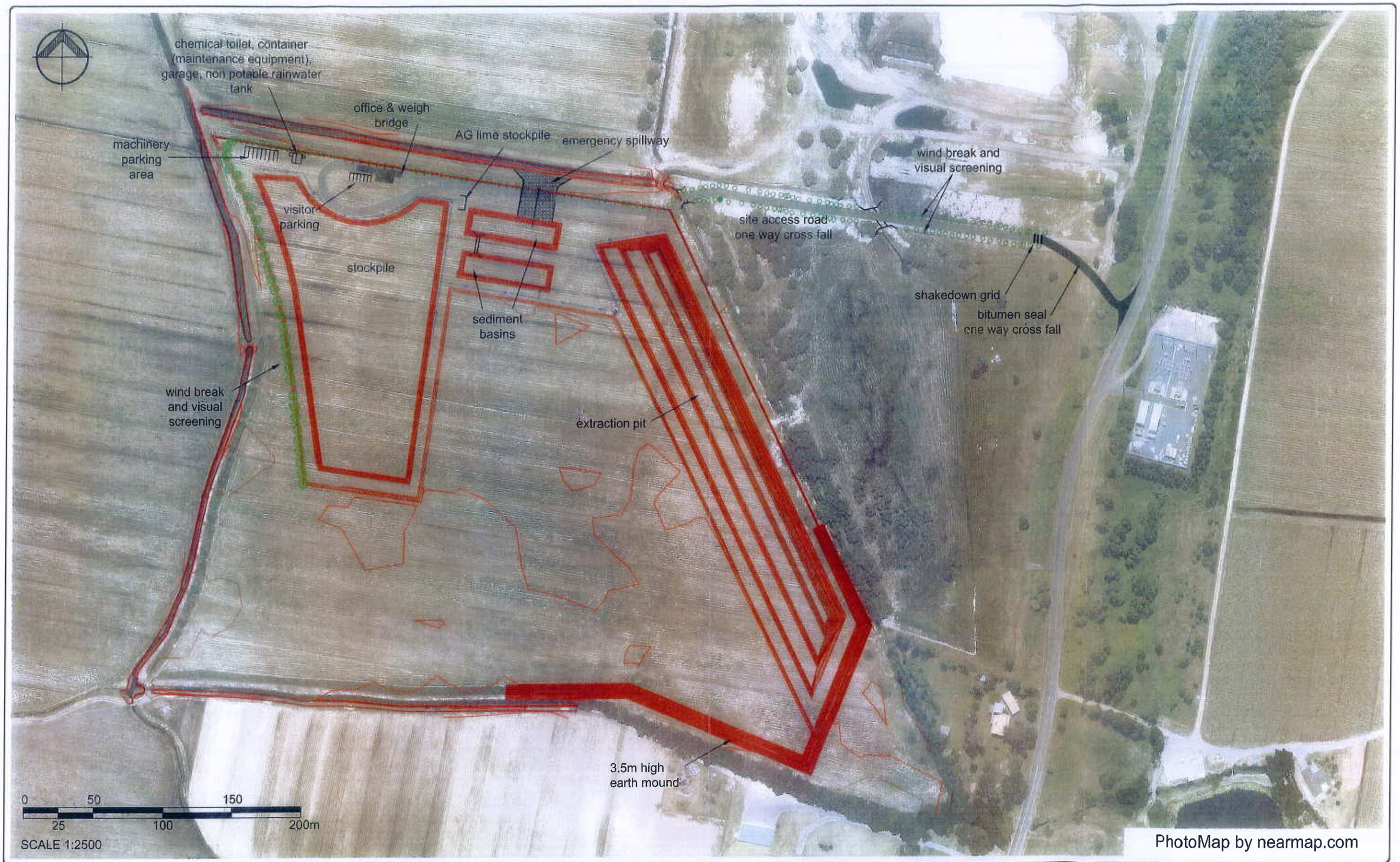
APPENDIX E

Site, Extraction
&
Rehabilitation Plans



Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:
Proposed Extraction Plan
Stage 1

ARDILL PAYNE & PARTNERS
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Town Planners & Surveyors
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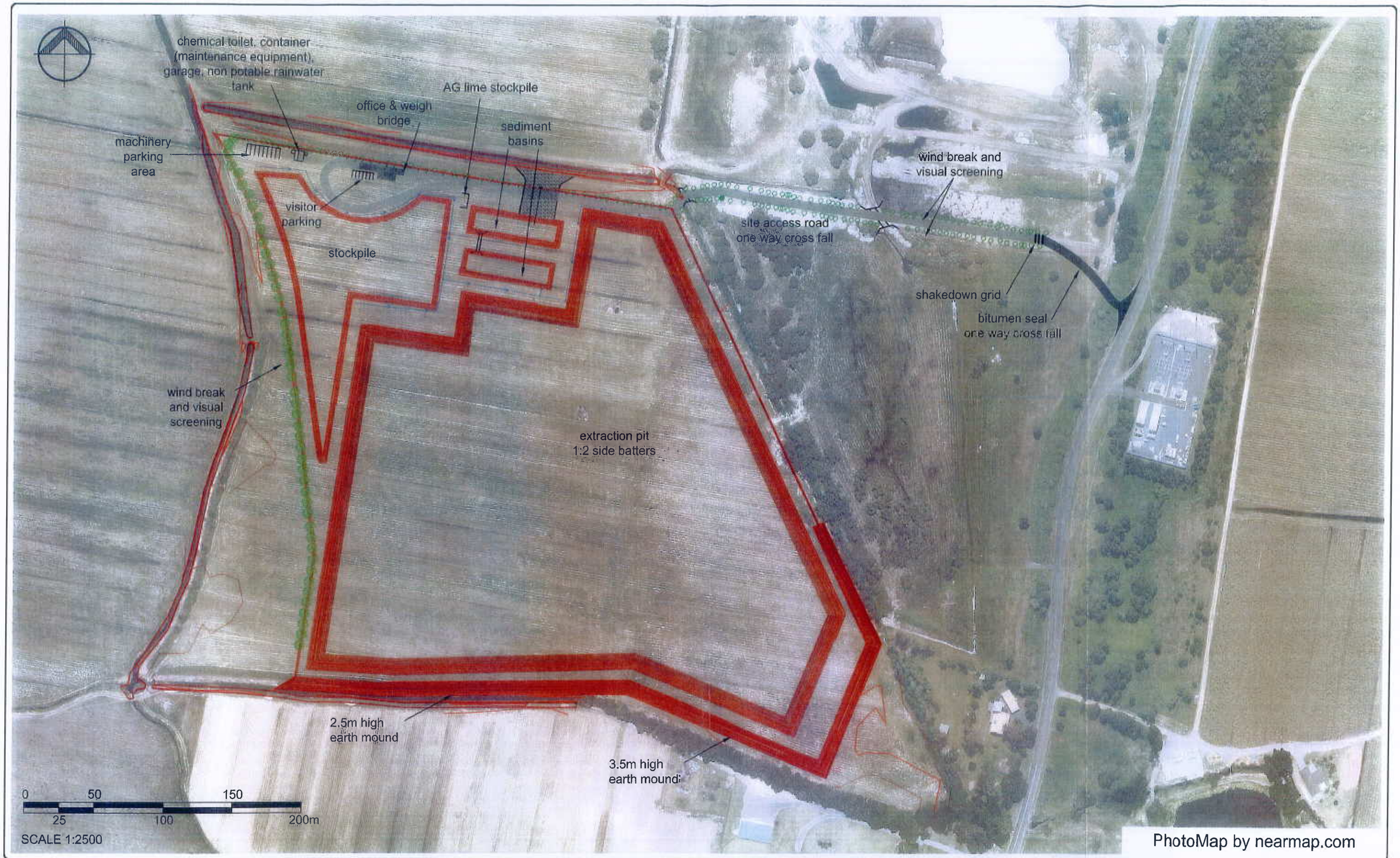
Email: info@ardillpayne.com.au
Website: www.ardillpayne.com.au

Design	JF	Scale at A3	1:2500
Drawn	RMcG	Datum	A.H.D
Date	14.01.2013	Filename	6542 2nd PIT
Checked		Approved	
Job No.	6542	Dwg. No.	FIG 1
		Issue	



Project:

Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:

Proposed Extraction Plan
Final Stage

ARDILL PAYNE & PARTNERS
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Town Planners & Surveyors
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Design	JF	Scale at A3	1:2500
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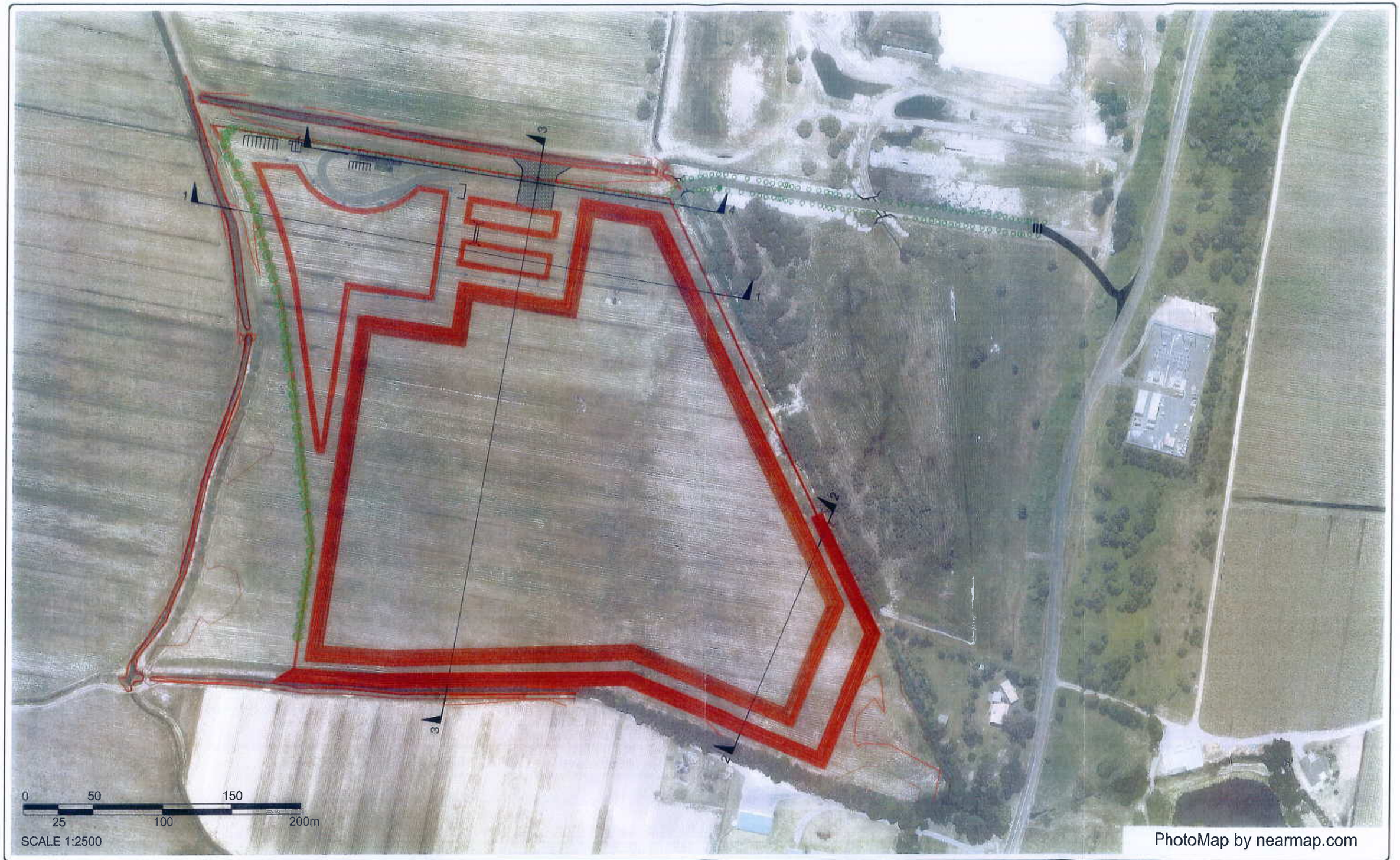

Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:
Proposed Extraction Plan
Section Map

ARDILL PAYNE & PARTNERS
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Design	JF	Scale at A3	1:2500
Drawn	RMcG	Datum	A.H.D
Date	14.01.2013	Filename	6542 2nd PIT
Checked		Approved	
Job No.	6542	Dwg. No.	FIG 3
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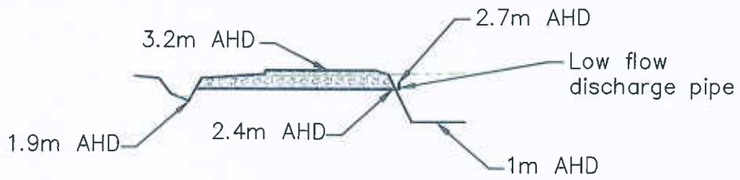

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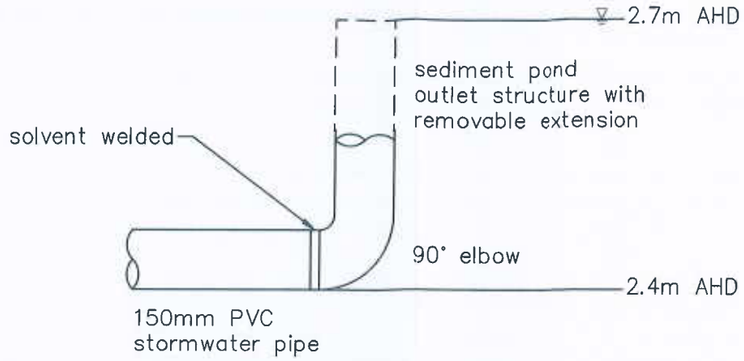
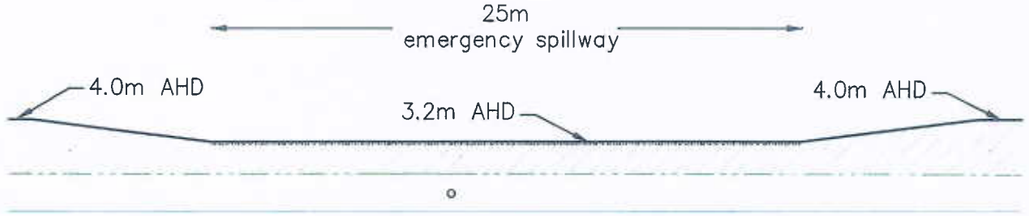


Low Flow Discharge Pipe Detail



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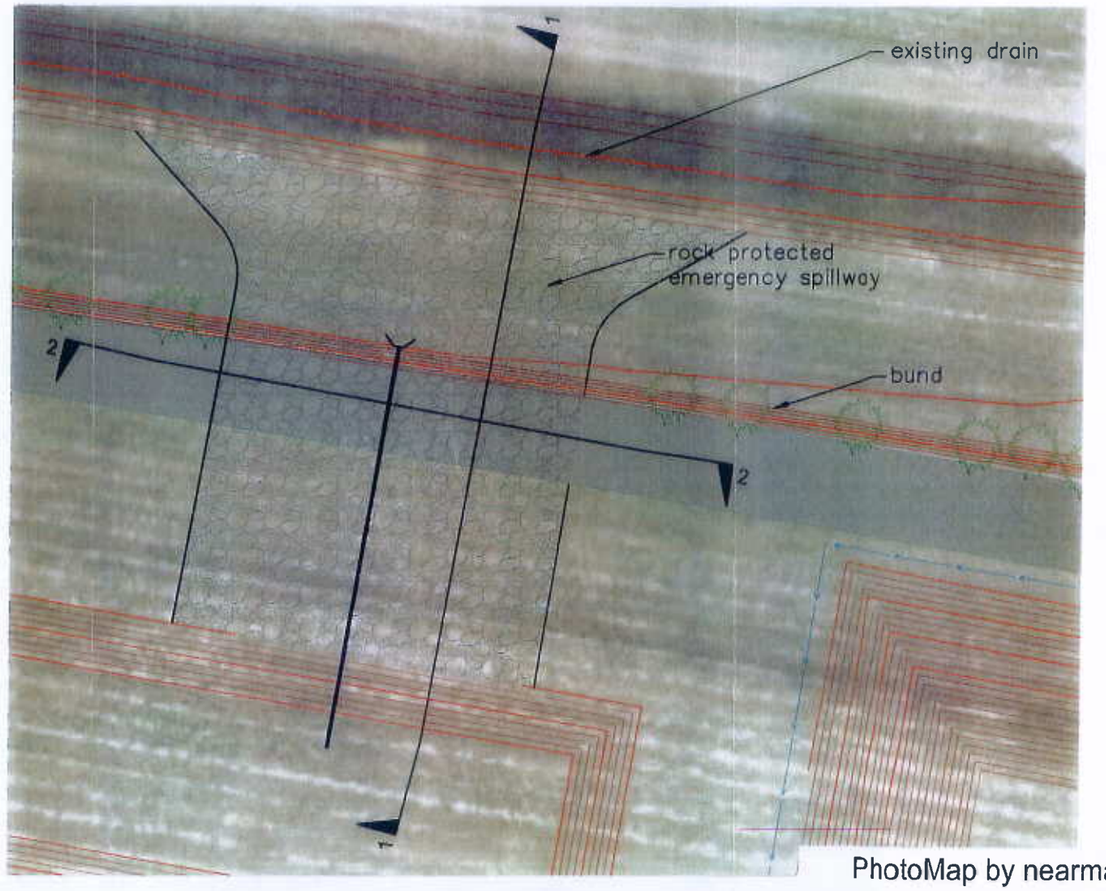

