria (**Table 14**) will be achieved, however this will be subject to the satisfaction of the Planning Secretary. Once completion criteria are achieved, and the Planning Secretary is satisfied, the Rehabilitation Bond (Condition 20) can be released. On release of the bond the site would be subject to the long-term management and land use defined in **Section 5.2**. Release of the Rehabilitation Bond may occur progressively during the life of the operation, and quarry closure would be considered to be achieved on release of the bond from the full extraction area.

5.2 LONG TERM MANAGEMENT AND FUTURE SITE USE

As the rehabilitation plan for the extraction area is to return the disturbed areas to native vegetation consistent with the pre-cleared vegetation communities and the surrounding landscape, the most appropriate use for the site would be conservation.

Future land use and development within the rehabilitated landscape is subject to the permissibility under prevailing legislation including the various State Environmental Planning Policies and *Port Stephens Local Environmental Plan 2013*. Protection of the ecological values on the site is provided under the *Biodiversity Conservation Act 2016*.

Control of Lots 1 and 2 of DP 408240 will revert to the HWC and control of Lot 408 DP 1041934 will revert to Crown Land. The former extraction area on Lots 11, 12 and 13 of DP 601306 will

be managed as private freehold land. Any development of the freehold land will be the decision of the land owner but will have to be consistent with planning law and the local environment plan.

6. REPORTING FRAMEWORK

Reporting, as required for the Tanilba Northern Dune Extension Project, will occur through the AEMR. The following summarises the reporting requirements of this LMP, based on sand extraction being completed:

- Details of rehabilitation actions carried out in the past year, including:
 - Rectification of landform and earthworks completed;
 - Redundant haul road rehabilitation;
 - Seeding and planting methods carried out; and
 - Supplementary planting undertaken.
- Details of erosion and sedimentation controls in place and their effectiveness;
- Describe the management works (weed and pest control) that were carried out in the previous year, and the works that are proposed to be carried out over coming year; and
- A comprehensive review of the rehabilitation area monitoring results over the past year, which includes:
 - A comparison of the results against the previous year;
 - Assessment against performance indicators; and
 - Identify trends in the monitoring data over the life of the project.

The AEMR will be distributed to PSC, OEH, HWC and DPIE, the report will also be made publicly available on The Operator's website.

7. REVIEW AND PERFORMANCE

This LMP will be reviewed and/ or updated annually as required, and as specified in the Project Approval.

In order to assess the performance of this LMP the following aspects will be considered:

- Are the performance indicators and completion criteria being met at the various stages of rehabilitation? And are the completion criteria still appropriate?
- Do the management actions still fulfil the objectives?
- Were the management actions and reporting completed as specified within the plan?
- Are aspects of the plan now obsolete, inefficient or ineffective?

The response to these aspects will inform the update of the LMP.

8. REFERENCES

Clulow (2008). *Resolution of the taxonomic status of a species of the frog genus Uperoleia (Gray, 1841) found at Oyster Cove, New South Wales*. Report prepared by ecobiological for The Operator Australia Limited (formerly Unimin Australia Limited).

Department of Planning and Infrastructure (DP&I) (2013) *Project Approval 09_0091 Tanilba Northern Dune Extension Project*. Approved 8 March 2013.

ERM (2012) *Tanilba Northern Dune Sand Extraction Extension: Environmental Assessment Report, Volume 1 & 2*. Prepared under the Environmental Planning and Assessment Act 1979 – Section 75.

Port Stephens Council (2007) *Koala Habitat Planning Map – Medowie/ Tilligerry Aug06*. Mapping prepared by Land use Planning: Sustainable Planning Group for Port Stephens Council, February, 2007.

APPENDIX 1. STAKEHOLDER CONSULTATION

APPENDIX 2. RELEVANT STATEMENTS OF COMMITMENTS

Issue	Mitigation measure/ Commitment	Section where Addressed
Ecology	<ul style="list-style-type: none"> Hollow bearing trees 16, 17, 18 and 20 (refer to Figure 2.2, Northern Dune Submission Report) to be retained. 	NA Extraction now completed.
	<ul style="list-style-type: none"> Avoidance of the use of biocides and implementing erosion and sediment controls; 	Section 4.3.5 and Section 4.3.7 of this LMP
	<ul style="list-style-type: none"> Incorporating implementation of pre-clearing surveys, a fauna displacement mitigation protocol, Koala mitigation measures, nest box installation and monitoring, and a monitoring plan for the Wallum Froglet (as detailed in Annex M of the EA); 	Section 4.3.2, Section 4.3.6 and Section 4.3.7 of this LMP and also in the BMP. Nest boxes installed, refer to the BMP. Refer to BMP for frog monitoring.
	<ul style="list-style-type: none"> Staged rehabilitation of the extraction area (to be supported by a Vegetation Rehabilitation Management Plan), to be conducted in the same fashion as successful rehabilitation of The Operator's existing approved extraction areas directly to the south; and 	Section 4 of this LMP, no additional plan completed or required for rehabilitation.
	<ul style="list-style-type: none"> Implementation of an offset strategy as detailed in Section 11.6.4 of the EA 	See the BMP.
Vegetation Clearing	At least one week prior to any vegetation clearing, a survey of habitat trees will be conducted in the planned clearing area in accordance with the survey methodology outlined in Section 11.6.1 of the EA	Section 4.3.2 of this LMP No significant clearing will be required now that extraction is completed. Provision remain to enable rehabilitation rectification if needed.
	Pre-clearing surveys will be conducted to check for the presence of any Koalas within the proposed extraction area	
	Hollow-bearing trees will be left standing for two nights after the surrounding vegetation has been cleared to encourage any native fauna species utilising the habitat hollows to self-relocate. The actual felling of any habitat trees will be attended by a suitably experienced fauna ecologist in order to ensure the safety of any fauna found to be in the hollows. On all occasions, trees having potential habitat hollows should be 'soft felled' by an experienced machine operator in accordance with the procedure outlined in Section 11.6.1 of the EA	Extraction completed, no further hollow-bearing tree removal required.
Fauna Displacement Protocol	A fully qualified, experienced and licenced ecologist will supervise clearing and encourage movement of any displaced animals into adjoining vegetation	Section 4.3.3 of this LMP.
	Captured fauna and/ or displaced fauna will be relocated to adjacent habitat by an ecologist. During tree removal or any	