PhotoMap by nearmap.com

Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Client: Ballina Sands

Title:
Proposed Extraction Plan
Sediment Basin Outlet

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Design	JF	Scale at A3	NTS
Drawn	RMcG	Datum	A.H.D
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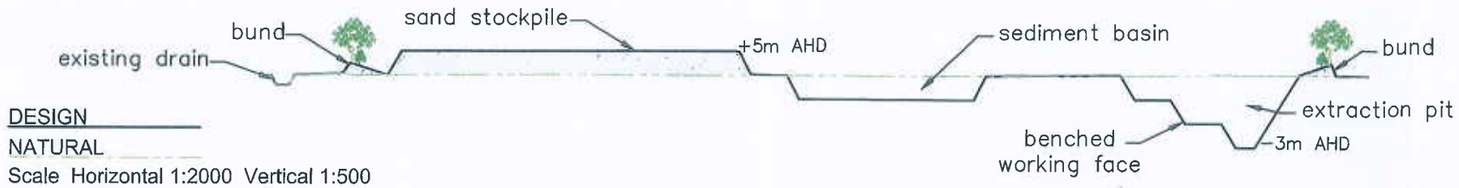

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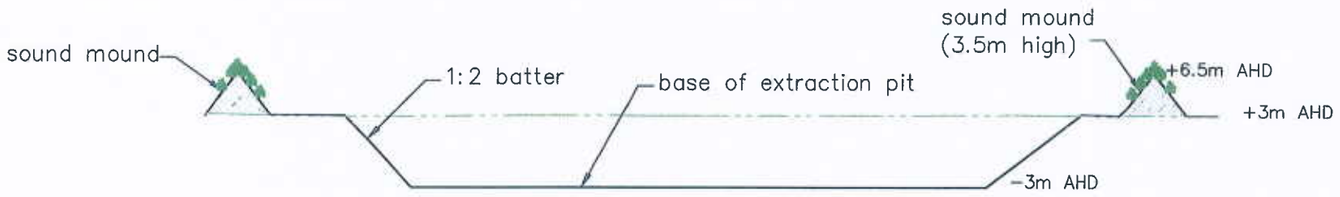

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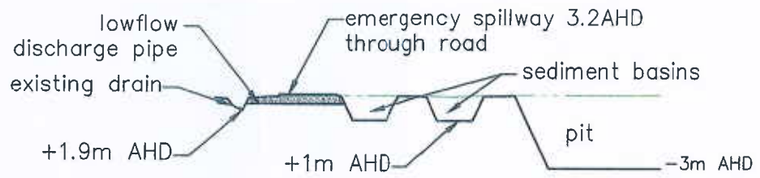
Cross Section 2-2



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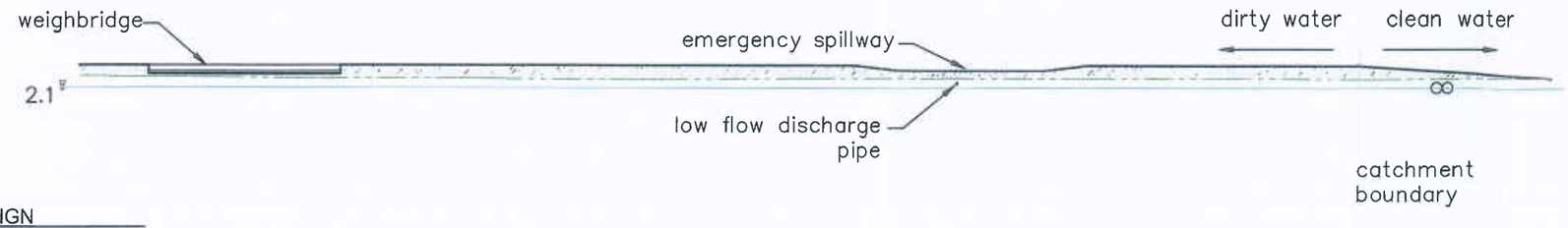
Cross Section 3-3



DESIGN
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INDICATIVE WATER LEVEL
Scale Horizontal 1:1000 Vertical 1:500

Cross Section 4-4

Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:
Proposed Extraction Plan
Cross-Sections

ARDILL PAYNE & PARTNERS
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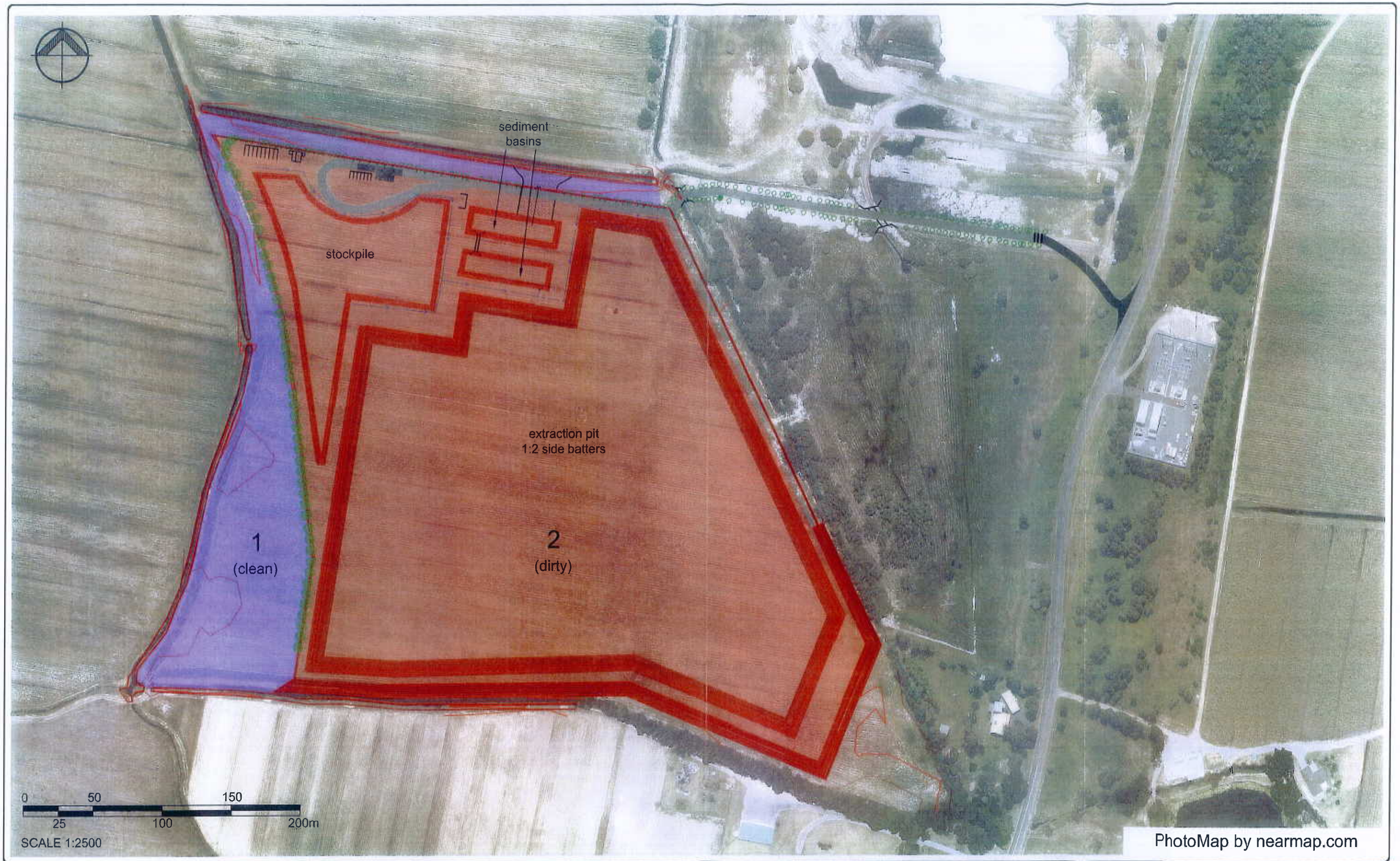
Design	JF	Scale at A3	AS SHOWN
Drawn	RMcG	Datum	A.H.D
Date	14.01.2013	Filename	6542 2nd PIT
Checked		Approved	
Job No.	6542	Dwg. No.	FIG 4
		Issue	



Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:
Proposed Extraction Plan
Final Stage

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Consulting Civil & Structural Engineers Project Managers
Town Planners & Surveyors
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Design	JF	Scale at A3	1:2500
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Date	14.01.2013	Filename	6542 2nd PIT
Checked		Approved	
Job No.	6542	Dwg. No.	FIG 6
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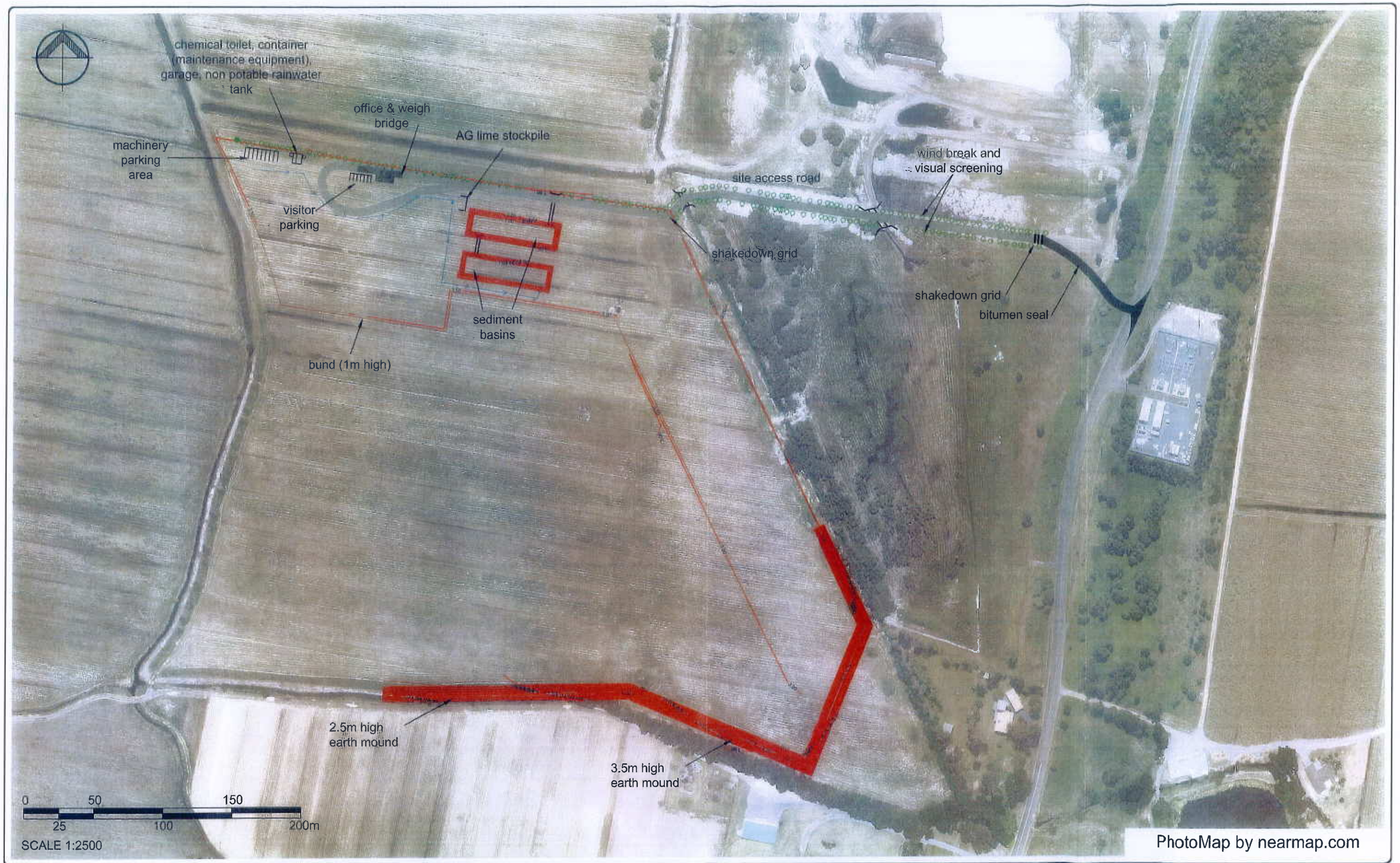

Project:

Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:

Staging Plan
Stage 1: Site Establishment & Setup

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Consulting Civil & Structural Engineers Project Managers
Town Planners & Surveyors
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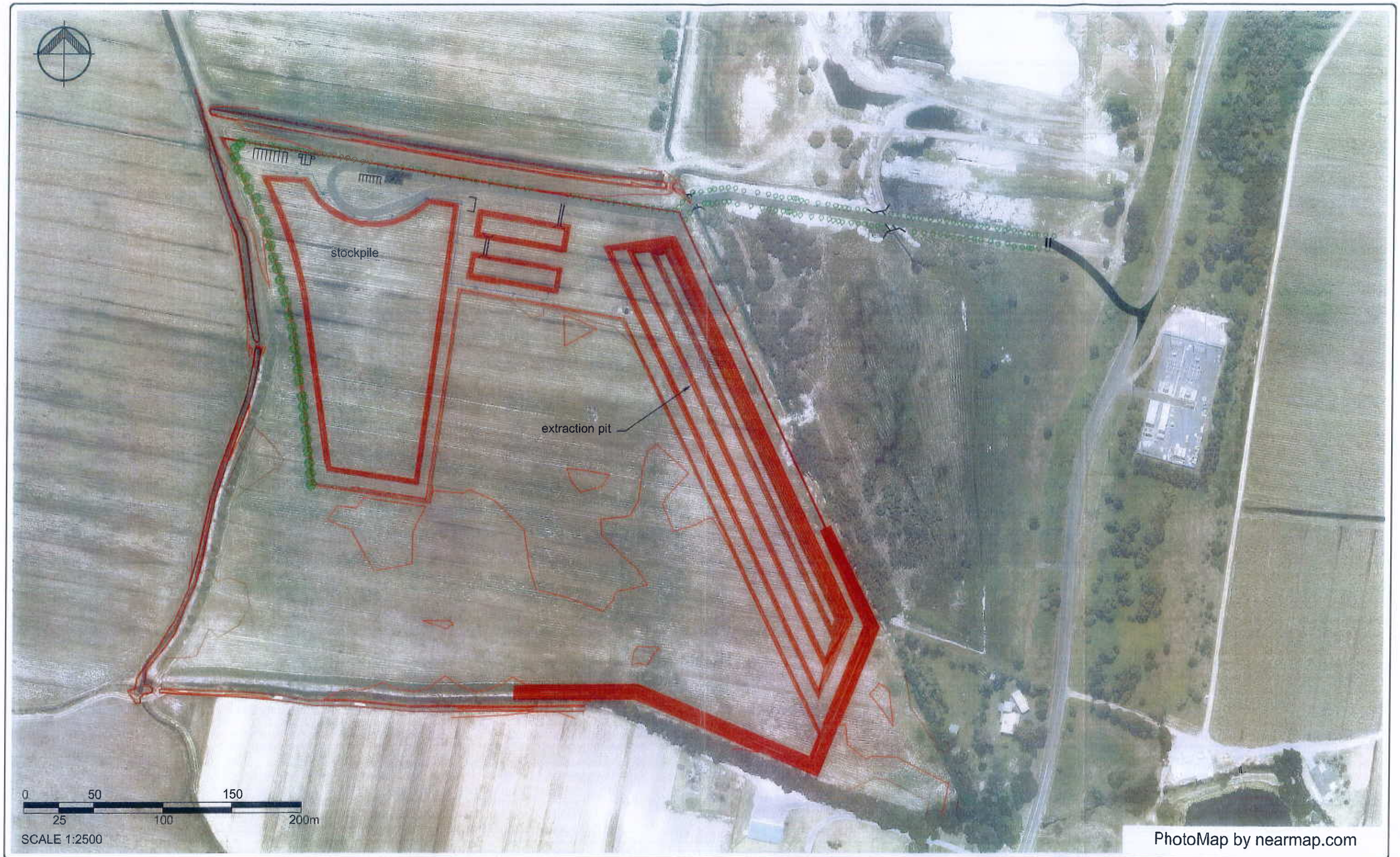
Design	JF	Scale at A3	1:2500
Drawn	RMcG	Datum	A.H.D
Date	14.01.2013	Filename	6542 Rehab Plans
Checked		Approved	
Job No.	6542	Dwg. No.	STAGE1
		Issue	



Project:
Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Do not scale drawing. Use written dimensions only

Client: Ballina Sands

Title:
Staging Plan
Stage 2: Commence Extraction

ARDILL PAYNE & PARTNERS
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Town Planners & Surveyors
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Design	JF	Scale at A3	1:2500
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Date	14.01.2013	Filename	6542 Rehab Plans
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Job No.	6542	Dwg. No.	STAGE2
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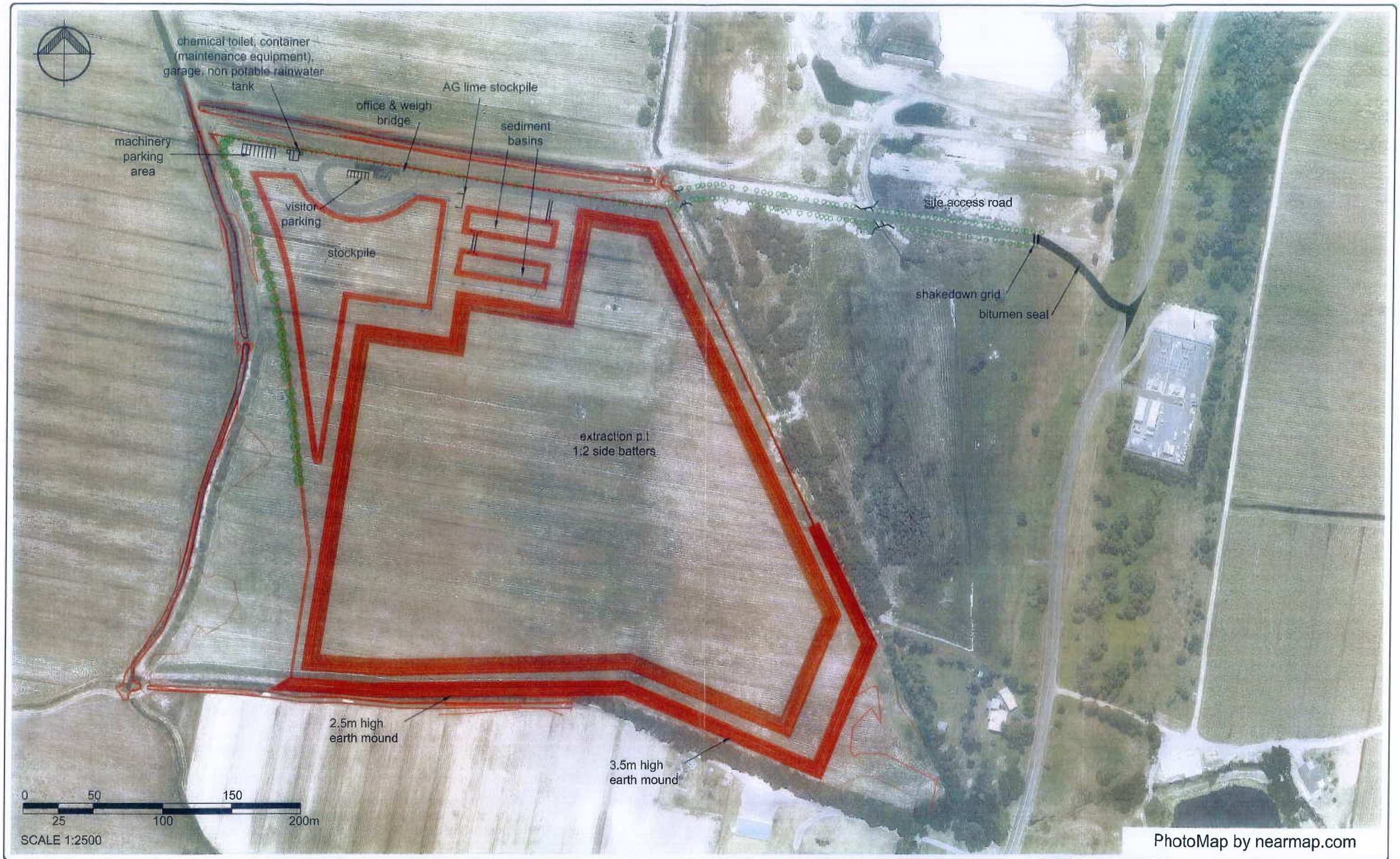

Project: Lot 32 DP 1151612 Newrybar Swamp Road Lennox Head	Client: Ballina Sands Title: Staging Plan Stage 3: Conclusion of Extraction	ARDILL PAYNE & PARTNERS Consulting Civil & Structural Engineers Project Managers Town Planners & Surveyors 79 Tamar Street P.O. Box 20 BALLINA NSW 2478 Telephone: 02 6686 3280 Facsimile: 02 6686 7920 Email: info@ardillpayne.com.au Website: www.ardillpayne.com.au

Design JF	Scale at A3 1:2500		
Drawn RMcG	Datum A.H.D		
Date 14.01.2013	Filename 6542 Rehab Plans		
Checked	Approved		
Job No. 6542	Dwg. No. STAGE3	Issue	

Project:

Lot 32 DP 1151612
Newrybar Swamp Road
Lennox Head

Client: Ballina Sands

Title:

Staging Plan
Stage 4: Final Rehabilitation & Revegetation of Site

ARDILL PAYNE & PARTNERS
Consulting Civil & Structural Engineers Project Managers Town Planners & Surveyors
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Website: www.ardillpayne.com.au

Design	JF	Scale at A3	1:2500
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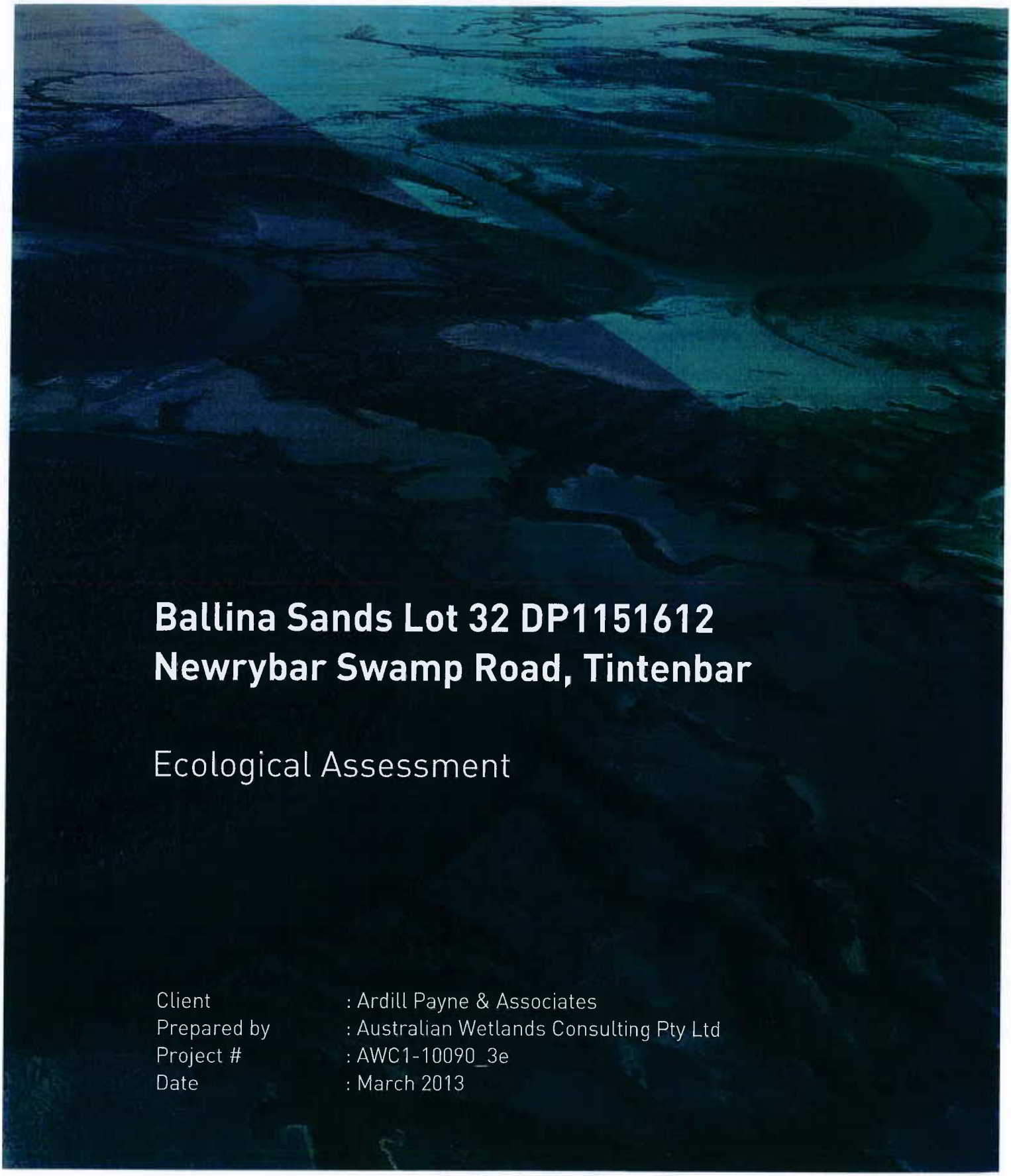
Date	14.01.2013	Filename	6542 Rehab Plans A
Checked		Approved	
Job No.	6542	Dwg. No.	STAGE4
		Issue	A

APPENDIX F

Ecological Assessment



Ballina Sands Lot 32 DP1151612 Newrybar Swamp Road, Tintenbar

Ecological Assessment

Client	: Ardill Payne & Associates
Prepared by	: Australian Wetlands Consulting Pty Ltd
Project #	: AWC1-10090_3e
Date	: March 2013

Leading environmental solutions...

AWC

Ballina Sands Lot 32 DP1151612 Newrybar Swamp Road, Tintenbar

Ecological Assessment

Project control

Project name: **Ballina Sands**
Ecological Assessment

Job number: AWC1-10090_3e
Client: Ardill Payne & Partners
Contact: James Foster

Prepared by: Australian Wetlands Consulting Pty Ltd

70 Butler Street / PO Box 2605
Byron Bay, NSW, 2481

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E | byron@awconsult.com.au

Date:	Revision:	Prepared by:	Reviewed by:	Distributed to:
25.05.2012	A	Ian Colvin	Jesse Munro Damian McCann	James Foster (Ardill Payne & Partners)
22.08.2012	B	Ian Colvin	Jesse Munro	Evan Elford (Ardill Payne & Partners)
11.09.2012	C	Ian Colvin	Jesse Munro	Evan Elford, James Foster (Ardill Payne & Partners)
08.10.2012	D	Ian Colvin	Jesse Munro	Evan Elford, James Foster (Ardill Payne & Partners)
26.03.2013	E	Ian Colvin	Jesse Munro	James Foster (Ardill Payne & Partners)

Table of Contents

List of Tables

List of Figures

1 Introduction and background

Ardill Payne & Partners has commissioned Australian Wetlands Consulting (AWC) to undertake an ecological assessment of land adjacent to Ballina Sands at Newrybar Swamp Road, Tintenbar ('the site'). The block of land ('the block') comprises Lot 32 DP1151612 Newrybar Swamp Road, Tintenbar and occurs within the Ballina Local Government Area (LGA). The block comprises land formerly used for sugar cane production, with some scattered native trees and wet heathland occurring. Neighbouring Lot 33 site supports an existing quarry and as the quarry is reaching capacity, it is proposed to expand operations to complete sand extraction in the south-western portion of the Lot 32 ('the site').

Director Generals Requirements (DGRs) for the preparation of an Environmental Impact Statement (EIS) were initially issued by the NSW Department of Planning (DoP) for the proposed expansion in September 2010. Among the key issues cited in the DGRs was an ecological assessment to determine the potential impacts of the proposal on threatened species, populations or their habitats, endangered ecological communities and groundwater dependent ecosystems. Advice from the Department of Environment, Climate Change and Water (DECCW, now the Office of Environment & Heritage [OEH]) in December 2010 also stated a number of requirements for flora and fauna assessment (refer to Appendix A).

New DGRs were issued by the Department of Planning and Infrastructure (DPI) on the 15th November 2012. For biodiversity matters, the new DGRs were essentially the same, but also requested details on *"...any measures to maintain or improve the biodiversity values within the development area in the medium to long term"*. These measures have been considered in the report, which forms part of the general application to Ballina Shire Council by Ardill Payne & Partners (APP).

A preliminary assessment of the block was completed by AWC in December 2010 and August 2011 and identified potential issues including: potential Koala habitat, habitat for the Wallum Froglet, microchiropteran bats and the occurrence of Endangered Ecological Communities. Based on the findings of the preliminary assessments the scope and footprint of works was modified accordingly, and hence impacts to sensitive parts of the block have been avoided.

The aim of this assessment is to complete detailed survey of the block to determine the potential for threatened species, populations or communities to occur, examine the potential impacts of the proposal with regard to the ecology of the site and complete assessments under relevant statutory instruments such that the DGRs are satisfactorily addressed.

1.1 The Site

The block comprises Lot 32 DP1151612 and encompasses approximately 49 hectares, inclusive of a road reserve along the northern boundary (refer to Figure 1.1). The western half of the block has been cleared for sugar cane farming, with the south-eastern portion mostly cleared but supporting some scattered native vegetation. It is proposed that the balance of the block will retain its existing agricultural land use.

Constructed drains occur at several locations: a central north-south drain occurs between the boundaries of the block and neighbouring Lot 33 (and is flanked by a windrow of mixed species) and connects to an east-west drain along the boundary with adjacent Lot 50 DP1112724. The block is also bound by constructed drains along the western and northern boundaries. A small feeder drain occurs along the western part of the southern boundary of Lot 33.

The block is maintained by regular slashing and no dwellings or infrastructure occurs.

1.2 The Proposal

The proposed development is for a new quarry to be established in the south-western portion of the block (refer to Figures 1.2, 1.3 and 1.4), within a total area of approximately 15 hectares. This development area is henceforth referred to as 'the site'. The quarry will comprise:

- Extraction pit
- Stockpile area
- Sediment basins (x 2)
- An office and weighbridge
- The construction of an access road to Newrybar Swamp Road and noise attenuation mounds
- Installation of visual landscape screens

The stockpile site, office site, sediment ponds and access road will collectively occupy approximately 2.4 hectares. The new quarry site will be accessed from an existing access road of approximately 10m width along the northern boundary of the eastern portion of the existing farm access road corridor (refer to Figure 1.2). The access road will connect to Newrybar Swamp Road and will require part removal of the existing sound attenuation mound. Extraction is proposed to a maximum depth of six metres as shown on the proposed extraction plan by Ardill Payne & Partners at Figure 1.4.

As the proposal will utilise formerly disturbed farming land, no areas of native vegetation will require removal or disturbance. Once operational the proposed quarry will require water storage and dispersal treatment methods as currently occurs at the existing adjacent quarry. Water will be pumped from the extraction pit into sediment basins for short term residence/settling and pH treatment (liming to raise acidity levels to ~6.5 as per current practice at the existing quarry) before discharge to the northern drain, which then flows south along the central north-south drain before being discharged from the block into Deadmans Creek.

Figure 1.5 shows the existing water treatment and dispersal methods for the current quarry at Lot 33 and the proposed quarry on Lot 32.

Following exhaustion of the resource the extraction area will remain as a shallow wetland fed by groundwater as is the case with the existing quarry on Lot 33 (refer Figure 1.6). Areas adjacent to the quarry will be revegetated with a variety of local flora to provide additional habitat.