Issue	Mitigation measure/ Commitment	Section where Addressed
	other construction activity, Fauna Displacement Protocols outlined in Section 11.6.2 of the EA will be followed in the case of any injured animal	
Wallum Froglet Management Plan	<p>A management plan for the Wallum Froglet (<i>Crinia tinnula</i>) will be developed in accordance with the management guidelines outlined under Section 6 of the National Recovery Plan for the Wallum Sedgefrog and Other Wallum-dependent Frog Species. In particular this will include:</p> <ul style="list-style-type: none"> • Minimising affects from soil disturbance; • Ensuring sufficient retention of vegetation particularly around breeding sites; and • Monitoring the habitat condition and frog numbers to ensure the threats to the species are properly managed. This should be undertaken with sufficient regularity and should preferably be carried out a year or more before development starts and continue for the duration of extraction operations, including rehabilitation works 	<p>See the BMP.</p> <p>Controls included within this LMP include erosion controls and protection of buffers from breeding habitat.</p>
Nest box installation and monitoring program	<p>A nest box installation and monitoring program will be implemented on a ratio of 2: 1 to replace 38 hollows present in 17 Hollow-bearing Trees mapped within the proposed extraction area. Nest boxes should be erected prior to clearing commencing in order to provide alternative dens and / or nest sites for any displaced fauna.</p> <p>Nest boxes are to be erected within the Proposed Offset Areas on Lots 11, 12 and 13. Nest box design should be selected to replace the natural hollow sizes removed (i.e. 20 small, 16 medium and 2 large) and will target insectivorous bats, gliders and possums. Annual monitoring for a minimum 6-year period post installation is recommended to record uptake of the nest boxes and to attend to any maintenance issues. A brief letter confirming annual inspection of the nest boxes and documentation of results should be provided to OEH.</p>	<p>See BMP.</p>
Vegetation Management and Monitoring Plan	<p>Weed Management and Vegetation Management and Monitoring Plans will be prepared for the rehabilitation area and proposed Offset Areas on Lots 11, 12, 13 and 24, which will include a through and intensive program to protect the adjoining forested wetland communities against weed invasion, and surface and underground run-off that may occur both during and after sand extraction activities. The management and monitoring plans will consider:</p> <ul style="list-style-type: none"> • The nature and control of sediment run-off during the extraction phase particularly as a result of an exceptional storm event; • The volume path and content of stormwater discharging from the site during and after extraction; • The handling of hydrocarbon spills on the site; • Existing flow regime of surface and groundwater flow from the proposed extraction area into the forested wetlands; and • Weed invasion. 	<p>Section 4.3.1, Section 4.3.5, Section 4.3.3 and Section 4.3.7 of this LMP, and the BMP.</p>

Issue	Mitigation measure/ Commitment	Section where Addressed
Biodiversity Offset Strategy	A Biodiversity Offset strategy will be adopted as outlined in detail in Appendix P of the EA. Biodiversity offsets are proposed on lands currently owned by The Operator, comprising portions of Lots 11 to 13, DP601306 (approximately 18.35 ha) and all of lots 24, DP579700 (approximately 9.44 ha) (the offset lands). A secure offset mechanism (through Voluntary Conservation Agreement or other similar tool for management in perpetuity) will be placed over these offset lands which will result in permanent protection and management of the land and result in numerous ecological benefits.	See BMP.

APPENDIX 3. STAFF CONTRIBUTIONS

The following Kleinfelder staff were involved in the compilation of this report.

Name	Qualification	Title/Experience	Contribution
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	Preparation of maps
Jonathan Berry	BAppSc (Hons)	Senior Environmental Planner	Report peer review
Nigel Fisher	BSc (Hons) PhD	Ecologist	Rehabilitation Input
Samara Schulz	BEnvSc & Mgt (Hons)	Ecologist	Report preparation