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NORTH POINT

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REV.	ISSUE / AMENDMENTS	DATE

DESIGNED IC
DRAWN RSS
CHECKED IC

PROJECT
BALLINA SANDS
ENVIROMENTAL IMPACT STATEMENT

DRAWING
FIGURE 1-1
SUBJECT SITE

DWG No.
AWC_1-10090_01

CAD FILE No.
1-10090_01 Figure1-1.dwg

SCALE
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DRAWING CREATED
15/5/2012

REV.
B

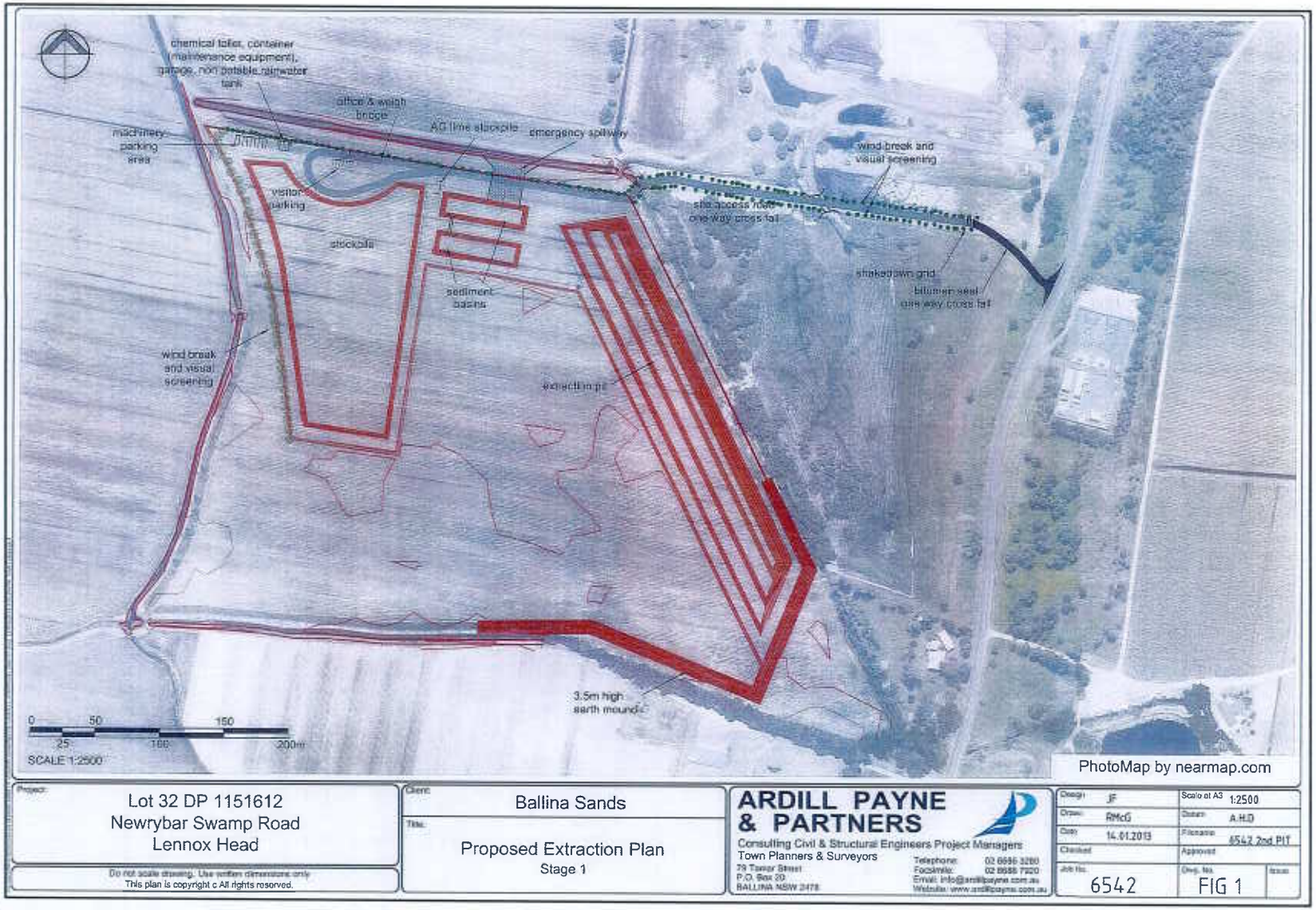


Figure 1.2 The proposed development – Stage 1

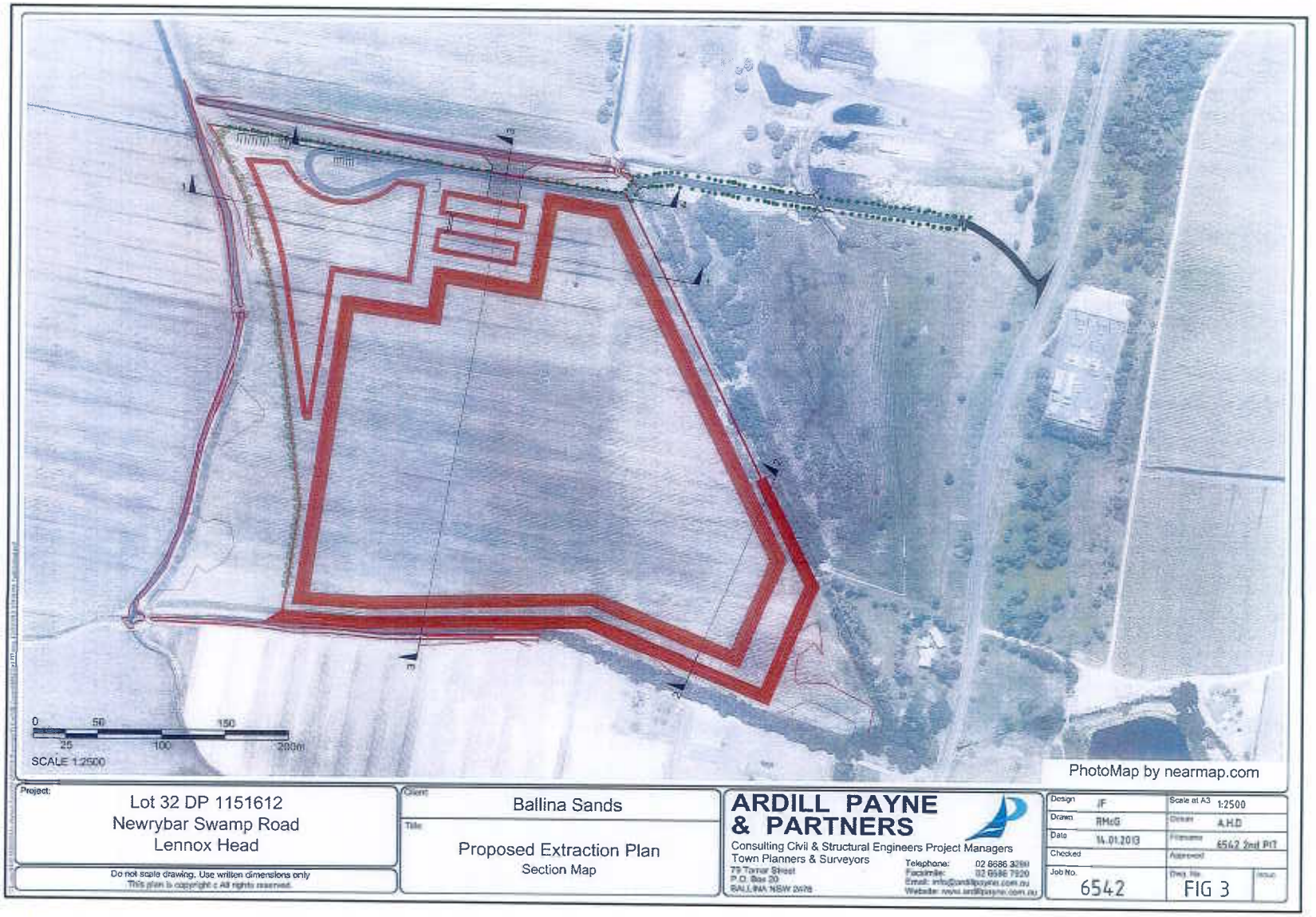


Figure 1.3 Proposed development - Final Stage

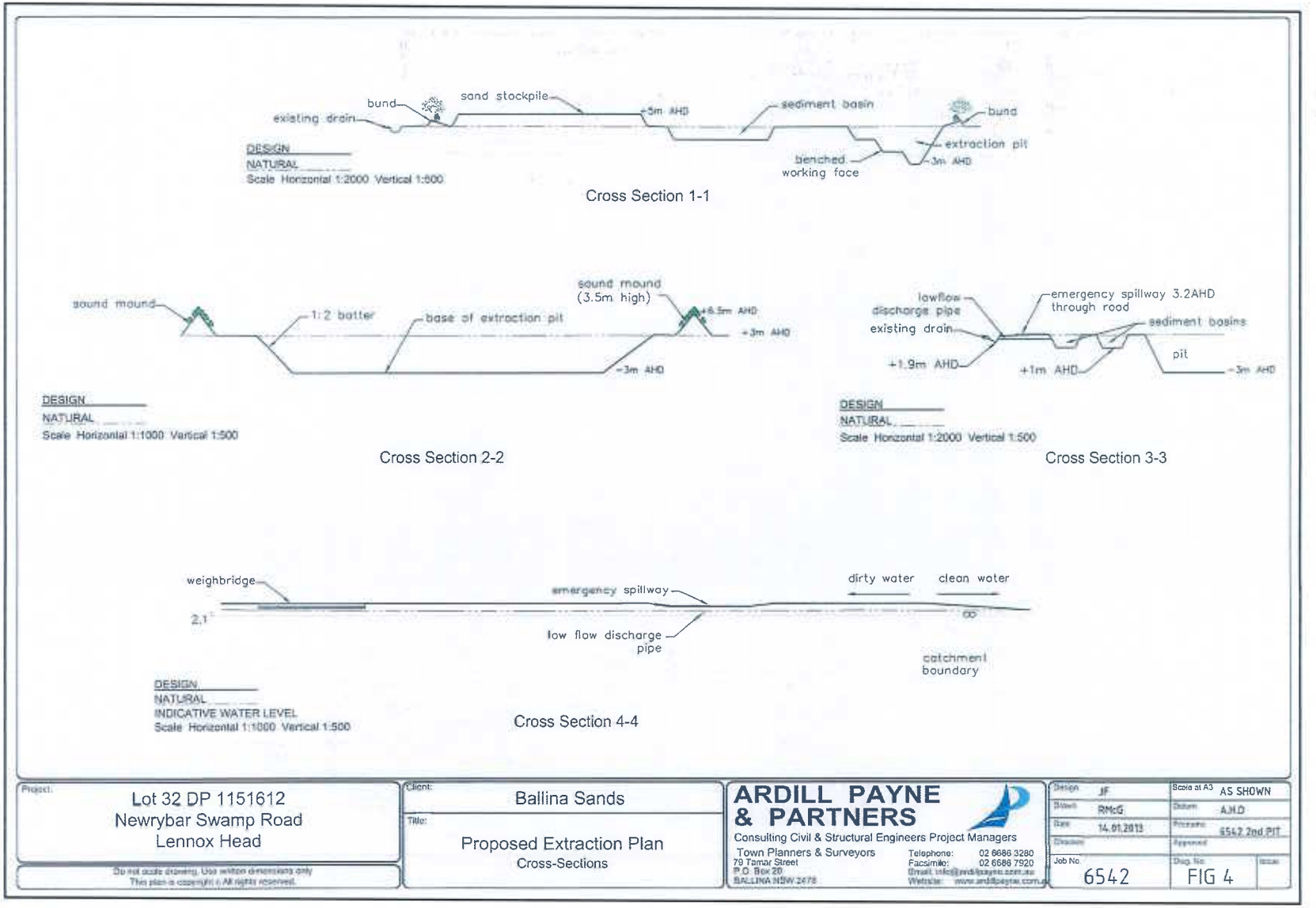
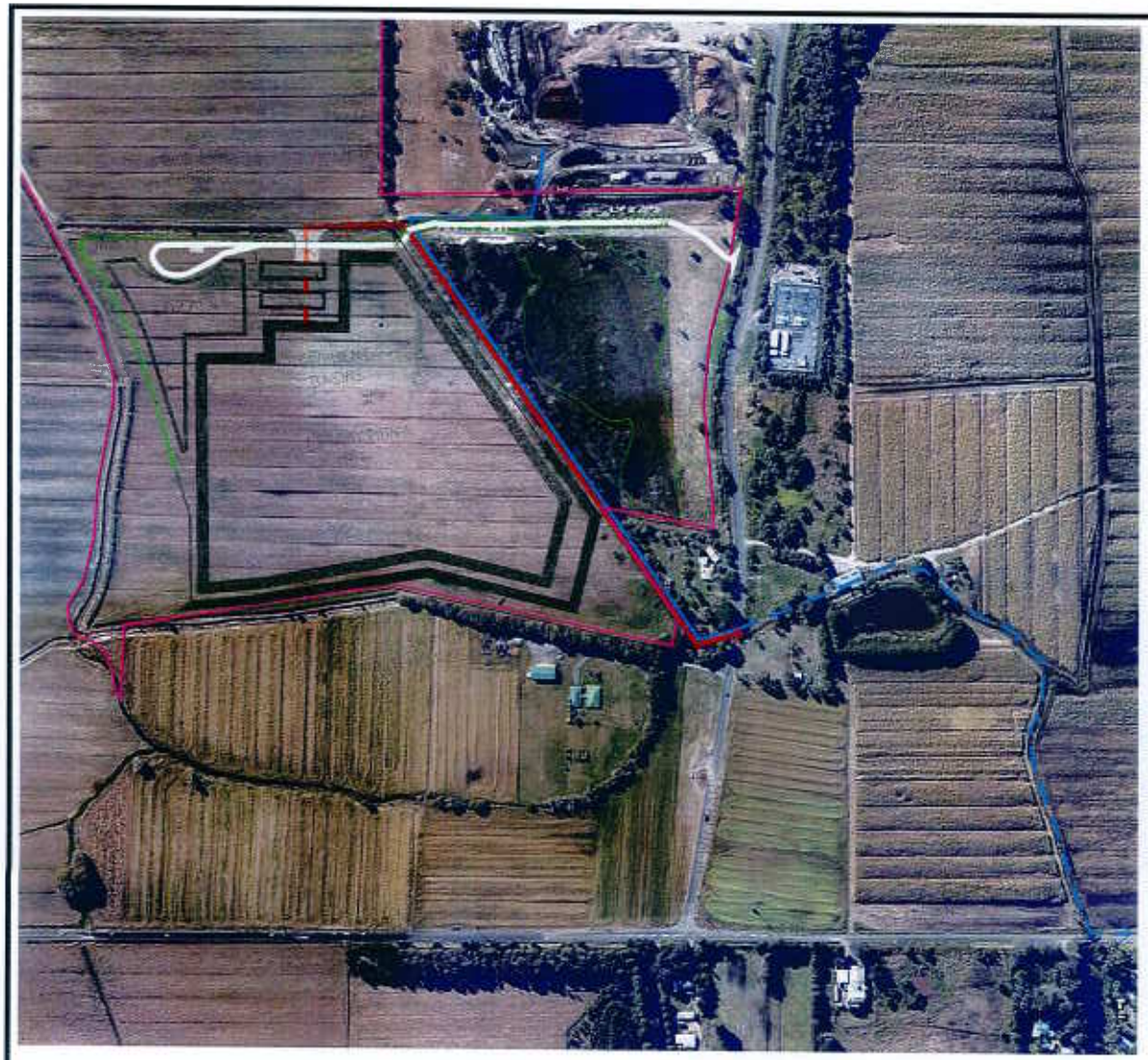


Figure 1.4 Final Stage – sections



LEGEND

EXISTING DRAIN EXTERNAL TO SITE

EXISTING DRAINAGE WITHIN SITE

PROPOSED DRAINAGE WITHIN SITE

AREA OF THREATENED SPECIES HABITAT- OLONGBURRA FROG & WALLUM FROGLET

CADASTRE - APPROX LOT BOUNDARY

METRES
100 50 0 100 200 300 400
75 25
SCALE 1:5000

NORTH POINT

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REV.	ISSUE / AMENDMENTS	DATE

DESIGNED	IC
DRAWN	RBS
CHECKED	IC

PROJECT: BALLINA SANDS
ENVIROMENTAL IMPACT STATEMENT

DRAWING: FIGURE 1-5
WATER TREATMENT & DISPERSAL

DWG No.: AWC_1-10090_02

CAD FILE No.: 1-10090_02 Figure 1-5.dwg

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DRAWING CREATED: 15/5/2012

REV.: C

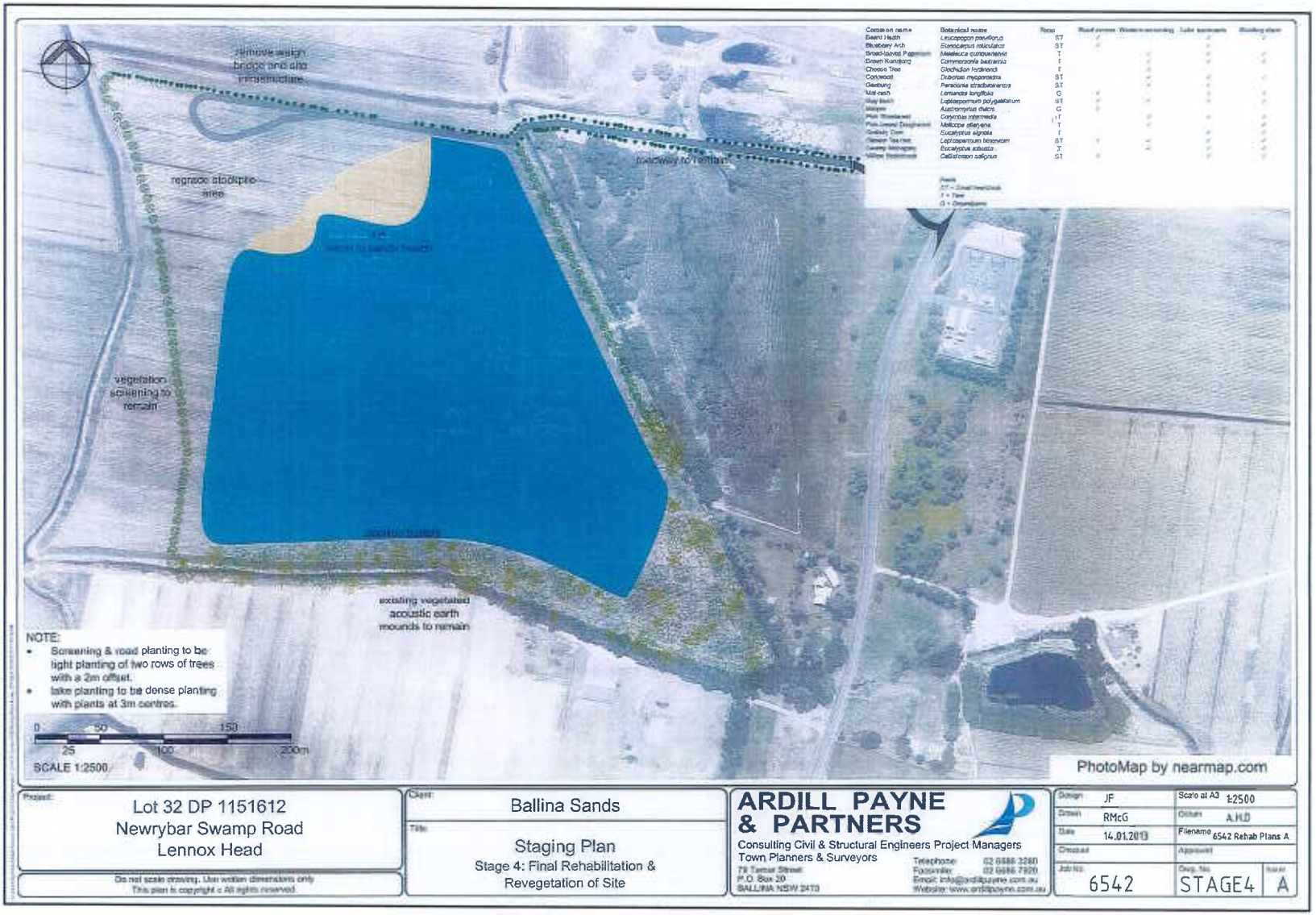


Figure 1.6 Final rehabilitation and revegetation plan

1.3 Soils and Topography

Soil mapping (Morand 1994) identifies two soil landscapes at the block (Wardell, Tyagarah) as shown at Table 1.1. The block is essentially flat land with minor local relief.

Table 1.1 Soil landscapes at the site (Morand 1994)

Soil Landscape	Attributes
Aeolian/Beach Landscapes	
Wardell "a" (**waa**)	**Landscape** – very low isolated transgressive sand dunes that are now stabilised, formed inland of the inner barrier. **Soils** – deep (> 300 cm) well-drained Podzols (Uc2,3, UC5). Deep (> 300 cm) poorly drained Peaty Podzols (Uc2) and Acid Peats (O) in low-lying, poorly drained areas. **Limitations** – high wind erosion hazard, very low fertility, highly permeable and highly acid soils.
Aeolian/Estuarine Landscapes	
Tyagarah (**ty**)	**Landscape** – sediment basins of mixed estuarine and aeolian origin, forming level to gently underlying plains. Tyagarah "a" is described as wet areas of the Tyagarah landscape that have not been drained. **Soils** – deep (> 150 cm) moderately well-drained minimal Prairie Soils (Gn3.91, Gn2.81, Dd4.51) near basaltic areas. Deep (> 150 cm) well-drained Podzols (Uc2.33, Uc2) and Acid Peats (O) near barrier systems. **Limitations** –very strongly acid, permeable often waterlogged soils of low fertility and low water holding capacity with localised salinity. Permanently high watertables and moderate wind erosion hazard.

2 Methods

Preliminary assessment of the block has been completed and involved desktop assessment (searches of the NSW Wildlife Atlas, review of results of other nearby ecological studies) and brief one day assessments where flora and vegetation communities were surveyed and fauna were identified opportunistically via observation or audible calls.

This assessment for the EIS utilised a number of targeted survey techniques as per the DGRs, including:

- Targeted searches for threatened flora
- Targeted vegetation assessment and determination of vegetation boundaries
- Cage trapping
- Anabat survey
- Harp trapping
- Spotlighting
- Pitfall trapping
- Elliott trapping (both ground and arboreal)
- Call playback
- Koala scat searches

The survey was completed over five days and four nights from December 12 to December 16 2011. Details of all survey techniques are attached at Appendix B, including a plan of all survey methods completed.

Survey methods generally met or exceeded requirements in DEC (2004) and are considered to adequately address the Flora and Fauna Requirements of DECCW (2010), attached at Appendix A (refer Table 2.1).

Table 2.1 Summary of fauna survey effort

Fauna target group	Recommended survey effort (DEC 2004)	Survey effort completed
Amphibians	Systematic day search – 1 hour per stratification unit	Amphibian searches conducted in all vegetation types during vegetation survey and trap checking.
	Night habitat search – 30 minutes on two separate nights per stratification unit	4 nights spotlighting transects conducted over total time of 5.85 hours
	Nocturnal call playback – 1 playback session on two separate nights	Completed at 6 sites over 4 nights for Wallum Froglet. 3 sites repeated over 2 nights for Olongburra Frog.
Reptiles	30 minute habitat searches – on two separate days	Two habitat searches over two days and opportunistic searches on each day of the survey
	24 pitfall trap nights over minimum of four nights	60 trap nights over four nights
	30 minute spotlighting search on two nights	4 nights spotlighting transects conducted over total time of 5.85 hours All vegetation types searched.
Diurnal Birds	Not specified	Eleven Area Searches and opportunistic searches over five days.
Nocturnal Birds	Up to 8 call playback sessions over eight nights	Four nocturnal call-playback sessions conducted over four nights.
	Day habitat searches for pellets, roosting birds, nest/roost sites	Large trees searched for roost / nest hollows.
	30 minute stag watch prior to sunset and 60 minutes following sunset.	n/a, no suitable stag trees present
Mammals (excluding bats)	100 trap nights using Small Elliott traps over 3-4 consecutive nights	200 trap nights over 4 nights
	100 trap nights using large Elliott traps over 3-4 consecutive nights	20 trap nights over 4 nights
	24 Arboreal trap nights over 3-4 consecutive nights	24 trap nights over 4 nights
	24 wire cage trap nights over 3-4 consecutive nights	24 wire cage trap nights over 4 nights
	24 pitfall trap nights over 3-4 consecutive nights	60 trap nights over 4 nights
	10 large and 10 small hair tube trap nights over 4 days and 4 nights	120 hair funnel trap nights over 6 nights
	30 hair tubes in habitat trees for 4 days and 4 nights	Not completed
	2 x 1 hour spotlighting transects on 2 separate nights	4 nights spotlighting transects conducted over total time of 5.85 hours
	2 call playback sites x 2 nights	n/a, SAT survey method utilised
	Observe potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset	Not completed
	30 minute searches for scats and signs	General searches during trap checks and flora surveys
	1km track search for signs and tracks	As above
Mammals (bats)	4 harp trap nights over two consecutive nights	8 harp trap nights over four nights
	2 ultrasound recording devices per night for 2 nights.	Anabat detector used for 4 nights with mix of roving and stationary (all-night) survey with total survey time of approximately 16 hrs.
	2x 1 hour spotlighting transects on two separate nights	Comprehensive spotlighting transects conducted on 4 nights over entire site, total time of 5.85 hours
	Day habitat searches for bat excreta	All vegetation types searched for mammals and signs during daily traverses of site.

3 Flora

3.1 Desktop review

3.1.1 Database/schedule searches

Database searches were completed to determine records of threatened flora, as listed in the *Threatened Species Conservation Act* (TSC Act) *1995* within the locality. Searches of the NSW Wildlife Atlas were completed November 2011 (and reviewed February 2013), based on an area of 5km by 5km centred on the site. The database search results returned confirmed records of 21 threatened flora species within five km of the site, including 16 species also listed under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) *1999* (refer Table 3.1). No threatened flora populations occur in the Ballina LGA.

Table 3.1 Threatened flora recorded within 5km of the site

Scientific name	Common name	Status	
		TSC	EPBC
Acalypha eremorum	Acalypha	E	-
Acronychia littoralis	Scented Acronychia	E	E
Archidendron hendersonii	White Lace Flower	V	-
Arthraxon hispidus	Hairy Jointgrass	V	V
Caesalpinia bonduc	Knicker Nut	E	-
Davidsonia jerseyana	Davidson's Plum	E	E
Davidsonia johnsonii	Smooth Davidson's Plum	E	E
Diploglottis campbellii	Small-leaved Tamarind	E	E
Endiandra muelleri subsp. *bracteata*	Green-leaved Rose Walnut	E	-
Floydia praealta	Ball Nut	V	V
Gossia fragrantissima	Sweet Myrtle	E	E
Hicksbeachia pinnatifolia	Red Boppel Nut	V	V
Isoglossa eranthemoides	Isoglossa	E	E
Macadamia tetraphylla	Rough-shelled Bush Nut	V	V
Melicope vitiflora	Coast Euodia	E	-
Ochrosia moorei	Southern Ochrosia	E	E
Owenia cepiodora	Onion Cedar	V	V
Phaius australis	Southern Swamp Orchid	E	E
Syzygium hodgkinsoniae	Red Lilly Pilly	V	V
Syzygium moorei	Durobby	V	V
Tinospora tinosporoides	Arrow-Head Vine	V	V

V = Vulnerable; E = Endangered species pursuant to the *TSC Act* or *EPBC Act*

Review of Schedule 1 of the *TSC Act 1995* indicates that up to ten Endangered Ecological Communities (EECs) may potentially occur in the Ballina LGA as follows:

- Coastal Cypress Pine Forest in the New South Wales North Coast bioregion;
- Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions;
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion;
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions;
- Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Lowland Rainforest on Floodplain in the New South Wales North Coast bioregion.

3.1.2 Literature Review

It is understood that an EIS was prepared for the existing quarry, however a copy of this document could not be obtained for review. The most recent detailed ecological assessments completed in the immediate locality are those for the Cumbalum Urban Release Area (CURA) – Precincts A and B. Comprehensive survey was also completed at the Pacific Pines Estate at Lennox Head (Cardno 2010). All studies identified a range of vegetation types inclusive of a number of EECs. Threatened flora records from these studies are summarised at Table 3.2.

Threatened flora records of particular interest in the locality include:

- A local population of Hairy Jointgrass (as identified in the CURA assessments) and other specialist reports.
- A population of Square-stemmed Spike-rush (*Eleocharis tetraquetra*) at Pacific Pines.

Table 3.2 Threatened flora records from known studies in the locality

Study	Threatened flora recorded
CURA – Precinct A (James Warren & Associates 2010)	Green-leaved Rose Walnut, Smooth Davidson's Plum , White Lace Flower, Rough-shelled Bush Nut, Hairy Jointgrass, Arrow-Head Vine, Davidson's Plum, Durobby
CURA – Precinct B (LandPartners Limited 2010, Sandpiper Environmental 2005)	White Lace Flower, Rough-shelled Bush Nut, Hairy Jointgrass, Arrow-Head Vine, Red Lilly Pilly, Small-leaved Tamarind
Pacific Pines (Cardno 2010)	Square-stemmed Spike-rush, Rough-shelled Bush Nut, Hairy Jointgrass, Arrow-Head Vine, White Lace Flower, Red Lilly Pilly

3.2 Site Assessment

3.2.1 Vegetation communities

Eight broad vegetation communities were recorded at the block (refer to Table 3.3, Figure 3.1). The DECCW (2010) requirements state that the conservation of vegetation communities must be identified at a local, regional and state level. As no local shire-wide vegetation study has been completed in Ballina, the local conservation significance of vegetation communities cannot be adequately determined. As a guide, the lowland vegetation assessment completed for the NSW Comprehensive Coastal Assessment (CCA) (Sheringham *et al.* 2008) was used to provide information on local vegetation communities, although it is noted that some vegetation associations in the CCA assessment are very specific.

On a regional basis the classification system used in BioMetric (CMA 2008) for the Northern Rivers Catchment has been used as it represents the most up to date classification system, where vegetation of >70% clearance is determined as being of conservation significance. Vegetation communities are also identified at statewide level as per the vegetation classes of Keith (2004) and the Plant Community Types (PCT) in the NSW Vegetation Information System (VIS) Classification Database (Version 2.0, Office of Environment & Heritage 2012).

A flora inventory is attached at Appendix C, with photographs attached at Appendix D.

Table 3.3 Vegetation communities at the site

	Vegetation community	Description	CCA (2008) equivalent	BioMetric equivalent	% Cleared Estimate (BioMetric)	Keith (2004) equivalent	VIS (2.0) equivalent
Dry sclerophyll communities							
1	Open forest (Scribbly Gum)	Occurs: on spoil bank adjacent to central drain and on eastern side of spoil bank (in north). Description: Open forest – woodland dominated by Scribbly Gum (*Eucalyptus signata*). Typical midstorey species (spoil bank): Satinwood (*Nematolepis squamea* subsp. *squamea*), Shaggy Pea (*Oxylobium robustum*), Teatree (*Leptospermum polygalifolium, L. trinervium*). Midstorey absent in slashed areas (some regeneration of same species). Ground layer: spoil bank – Bracken (*Pteridium esculentum*), Twining Guinea Flower (*Hibbertia scandens*). Slashed communities – Bracken, Wiry Panic (*Entolasia marginata*). Pomax (*Pomax umbellata*), Flax Lily (*Dianella caerulea*). Condition: Historically cleared and modified, disturbed by slashing in east.	Community 31: Scribbly Gum-Red Mahogany-Brush Box dry sclerophyll Open to Closed Forest on Coastal Barrier Sands Conservation status: small areas locally reserved	NR227 - Scribbly Gum - Needlebark Stringybark heathy open forest of coastal lowlands of the northern North Coast (in part)	40	North Coast Dry Sclerophyll Forests	PCT 1135 Scribbly Gum - Needlebark Stringybark heathy open forest of coastal lowlands of the northern NSW North Coast Bioregion
Swamp sclerophyll communities							
2	Open forest (Swamp Mahogany)	Occurs: on spoil bank adjacent to central drain and on eastern side of spoil bank (in south). Description: Open forest – woodland dominated by Swamp Mahogany (*Eucalyptus robusta*). Typical midstorey species (spoil bank): Beard Heath (*Leucopogon lanceolatus*), Satinwood, Shaggy Pea. Midstorey absent in slashed areas (some regeneration of same species). Ground layer: spoil bank – Bracken, Twining Guinea Flower. Slashed community – Plume Rush (*Baloskion tetraphyllum* subsp. *meiostachyum*), Bracken, Wiry Panic, Raspwort (*Gonocarpus micranthus* subsp. *ramosissimus*). Lower areas around eastern margins are dominated by Water Fern (*Blechnum indicum*) and Swamp Grass-tree (*Xanthorrhoea fulva*). Condition: Historically cleared and modified, disturbed by slashing.	Community 14: Swamp Mahogany-Broad-leaved Paperbark-Bangalow Palm-sedge/fern Swamp Sclerophyll Open Forest Conservation status: sites on alluvial plain are 'Swamp sclerophyll forest' EEC, probably poorly reserved (Griffith 2005)	NR254 - Swamp Mahogany swamp forest of the coastal lowlands of the North Coast	75	Coastal Swamp Forests	PCT 1230 Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion
3	Open forest (Broad-leaved Paperbark)	Occurs: Along southern drain and northern boundary, small patch in north-east corner. Description: Dominated by Broad-leaved Paperbark (*Melaleuca quinquenervia*) with sparse midstorey. Typical infrequent species include Camphor Laurel (*Cinnamomum camphora*), Sally Wattle (*Acacia melanoxylon*), Blueberry Ash (*Elaeocarpus reticulatus*), Black Wattle (*Callicoma serrulata*). The community along the southern drain is highly simplified. Where the southern drain turns northward a high proportion of Sally Wattle occurs. Condition: Fragmented and disturbed in south with high edge to core ratio. Northern community forms part of a large mature patch on neighbouring land.	Community 11: Broad-leaved Paperbark-Pink-flowered Doughwood Swamp Sclerophyll Open Forest Conservation status: sites on alluvial plain are Swamp sclerophyll forest EEC , floodplain occurrences poorly reserved (Griffith 2005)	NR217 - Paperbark swamp forest of the coastal lowlands of the North Coast	75	Coastal Swamp Forests	PCT 1064 Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion

	Vegetation community	Description	CCA (2008) equivalent	BioMetric equivalent	% Cleared Estimate (BioMetric)	Keith (2004) equivalent	VIS (2.0) equivalent
Regrowth communities							
4	Closed forest (Camphor Laurel, Brush Box, Riberry)	Occurs: Southern drain Description: Small patch of forest along drain dominated by Camphor Laurel, with several mature Brush Box (*Lophostemon confertus*) and Riberry (*Syzygium leuhmannii*). Midstorey sparse – occasional Narrow-leaved Palm Lily (*Cordyline stricta*), Brown Bolly Gum (*Litsea reticulata*). Ground cover sparse & patchy: Rainbow Fern (*Calochlaena dubia*), Birdsnest Fern (*Asplenium australe*). Condition: Very small in area, fragmented and disturbed, dominated by Camphor Laurel. High edge to core ratio.	No equivalent	No equivalent	na	No equivalent	No equivalent
Wet heath communities							
5	Fernland/sedgeland (Swamp Water Fern, Plume Rush, Twig-rush, Swamp Grass-tree)	Occurs: South-east of site Description: Wet fernland/sedgeland with wet heath elements. Typical species: Twig-rush (*Baumea rubiginosa*), Swamp Grass-tree, Plume Rush, Swamp Water Fern, Wiry Panic. Infrequent regeneration of Teatree (*L. liversidgei, L. juniperinum*) and Baeckea (*B. frutescens*) along north-western edge Condition: Modified and disturbed from slashing	No equivalent	NR276 - Wallum sedgeland and rushland of near coastal lowlands of the North Coast	70	Coastal Heath Swamps	PCT 1290 Wallum sedgeland and rushland of near coastal lowlands of the NSW North Coast Bioregion
Modified communities							
6	Windrow	Occurs: north-eastern boundary Description: Planted windrow of Swamp Mahogany and Turpentine (*Syncarpia glomulifera*), with regrowth of Sally Wattle, Shaggy Pea, Midyim etc. Groundcover species include Plume Rush and Mat-rush. Condition: Highly modified and disturbed.	No equivalent	No equivalent	na	No equivalent	No equivalent
7	Closed grassland (mixed species)	Occurs: west of site. Description: Disturbed grassland dominated by exotic grasses - Setaria (*Setaria sphacelata*), Whiskey Grass (*Andropogon virginicus*), Kikuyu (*Pennisetum clandestinum*), Carpet Grass (*Axonopus compressus*) and occasional agricultural weeds. Wild Parsnip (*Trachymene composita*) occurs commonly, while infrequent native species include Raspwort, Pomax, Plume Rush, and shrubs of Broad-leaved Paperbark and Teatree. Cuphea (*Cuphea carthageninsis*) and Pin Rush (*Juncus usitatus*) are common in cross drains. Condition: Highly modified and disturbed.	No equivalent	No equivalent	na	No equivalent	No equivalent
8	Reedland/swamp grassland (Frogsmouth, Spike-rush)	Occurs: Central, western, northern and southern drains and main cross drain. Description: Dominated by Frogsmouth (*Philydrum lanuginosum*), with other common species including Spike-rush (*Eleocharis equisetina*), Swamp Ricegrass (*Leersia hexandra*), Swamp Millet (*Isachne globosa*), Smartweed (*Persicaria strigosa*). Condition: Modified and disturbed. Slashed and sprayed annually.	Community 25: Swamp Ricegrass-*Bolboschoenus caldwellii-Schoenoplectus validus-Cyperus exaltatus* Freshwater Wetland (in part)	NR149 - Coastal floodplain sedgelands, rushlands, and forblands (in part)	80	Coastal Freshwater Lagoons	PCT 780 Coastal floodplain sedgelands, rushlands, and forblands of the North Coast

VEGETATION COMMUNITY

1 OPEN FOREST (SCRIBBLY GUM)

2 OPEN FOREST (SWAMP MAHOGANY)

3 OPEN FOREST (BROAD-LEAVED PAPERBARK)

4 CLOSED FOREST (CAMPHOR LAUREL, BRUSH BOX, RIBERRY)

5 FERNLAND/SEDGELAND (SWAMP WATER FERN, PLUME RUSH, TWIG-RUSH, SWAMP GRASS-TREE)

6 WINDROW

7 CLOSED GRASSLAND (MIXED SPECIES)

8 REEDLAND/SWAMP GRASSLAND (FROGSMOUTH, SPIKE-RUSH)

LEGEND

(6) VEGETATION COMMUNITY ID NUMBER

AREA OF VEGETATION COMMUNITIES

AREA OF ENDANGERED ECOLOGICAL COMMUNITIES - SWAMP SCLEROPHYLL FOREST

VEGETATION WITHIN DRAINAGE SWALES

METRES 100 50 0 100 200 300 400

75 25 SCALE 1:5000

NORTH POINT

AWC
Australian Wetlands Consulting Pty Ltd
PO Box 2605 / 70 Butler Street
Byron Bay NSW 2481
P (02) 6685 5466 | F (02) 6680 9406
www.awconsult.com.au

DO NOT SCALE FROM PLANS. TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY PROJECT SUPERVISOR. SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.

REV.	ISSUE / AMENDMENTS	DATE

DESIGNED	IC
DRAWN	RBS
CHECKED	IC

PROJECT: BALLINA SANDS
ENVIROMENTAL IMPACT STATEMENT

DRAWING: FIGURE 3-1
VEGETATION COMMUNITY MAP

DWG No: AWC_1-10090_03

CAD FILE No: 1-10090_03 Figure3-1.dwg

SCALE: 1:5 000 @ A3

DRAWING CREATED: 15/5/2012

REV: B

3.2.2 Threatened flora

No threatened flora species were recorded.

The DECCW (2010) Flora and Fauna Requirements state that the potential for threatened flora to occur at the site must be assessed. As such, the flora list at Table 3.1 is reviewed based on the flora assessment and the potential for threatened flora to occur based on the habitat present is summarised at Table 3.4. The majority of all threatened flora species considered in Table 3.4 are rainforest species. Given that the single small patch of vegetation which supports rainforest species at the block is isolated and disturbed (dominated by Camphor Laurel), small in area, was thoroughly surveyed and that no threatened flora were recorded discounts the possibility of any of these species occurring at the site.

The exception to this rationale is for Hairy Jointgrass (HJG), which has been recorded within approximately 400 metres of the block within Precinct B of the CURA. Based on considerable survey experience for HJG (including at CURA Precinct B), the hydrology, aspect and soils at the site are generally unsuitable for HJG and characteristic co-dominant species such as Swamp Foxtail (*Pennisetum alopecuroides*), Cuphea (*Cuphea carthageninsis*) and Knotweed (*Persicaria strigosa*) are absent.

A targeted one hour random traverse of the proposal area, with a focus on moist cross drains did not detect the species While the survey was completed outside the optimum time for the species detection (January – April), it is highly likely that the species would be evident if it occurred. HJG in the locality is known to have attained heights of up to 40 cm by the time of survey (David Havilah [Geolink ecologist] pers. comm. 14/12/11). Historical disturbance associated with sugar cane production and regular slashing is also likely to inhibit potential for the species to occur or establish, and the grassland communities have no hydrological connection with other known areas of HJG habitat from where seed may be dispersed (water being a suspected dispersal agent for the species). Moist areas within swamp heath communities provide suitable hydrological conditions for the species, but HJG is not known to occur in association with this community type, nor on acidic peaty soils.

The northern swamp sclerophyll community may provide potential habitat for the Southern Swamp Orchid. While the portion of this community on the block is disturbed and slightly elevated from better quality forest on the adjacent site to the north, this community was not thoroughly surveyed and so the potential for occurrence cannot be discounted.

3.2.3 ROTAP flora

No flora species classified as Rare or Threatened Australian Plants (ROTAP) as per Briggs & Leigh (1996) were recorded.

Table 3.4 Potential for threatened flora to occur at the site

Common name	Habitat*	Recorded	May occur	Unlikely to occur	Rationale
Acalypha	subtropical rainforest, dry rainforest and vine thickets			✓	Potential habitat patch thoroughly traversed, species not recorded
Arrow-Head Vine	wetter subtropical rainforest, including littoral rainforest, on fertile, basalt-derived soils			✓	Potential habitat patch thoroughly traversed, species not recorded
Ball Nut	riverine and subtropical rainforest, usually on basalt-derived soils			✓	Potential habitat patch thoroughly traversed, species not recorded
Coast Euodia	subtropical and littoral rainforest			✓	Potential habitat patch thoroughly traversed, species not recorded
Coastal Fontainea	remnant regrowth littoral rainforest on highly fertile red-brown krasnozem soils			✓	No suitable habitat, very restricted distribution
Davidson's Plum	lowland subtropical rainforest and wet eucalypt forest at low altitudes			✓	Potential habitat patch thoroughly traversed, species not recorded
Durobby	subtropical and riverine rainforest at low altitude			✓	Potential habitat patch thoroughly traversed, species not recorded
Green-leaved Rose Walnut	subtropical rainforest, chiefly at lower altitudes			✓	Potential habitat patch thoroughly traversed, species not recorded
Hairy Jointgrass	edges of rainforest and in wet eucalypt forest, often near creeks or swamps. Also recorded from wet pasture.			✓	Soils and disturbance history unlikely to support habitat
Knicker Nut	sandy, coral-derived soil close to the shoreline in coastal scrub vegetation			✓	Potential habitat patch thoroughly traversed, species not recorded
Onion Cedar	subtropical and dry rainforest on or near basalt-derived soils			✓	Potential habitat patch thoroughly traversed, species not recorded
Red Lilly Pilly	riverine and subtropical rainforest on rich alluvial or basaltic soils			✓	Potential habitat patch thoroughly traversed, species not recorded
Rough-shelled Bush Nut	subtropical rainforest, usually near the coast			✓	Potential habitat patch thoroughly traversed, species not recorded
Scented Acronychia	littoral rainforest on sand			✓	No suitable habitat present
Small-leaved Tamarind	subtropical rainforests on coastal lowlands			✓	Potential habitat patch thoroughly traversed, species not recorded
Smooth Davidson's Plum	lowland subtropical rainforest and wet eucalypt forest at low altitudes			✓	Potential habitat patch thoroughly traversed, species not recorded
Southern Ochrosia	riverine and lowland subtropical rainforest			✓	Potential habitat patch thoroughly traversed, species not recorded
Southern Swamp Orchid	swampy grassland or forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas		✓		Potential habitat in northern swamp sclerophyll forest.
Stinking Cryptocarya	littoral rainforest, usually on sandy soils, mature trees also known to occur on basalt soils			✓	Potential habitat patch thoroughly traversed, species not recorded

* www.threatenedspecies.environment.nsw.gov.au

3.2.4 Endangered ecological communities

Vegetation at the block is indicative of the EEC 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' with regard to Communities 2 and 3 (refer to Figure 3.1).

The sedgeland/fernland community is not representative of the EEC 'freshwater wetlands on coastal floodplains' as the block occurs on a sandplain of Aeolian origin. The Final Determination for the 'freshwater wetlands on coastal floodplains' EEC (NSW Scientific Committee 2004) specifically states that sandplain communities are not captured within the EEC description. Further, woody regeneration of Teatree species and the presence of Swamp Grass-tree are indicative of a coastal wet heath complex with Twig-rush and Water Fern occurring in lower swales where water persists.

While drainline communities are broadly analogous with a vegetation unit considered indicative of the 'Freshwater wetlands' EEC in Sheringham *et al.* (2008), these communities are artificial whereby drainage channels have incised into what is likely to have been low relief floodplain. Wetland species colonising constructed drainline are not representative of 'true' wetland environments and hence are not considered as being part of the subject EEC.

No other EECs are considered to occur based on floristic, hydrological or edaphic characteristics.

3.2.5 Weed species

Within areas of native vegetation weed species are virtually absent, with infrequent Lantana occurring along the margins of Communities 3 and 4. Grassland communities are highly disturbed and primarily comprised of pasture grasses and common agricultural weeds.

One listed noxious weed species was recorded (Groundsel Bush *Baccharis halimifolia*), with several shrubs observed.

4 Fauna

4.1 Desktop Review

4.1.1 Database searches

Database searches were completed to determine records of threatened fauna, as described in Section 3.1.1.The database search results returned confirmed records of 36 threatened fauna species within five km of the site, including six species also listed under the *EPBC Act 1999* (refer Table 4.1).

Table 4.1 Threatened fauna recorded within 5km of the site

Scientific name	Common name	TSC Act	EPBC Act
Gastropods			
Thersites mitchellae	Mitchell's Rainforest Snail	E	CE
Amphibians			
Crinia tinnula	Wallum Froglet	V	-
Litoria aurea	Green and Golden Bell Frog	E	V
Litoria olongburensis	Olongburra Frog	V	V
Birds			
Anseranas semipalmata	Magpie Goose	V	-
Botaurus poiciloptilus	Australasian Bittern	E	-
Burhinus grallarius	Bush Stone-curlew	E	-
Calidris ferruginea	Curlew Sandpiper	E	-
Carterornis leucotis	White-eared Monarch	V	-
Circus assimilis	Spotted Harrier	V	-
Ephippiorhynchus asiaticus	Black-necked Stork	E	-
Grus rubicunda	Brolga	V	-
Gygis alba	White Tern	V	-
Haematopus longirostris	Pied Oystercatcher	E	-
Hieraaetus morphnoides	Little Eagle	V	-
Irediparra gallinacea	Comb-crested Jacana	V	-
Ixobrychus flavicollis	Black Bittern	V	-
Lichenostomus fasciogularis	Mangrove Honeyeater	V	-
Pandion cristatus	Eastern Osprey	V	-
Pezoporus wallicus wallicus	Eastern Ground Parrot	V	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	-
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-
Sterna albifrons	Little Tern	E	-
Tyto longimembris	Eastern Grass Owl	V	-
Tyto novaehollandiae	Masked Owl	V	-

Scientific name	Common name	TSC Act	EPBC Act
Mammals			
Dasyurus maculatus	Spotted-tailed Quoll	V	V
Miniopterus australis	Little Bentwing-bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Myotis macropus	Southern Myotis	V	-
Nyctophilus bifax	Eastern Long-eared Bat	V	-
Phascolarctos cinereus	Koala	V	V
Planigale maculata	Common Planigale	V	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Syconycteris australis	Common Blossom Bat	V	-

V = Vulnerable; E = Endangered; CE = Critically Endangered species pursuant to the *TSC Act* or *EPBC Act.*

4.1.2 Literature review

As per the reports discussed at Section 3.1.2, a summary of threatened fauna records is shown at Table 4.2. No targeted fauna survey was completed for the Pacific Pines project hence is excluded from the Table.

Table 4.2 Threatened fauna records from known studies in the locality

Study	Threatened fauna recorded
CURA – Precinct A (James Warren & Associates 2010)	Wallum Froglet, Rose-crowned Fruit-dove, Eastern Bentwing-bat, Little Bentwing-bat, Grey-headed Flying-fox
CURA – Precinct B (LandPartners Limited 2010, Sandpiper Environmental 2005)	Black- necked Stork, Brolga, Eastern Bentwing-bat, Common Planigale, Eastern Freetail Bat, Eastern Grass Owl, Grey-crowned Babbler, Grey-headed Flying-fox, Little Bentwing-bat, Masked Owl, Rose-crowned Fruit-dove, Southern Myotis

4.2 Site Assessment

4.2.1 Fauna recorded

The site assessments confirmed the occurrence of ten amphibian species, four reptile species, 66 bird and 14 mammal species (refer to Table 4.3). Only microchiropteran bats positively identified from the anabat analysis have been included in the results table, with results attached in full at Appendix E. Results of the bird survey are attached at Appendix F.

Targeted survey recorded a diverse suite of frog species (including the three acid frog species known in northern NSW) and bird species. However trapping/survey for ground-dwelling and arboreal mammals and megachiropteran bats resulted in very poor results, with a total of five House Mice, four Swamp Rats, one Bush Rat, one Grassland Melomys and a total of four individuals of both Flying-fox species recorded. No arboreal mammal species were recorded. None of the major tree/shrub species at the site were flowering at the time of survey (Scribbly Gum, Broad-leaved Paperbark, Swamp Mahogany, Swamp Grass-tree), so resources for nectar feeding species were very limited.

Microchiropteran bat activity was very low from both trapping (only one animal captured) and Anabat survey results. Prey items for microbats (beetles and moths) were commonly observed during spotlighting, and weather conditions during Anabat surveys were free from any significant rain events. It is unclear why activity levels were so low during roaming surveys.

Two aquatic species were observed: Mosquito Fish (*Gambusia holbrooki*) were commonly observed in drains, while Freshwater Crayfish (*Cherax cuspidatus*) utilise the constructed drain within the wet heath community.

Table 4.3 Fauna recorded during the survey

Common name	Scientific name	Recorded
Amphibians		
Bleating Tree Frog	*Litoria dentata*	W
Cane Toad #	*Rhinella marina*	O, C
Common Eastern Froglet	*Crinia signifera*	W
Dwarf Green Tree Frog	*Litoria fallax*	W
Olongburra Frog*	*Litoria olongburensis*	W
Ornate Burrowing Frog	*Limnodynastes ornatus*	C
Rocket Frog	*Litoria nasuta*	W, C
Striped Marsh Frog	*Limnodynastes peroni*	W
Wallum Froglet*	*Crinia tinnula*	W, C
Wallum Rocket Frog	*Litoria freycineti*	W, C
Reptiles		
Dark-flecked Sun Skink	*Lampropholis delicata*	O
Eastern Brown Snake	*Pseudonaja textilis*	C
Eastern Water Dragon	*Physignathus lesueurii*	O, C
Pale-flecked Sun Skink	*Lampropholis guichenoti*	O
Birds		
Australian Magpie	*Cracticus tibicen*	O
Australian Hobby	*Falco longipennis*	O
Australian White Ibis	*Theskiornis moluccana*	O
Australian Wood Duck	*Chenonetta jubata*	O
Bar-shouldered Dove	*Geopelia humeralis*	W

Common name	Scientific name	Recorded
Barn Owl	*Tyto alba*	0
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	0
Black-shouldered Kite	*Elanus axillaris*	0
Brown Quail	*Coturnix ypsilophora*	0
Brown Thornbill	*Acanthiza pusilla*	0
Brush Turkey	*Alectura lathami*	mound
Cattle Egret^	*Ardea ibis*	0
Cicadabird	*Coracina tenuirostris*	W
Common Koel	*Eudynamys scolopacea*	W
Common Mynah #	*Acridotheres tristis*	W
Dollarbird	*Eurystomus orientalis*	0
Crested Pigeon	*Ocyphaps lophotes*	0
Double-barred Finch	*Taeniopygia bichenovii*	0
Dusky Woodswallow	*Artamus cyanopterus*	0
Eastern Rosella	*Platycerus eximius*	0
Eastern Whipbird	*Psophodes olivaceus*	W
Eastern Yellow Robin	*Eopsaltria australis*	W
Fairy Martin	*Hirundo ariel*	0
Figbird	*Sphecotheres viridis*	0
Galah	*Cacatia roseicapilla*	0
Golden-headed Cisticola	*Cisticola exilis*	0
Golden Whistler	*Pachycephala pectoralis*	W
Green Catbird	*Ailuroedus crassirostris*	W
Grey Butcherbird	*Cracticus torquatus*	0
Grey Fantail	*Rhipidura fuliginosa*	0
Grey Shrike-thrush	*Colluricincla harmonica*	W
House Sparrow #	*Passer domesticus*	0
King Quail	*Coturnix chinensis*	0
Latham's Snipe^	*Gallinago hardwickii*	0
Lewin's Honeyeater	*Meliphaga lewinii*	0
Little Pied Cormorant	*Phalacrocorax melanoleucos*	0
Magpie-lark	*Grallina cyanoleuca*	0
Masked Lapwing	*Vallenus miles*	0
Masked Owl*	*Tyto novaehollandiae*	W
Nankeen Night Heron	*Nycticorax caledonicus*	0
Noisy Miner	*Manorina melanocephala*	W
Pacific Black Duck	*Anas supercilliosa*	0
Pheasant Coucal	*Centropus phasianinus*	0
Pied Butcherbird	*Cracticus nigrogularis*	0
Pied Currawong	*Strepera graculina*	0
Plumed Whistling Duck	*Dendrocygna eytoni*	0
Purple Swamphen	*Porphyrio porphyrio*	0
Rainbow Bee-eater^	*Merops ornatus*	0
Rainbow Lorikeet	*Trichoglossus haematodus*	0
Red-backed Fairy-wren	*Malurus melanocephalus*	0
Red-browed Finch	*Neochmia temporalis*	0
Richard's Pipit	*Anthus novaeseelandiae*	W
Rufous Whistler	*Pachycephala rufiventris*	0
Satin Flycatcher	*Myiagra cyanoleuca*	0
Shining Bronze Cuckoo	*Chrysococcyx lucidus*	W
Spangled Drongo	*Dicrurus bracteatus*	W
Spotted Harrier*	*Circus assimilis*	0
Superb Fairy-wren	*Malurus cyaneus*	0
Tawny Frogmouth	*Podargus strigoides*	0
Torresian Crow	*Corvus orru*	0

Common name	Scientific name	Recorded
Variegated Fairy-wren	*Malurus lamberti*	O
Welcome Swallow	*Hirundo neoxena*	O
White-browed Scrubwren	*Sericornis frontalis*	O
White-faced Heron	*Egretta novaehollandiae*	O
White-throated Gerygone	*Gerygone olivacea*	W
Willie Wagtail	*Rhipidura leucophrys*	O
Mammals		
Black Flying-fox	*Pteropus alecto*	O
Bush Rat	*Rattus fuscipes*	C
Eastern Broad-nosed Bat	*Scotorepens orion*	A
Eastern Freetail Bat	*Mormopterus ridei*	A
Eastern Long-eared Bat*	*Nyctophilus bifax*	C
Gould's Wattled Bat	*Chalinolobus gouldii*	A
Grassland Melomys	*Melomys cervinipes*	O
Greater Broad-nosed Bat*	*Scoteanax rueppellii*	A
Grey-headed Flying-fox*	*Pteropus poliocephalus*	O
House Mouse #	*Mus musculus*	C, H
Little Bentwing-bat*	*Miniopteris australis*	A
Northern Brown Bandicoot	*Isoodon macrourus*	H
Red Fox #	*Vulpes vulpes*	den
Swamp Rat	*Rattus lutreolus*	C

Note: W=Call; O=Observed; A= Anabat; C = Captured; H = Hair Tube

* Threatened Species; ^ Migratory species (*EPBC Act 1999*); # Introduced species

4.2.2 Threatened/significant fauna

Eight threatened fauna species listed under the *TSC Act 1995* were recorded (refer Table 4.4) and are further discussed below. While not recorded during the December 2011 survey, a Spotted Harrier was observed overflying the block during the preliminary assessment in August 2011 and so is included in the Table. Threatened fauna records are shown at Figure 4.1.

Table 4.4 Threatened fauna recorded during the survey

Scientific name	Common name
Eastern Long-eared Bat	*Nyctophilus bifax*
Greater Broad-nosed Bat	*Scoteanax rueppellii*
Grey-headed Flying-fox	*Pteropus poliocephalus*
Little Bentwing-bat	*Miniopteris australis*
Masked Owl	*Tyto novaehollandiae*
Olongburra Frog	*Litoria olongburensis*
Spotted Harrier	*Circus assimilis*
Wallum Froglet	*Crinia tinnula*

Details on threatened fauna records are as follows:

Eastern Long-eared Bat: A single individual (male) was captured in harp trap 1 adjacent to the central drain and Swamp Mahogany forest.

Greater Broad-nosed Bat: Detected on one night only from a number of passes over the fixed Anabat location (midway along the central spoil bank)

Grey-headed Flying-fox: Three individuals were observed overflying the block.

Little Bentwing-bat: Detected on one night only from multiple passes over the fixed Anabat location.

Masked Owl: A Masked Owl was heard calling near Newrybar Swamp Road on the first night of the survey. There was no response to any of the call playback sessions completed.

Olongburra Frog: A faint call of the Olongburra Frog was heard within the wet heath community and was tested (and confirmed) by call playback. Only one individual responded, and the animal was not observed. Habitat at the record site comprised *Baumea rubiginosa* sedgeland in the core of the wet heath community, where standing water was present to approximately 100mm depth. The species was not heard or observed on any other occasions.

Spotted Harrier: A single bird was observed overflying the block during the preliminary assessment in August 2011. No nests were observed.

Wallum Froglet: The wet heath community in the south-east of the site provides good quality habitat for the species and it was commonly recorded calling from within this habitat in small groups of two to three individuals. Several individuals were also recorded along the western margins adjacent Lot 33 in association with the drainline and areas of Water Fern and Plume Rush.

Three migratory species listed under the *EPBC Act 1999* were recorded – Cattle Egret, Rainbow Bee-eater and Latham's Snipe.

4.2.3 Pest species

Five pest species were recorded - Cane Toad, Common Mynah, House Sparrow, House Mouse and Red Fox. Cane Toads were observed within drainlines and the wet heath community and were also captured in all pitfall trap lines. The species appears to occur in relatively low numbers at the site. All other pest species were recorded infrequently. Two fox dens occur along the central spoil-bank, but did not appear active (no footprints or prey items observed).

4.2.4 Fauna habitat and corridors

The suitability of the site for typical vertebrate fauna groups is described as follows:

Amphibians: Drains, wet heath and sedgeland provide suitable habitat for a range of amphibian species, particularly for the acid frog species and other species in the hylidae group. A population of Wallum Froglets, Wallum Rocket Frog, Rocket Frog and Olongburra Frog are utilising the wet heath complex, with large numbers of Rocket Frogs calling on three of the four nights.

Wallum Froglets were typically recorded in small numbers (scattered individuals or two's and three's), with no substantial choruses recorded. Wallum Rocket Frogs were recorded calling in the southern portion of disturbed heath in low numbers. Given the single record of the Olongburra Frog, the extent of the population is not known, but would not be expected to be substantial given the sites small area, isolation and disturbance history. The species is unlikely to occur outside the wet heath community as no other suitable habitat occurs at the block. The wet heath complex functions as an ephemeral basin following rain events, but is known to dry out completely (pers. comm. Jack Krupski [Site manager] 16/12/2011). During dry periods it would be expected that frog species may seek refuge in moist peat and organic matter or within the constructed drainline where dense sphagnum moss retains moisture and suitable microclimatic conditions.

Wallum Froglets are unlikely to utilise the southern portion of the central north-south drain due to its depth, steepness, disturbance and unsuitable pH (raised to 6.5 from liming application prior to discharge from the existing quarry). Similarly, the species would not occur along the southern, western, mid-drain or northern drains where characteristic wet heath species such as Water Fern and Plume Rush are absent and acidic conditions unlikely to be present. In the northern portion of the central drain the narrow shoulder between the windrow and drain may be utilised as forage habitat by Wallum Froglets which occur within the quarry site (pers obs.).

Sub-drains within ex-caneland within the block are shallow and highly disturbed and these environments are managed by regular slashing. Standing water is unlikely to persist in any of these drains for more than a day or two due to high infiltration rates from the Aeolian sands. No suitable habitat for the Wallum Froglet is likely to occur.

Within constructed drains the Dwarf Tree Frog commonly occurred, with infrequent other species including Striped Marsh Frog and Common Eastern Froglet. Rocket Frogs were also observed occasionally within grassland flanking the central drain, while the Ornate Burrowing Frog was only recorded once at pitfall line 2.

Reptiles: Habitat for reptiles is relatively poor due to the lack of an established litter layer and basking sites and slashing of eucalypt patches. Species such as the Green Tree Snake, Carpet Python, Swamp Snake, Lace Monitor and several skink species may occur in addition to those species recorded. Eastern Water Dragons were commonly recorded near constructed drainlines, while the landowner has also observed Red-bellied Black Snakes.

Birds: A diverse range of birds was recorded and is considered typical of the suite of species which occur in coastal agricultural/modified environments. The shrub layer along the spoil bank and regrowth in eucalypts patches is well-suited to fantails, scrub-wrens, fairy-wrens and finches, while mature trees are used by open country species such as the Magpie, Pied Butcherbird and Torresian Crow. During flowering periods it would be expected that nectivorous species such as lorikeets and honeyeaters (White-cheeked, Brown, Little Wattlebirds; Noisy Friarbird) would commonly occur.

Dense forest in the north of the block (and on adjacent land) supports more reclusive species such as the Eastern Yellow Robin, Golden Whistler and Eastern Whipbird. While several species of waterbird were noted on the existing quarry site on Lot 33 (Australasian Grebe, Hardhead, Pacific Black Duck, Wood Duck), these would be unlikely to use the block to any great degree. Inundated wet heath may be used by species such as White and Straw-necked Ibis, White-faced Heron, Intermediate and Cattle Egret, with these species also likely to forage along drainlines along with

duck species (as above).

Mammals: As noted, few mammal species were recorded, and all at very low abundance. It is suspected that a combination of isolation from other similar habitat types, and the presence of foxes and raptors/owls (Australian Hobby, Black-shouldered Kite, Barn Owl, Masked Owl) may have impacted on the numbers of ground-dwelling mammals. Occasional diggings of bandicoots were observed and the Northern Brown Bandicoot was detected from hair samples. A decapitated and partially eaten bandicoot corpse was observed and is likely to have been preyed upon by foxes or owls. Several Swamp Rats were captured within dense stands of Setaria at the site, while House Mice were captured infrequently within swamp sclerophyll forest along the spoil bank (the single Bush Rat was also captured here) and in pitfall traps. The Grassland Melomys was observed in the midstorey of the northern swamp sclerophyll forest. Other ground-dwelling mammals expected to occur are limited to the introduced Black Rat.

No trees with hollows were observed within eucalypt communities, and mature trees primarily only occur along the spoil bank. Mature paperbark in the north of the block are likely to contain hollows which may be suitable for microchiropteran bats.

The lack of arboreal mammals was notable, with common species such as the Common Brushtail and Ringtail Possum not recorded. The sites isolation from nearby eucalypt communities precludes the likelihood of glider species (eg. Feathertail Glider, Sugar Glider) occurring. Swamp Wallabies would be expected to browse in grasslands and shelter in the northern paperbark community, although none were observed.

Swamp Mahogany and Scribbly Gum are preferred feed species of the Koala in coastal environments, although records in the locality are relatively scarce (Atlas of NSW Wildlife). Swamp Mahogany planted along the northern windrow links to a large area of swamp sclerophyll forest which appears to contain occasional Swamp Mahogany and may potentially support Koalas, which may disperse into the block, however the species was not recorded from the SAT and spotlighting surveys completed.

The block does not occur in any wildlife corridors mapped in Scotts (2003) and Key Habitat does not occur.

4.2.5 Potential for threatened fauna to occur

The likelihood of occurrence for any of the threatened fauna species listed at Table 4.1 is further discussed at Table 4.5. Based on the survey results and the habitat present, there is potential for a number of threatened fauna species to occur at the site. Assessments of Significance under Section 5A of the *Environmental Planning and Assessment Act 1979* have been completed for these species (refer to Appendix G).

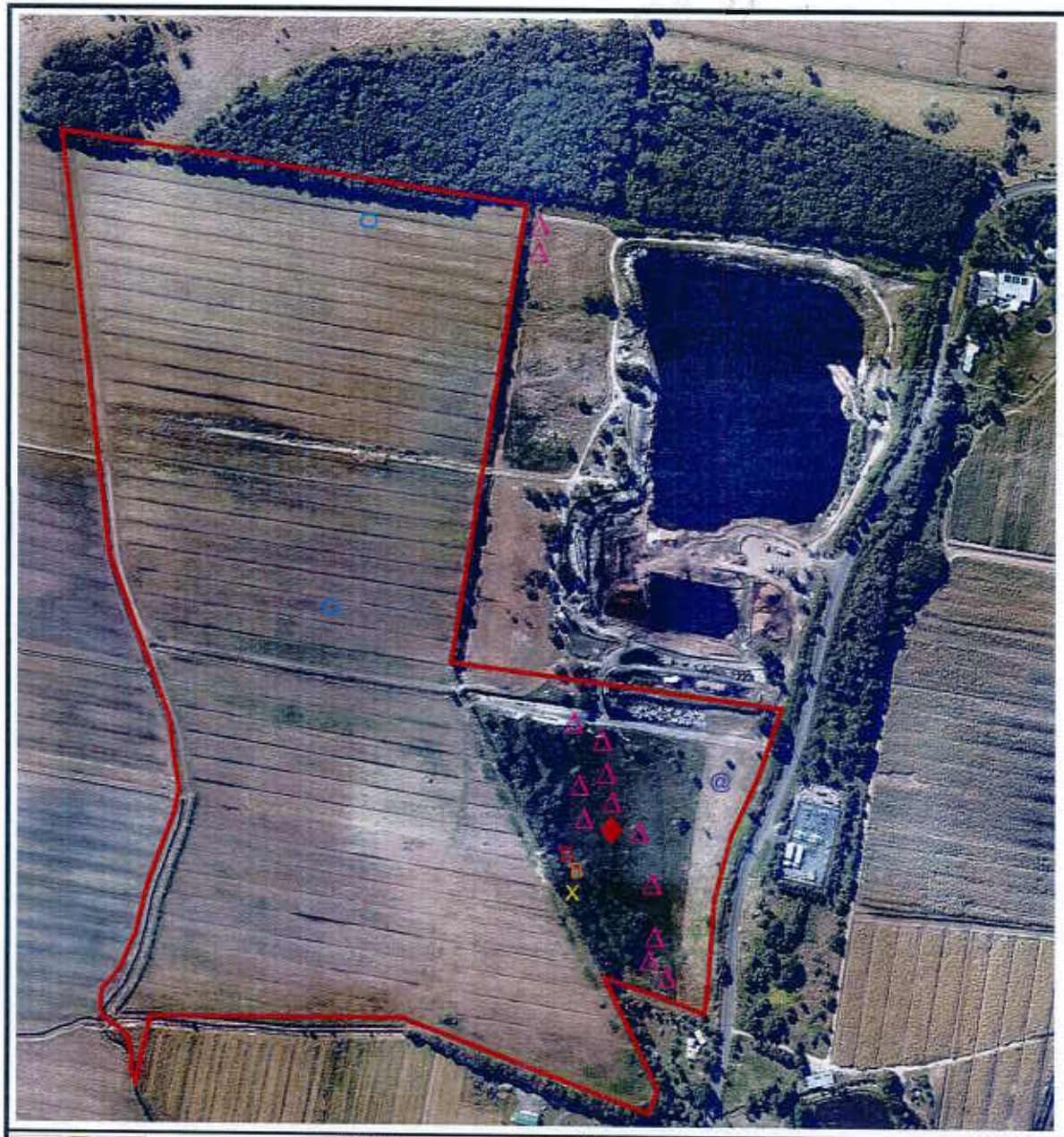
Given the highly modified nature of the block, it is likely that the majority of threatened fauna which may occur would do so opportunistically as part of a broader habitat range within the locality, with resources at the site unlikely to provide core habitat for any threatened species. The exception to this is are the acid frog species Wallum Froglet and Olongburra Frog, where an isolated area of habitat supports a local population of both species.

Table 4.5 Potential for threatened fauna to occur at the site

Common name	Habitat	Recorded	May occur	Unlikely to occur	Rationale
Australasian Bittern	Permanent freshwater wetlands with tall dense vegetation such as Common Reed and Bullrushes.			✓	No suitable habitat occurs.
Black Bittern	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.			✓	No suitable habitat occurs.
Black-necked Stork	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries.		✓		Potential forage habitat within wet heath.
Brolga	Coastal heaths, sedgelands, pastures and freshwater wetlands.		✓		Potential forage habitat within wet heath. Known breeding sites in locality.
Bush Stone-curlew	Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber.			✓	Eucalypt communities highly modified.
Comb-crested Jacana	Slow-moving rivers and permanent lagoons, lakes, swamps and dams where waterlilies or other extensive cover of floating vegetation occurs.			✓	No suitable habitat occurs.
Common Blossom Bat	Roosts in littoral rainforest and feeds on flowers in adjacent heathland and paperbark swamps.			✓	Coast Banksia and littoral rainforest absent
Common Planigale	Inhabits rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, usually close to water.			✓	Potential habitat highly modified, fragmented and isolated.
Curlew Sandpiper	Mainly found in intertidal mudflats of sheltered coasts in NSW. Also occurs in non-tidal swamps, lakes and lagoons on the coast.			✓	No suitable habitat occurs.
Eastern Bentwing-bat	Caves are the primary roosting habitat, but species also uses derelict mines, storm-water tunnels, buildings and other man-made structures. Hunts in forested areas.		✓		Potential foraging habitat occurs
Eastern Freetail-bat	Dry eucalypt forest and woodland. Roosts by day in tree hollows.		✓		Potential foraging habitat occurs
Eastern Grass Owl	Open-tussock grasslands, marshy areas with tall dense tussocks or reeds such as Common Reed and tall dense grasslands dominated by Blady Grass. Also commonly recorded from coastal heathlands or well-grassed and densely vegetated coastal dunes.		✓		Potential foraging habitat occurs.
Eastern Ground Parrot	Wet heathland and sedgeland adjacent or within swamps. Optimum habitat is regenerating vegetation 6-8 years after fire.			✓	Wet heath isolated, small in area and highly disturbed.

Common name	Habitat	Recorded	May occur	Unlikely to occur	Rationale
Eastern Long-eared Bat	Lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest.	✓			**Recorded**
Greater Broad-nosed Bat	Uses a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest.	✓			**Recorded**
Green and Golden Bell Frog	Occurs in well-structured vegetation in and around coastal wetlands, lagoons, lakes, dams, flooded quarries.			✓	No suitable habitat occurs.
Grey-crowned Babbler	Occupies woodlands dominated by Eucalypts with a developed shrub layer and ground cover of grasses and forbs. Breeding is co-operative in sedentary family groups.		✓		Recorded close to site, potential foraging habitat within eucalypt fragments
Grey-headed Flying-fox	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	✓			**Recorded**
Koala	Eucalypt woodlands and forests.		✓		Preferred tree species occur, but local records very sparse.
Little Bentwing-bat	Moist eucalypt forest, rainforest or dense coastal banksia scrub.	✓			**Recorded**
Little Eagle	Occupies open eucalypt forest, woodland or open woodland.		✓		Potential foraging habitat occurs.
Little Tern	Coastal/marine species			✓	No suitable habitat occurs.
Magpie Goose	Shallow floodplain wetlands with dense rushes or sedges with permanent swamps or dams and grasslands nearby.			✓	No suitable habitat occurs.
Mangrove Honeyeater	Mostly found in mangrove forest but visits other near-coastal forests and woodlands including casuarina and paperbark swamp forests.			✓	No suitable habitat occurs.
Masked Owl	Dry eucalypt forest and have large home ranges of 500 to 1000 hectares per pair, covering forested and partly open country.	✓			**Heard calling at/near site, records from south of Ross Lane**
Mitchell's Rainforest Snail	Remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils. Slightly higher ground around wetlands edges with palms and fig trees are particularly favoured habitat.			✓	Swamp sclerophyll remnants highly modified. Northern forest lacks typical habitat features.
Olongburra Frog	Paperbark swamps and sedge swamps of the coastal 'wallum' country.	✓			**Recorded**
Osprey	Coastal areas, especially the mouths of large rivers, lagoons and lakes, clear open water for foraging.			✓	No suitable habitat occurs.
Pied Oystercatcher	Intertidal flats of inlets and bays, open beaches and sandbanks.			✓	No suitable habitat occurs.
Rose-crowned Fruit-Dove	Occurs mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.			✓	No suitable habitat occurs.
Southern Myotis	Forages over streams and pools catching insects and small fish by raking their feet across the water surface.		✓		Suitable foraging habitat along drainlines

Common name	Habitat	Recorded	May occur	Unlikely to occur	Rationale
Spotted Harrier	Grassy open woodland including, grassland and shrub steppe. Found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	✓			**Recorded overflying block on previous assessment**
Spotted-tailed Quoll	Range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.			✓	Site too disturbed, isolated and modified.
Wallum Froglet	Paperbark swamps and sedge swamps of the coastal "wallum" country. Acidic waterbodies.	✓			**Recorded**
White Tern	Coastal/marine species			✓	No suitable habitat occurs.
White-eared Monarch	Occurs primarily in coastal rainforest, swamp forest and wet eucalypt forest.		✓		Potential habitat within northern swamp forest.



LEGEND

- GREATER BROAD-NOSED BAT
- LITTLE BENT-WING BAT
- EASTERN LONG EARED BAT
- MASKED OWL (ESTIMATED POSITION)
- GREY-HEADED FLYING FOX (OVER FLY)
- SPOTTED HARRIER
- WALLUM FROGLET
- OLONGBURRA FROG

METRES
100 50 0 100 200 300 400
75 25
SCALE 1:5000

NORTH POINT

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DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS, ENGINEERS CERTIFICATE BY OTHERS.

REV.	ISSUE / AMENDMENTS	DATE

DESIGNED AC
DRAWN ABS
CHECKED AC

PROJECT
BALLINA SANDS
ENVIROMENTAL IMPACT STATEMENT

DRAWING
FIGURE 4-1
THREATENED FAUNA RECORDS

DWG No. AWC_1-10090_04
CAD FILE No. 1-10090_04 Figure 4-1.dwg
REV B

SCALE 1:5 000 @ A3
DRAWING CREATED 15/5/2012

5 Groundwater Dependent Ecosystems

5.1 NSW Groundwater Dependent Ecosystems Policy

The DGRs requested that Groundwater Dependent Ecosystems (GDEs) are considered with regard to the proposal. The NSW Groundwater Dependent Ecosystems Policy (NSW Department of Land and Water Conservation 2002) sets out management objectives and principles to:

- *Ensure the most vulnerable and valuable ecosystems are protected;*
- *Manage groundwater extraction within defined limits thereby providing flow sufficient to sustain ecological processes and maintain biodiversity;*
- *Ensure sufficient groundwater of suitable quality is available to ecosystems when needed; and*
- *Ensure the precautionary principle is applied to protect GDEs, particularly the dynamics of flow and availability and the species reliant on these attributes.*

Two threatened species (Wallum Froglet, Olongburra Frog) and two communities (wet heath, swamp sclerophyll forest - Communities 2, 3 and 4) are considered groundwater dependent. Habitat for all these species/communities would be retained at the block under the proposal. No groundwater extraction is proposed as part of the proposal.

A groundwater assessment based on site investigations and modeling was completed by Douglas Partners (2011), and information from this assessment is as follows. Under current operations existing quarry at Lot 33 discharges water into the Central north-south drain which flows via Deadmans Creek to the Richmond River. When the proposed quarry begins operations the existing quarry is expected to have sufficient storage (including seepage back to the groundwater table) to accept water from the new pit, and for the duration of operation during the dry season (winter to early spring) (Douglas Partners 2011). Compared with current operations the proposed methods at the new quarry are expected to result in considerable re-circulation of water and a net reduction in water lost by pumping (Douglas Partners 2011). The Douglas Partners assessment (2011, p.12) noted that drawdown should not extend beyond the drains which border the site due to the high degree of hydraulic connection between surface water in the drains and the groundwater system. On this basis, the proposed quarry would not have an adverse impact on significant frog habitat within the wet sedgeland /heathland environment in the south-east of the site, as concluded by Douglas Partners (2011).

Given the findings of Douglas Partners, it is unlikely that any significant impacts would occur to groundwater systems. As such habitat for threatened frog species or groundwater dependent vegetation communities would be unlikely to be significantly affected, hence the Policy does not require further consideration.

6 Potential Impacts and Mitigation

6.1 Potential Impacts of the Proposal

Potential ecological impacts which may result from the proposal include:

- Loss of approximately 15 ha of disturbed grassland from the quarry construction, retention ponds, sound mounds etc.
- Potential for sedimentation and/or reduced water quality within drainline environments and acid frog habitat.
- Potential for groundwater drawdown which may negatively impact threatened frog habitat.
- Potential for damage to native vegetation
- Disturbance to local fauna from ongoing noise and disturbance during establishment and operations.
- Potential for injury to fauna during construction and daily operations from plant/vehicles.

Potential impacts of the proposal on native vegetation, EECs and threatened fauna habitat are illustrated at Figure 6.1 where the project footprint is overlaid on vegetation mapping and threatened fauna records.

6.2 Proposed Mitigation

To reduce the potential for and adverse impacts from the proposal, the following broad mitigation strategies are recommended:

- Native vegetation in the south-eastern portion of the block (Scribbly Gum and Swamp Mahogany forest, wet heath) should be fenced with star pickets and high visibility mesh fencing along the entire southern boundary of the access road where a bund will be constructed. The bund will prohibit discharge of water and vehicular access associated with development activities along the entire southern boundary of the access road.
- Appropriate sedimentation and erosion controls must be installed and maintained at all times during construction and operations.
- Water treatment and disposal must be completed in accordance with licencing requirements and ensure that acid frog habitat in the south-east of the site is appropriately protected.
- Groundwater monitoring should be completed for a preliminary period of at least three years to inform quarry management with regard to maintaining current environmental conditions within threatened frog habitat. The monitoring should build on baseline data obtained from ongoing groundwater monitoring which has been ongoing since May 2011.
- Monitoring of acid frog habitat for species persistence.
- Landscaping and rehabilitation works should utilise locally occurring native species (refer rehabilitation strategy at Section 6.3).

The primary mitigation measure is to avoid impacting the acid frog habitat within the wet heath community in the south-east of the block. All of the habitat and adjacent eucalypt forest would be retained and would not be disturbed as part of the establishment and on-going operations of the quarry. The potential for changed water quality and hydrology within the wet heath would be avoided, as the treatment and dispersal pathway (refer to Figure 1.5) is hydrologically separate from this environment and the two systems do not integrate. Natural surface drainage into the acid frog habitat area would be maintained by retention of the existing network of constructed drains from the existing quarry and surface flow into the habitat area would continue. The existing sediment basin for the current quarry would be removed and rock stabilised, reducing potential for any sediment entering the constructed drain within the acid frog habitat when overflow occurs during prolonged rainfall events. The access road to the proposed quarry site would be bunded to prevent any surface water from flowing south into sensitive habitat areas, and bunds would be stabilised with vegetation.

The groundwater study (Douglas Partners 2011) notes that operating the quarry during the drier months of the year (July to November) will minimise the need for dewatering and reduce any potential impact which may result from lowering groundwater levels. It is noted that drawdown should not extend beyond the drains which border the site due to the high degree of hydraulic connection between surface water in the drains and the groundwater system. As such, the potential for quarry operations to result in drawdown of groundwater from within acid frog habitat is relatively low. Groundwater monitoring prior to and during operations is necessary to ensure that quarrying operations do not negatively affect groundwater regimes within acid frog habitat and would inform quarry management operations appropriately.

Annual monitoring of the acid frog habitat area is recommended to determine any changes in persistence or population. Monitoring should be completed by using fixed monitoring points or transects (or other method to the satisfaction of Council/OEH) and replicated for a minimum period of three years consistent with groundwater monitoring.

Native fauna in the locality are likely to be habituated to the disturbance associated with the existing quarry and use of machinery and vehicles during daytime hours would not be expected to have any substantial effects on the foraging, nesting or breeding requirements of any fauna species. Further, vehicle movements would only be during daytime hours and at low speeds and unlikely to generate any significant fauna mortality, particularly to acid frogs or other predominantly nocturnal species. As such, no specific mitigation measures for general fauna are warranted.

LEGEND

- VEGETATION COMMUNITY ID NUMBER
- AREA OF VEGETATION COMMUNITIES
- AREA OF ENDANGERED ECOLOGICAL COMMUNITY - SWAMP SCLEROPHYLL FOREST
- VEGETATION WITHIN DRAINAGE SWALES
- AREA OF THREATENED SPECIES HABITAT- OLONGBURRA FROG & WALLUM FROGLET

VEGETATION COMMUNITY

1 OPEN FOREST (SCRIBBLY GUM)

2 OPEN FOREST (SWAMP MAHOGANY)

3 OPEN FOREST (BROAD-LEAVED PAPERBARK)

4 CLOSED FOREST (CAMPHOR LAUREL, BRUSH BOX, RIBERRY)

5 FERNLAND/SEDGELAND (SWAMP WATER FERN, BLUME RUSH, TWIG-RUSH, SWAMP GRASS-TREE)

6 WINDROW

7 CLOSED GRASSLAND (MIXED SPECIES)

8 REEDLAND/SWAMP GRASSLAND (FROGSMOUTH, SPIKE-RUSH)

METRES
100 50 0 100 200 300 400
75 25
SCALE 1:5000

NORTH POINT

AWC
Australian Wetlands Consulting Pty Ltd
PO Box 2605 / 70 Butler Street
Byron Bay NSW 2481
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REV.	ISSUE / AMENDMENTS	DATE

DESIGNED	IC
DRAWN	RSS
CHECKED	IC

PROJECT: BALLINA SANDS
ENVIROMENTAL IMPACT STATEMENT

DRAWING: FIGURE 6-1
IMPACTS OF DEVELOPMENT

DWG No.: AWC_1-10090_05

CAD FILE No.: 1-10090_05 Figure 6-1.dwg

SCALE: 1:5 000 @ A3

DRAWING CREATED: 15/5/2012

REV.: C

6.4 Rehabilitation

To satisfy the re-issued DGRs, further details on the rehabilitation of the site (as shown at Figure 1.6) is detailed as follows. Rehabilitation will occur in one main area at the final stage of the quarry, in conjunction with the lake planting upon cessation of extraction. An area of approximately 1 ha is proposed for rehabilitation using a species selection based on flora at the site.

In addition the rehabilitation plantings, screening and buffer plantings would be completed along the western boundary, access road and central drain (refer Figure 1.6). The timing for implementation of these plantings would be dependent upon commencement of DA, while the rehabilitation works could only commence at the final stage of the quarry.

A list of flora species suitable for all rehabilitation/screening works is shown at Table 6.1.

Table 6.1 Flora species for use in rehabilitation works

Common name	Scientific name	Road access	West screening	Rehab. area	Dividing drain
Beard Heath	*Leucopogon parviflorus*	✓		✓	✓
Blueberry Ash	*Elaeocarpus reticulatus*	✓		✓	
Broad-leaved Paperbark	*Melaleuca quinquenervia*		✓	✓	✓
Brown Kurrajong	*Commersonia bartramia*		✓	✓	✓
Cheese Tree	*Glochidion ferdinandi*		✓		
Corkwood	*Duboisia myoporoides*		✓	✓	✓
Geebung	*Persoonia stradbrokensis*		✓	✓	
Mat-rush	*Lomandra longifolia*	✓		✓	✓
May-bush	*Leptospermum polygalifolium*	✓	✓	✓	✓
Midyim	*Austromyrtus dulcis*	✓			
Pink Bloodwood	*Corymbia intermedia*		✓	✓	✓
Pink-leaved Doughwood	*Melicope elleryana*		✓		✓
Scribbly Gum	*Eucalyptus signata*			✓	✓
Slender Tea-tree	*Leptospermum trinervium*	✓	✓	✓	✓
Swamp Mahogany	*Eucalyptus robusta*		✓	✓	✓
Willow Bottlebrush	*Callistemon salignus*	✓		✓	✓

For all screening plantings, trees should be densely planted at two metre centres in two offset rows spaced two metres apart and mulched and fertilised at the time of planting. Due to the site being low nutrient sand, weed invasion of plantings is unlikely to be problematic and limited to annual herbs or grasses (eg. Billygoat Weed, Natal Grass).

For the rehabilitation area, a Vegetation Management Plan (VMP) should be prepared to guide the works and include information on planting densities, care and maintenance and monitoring prescriptions.

7 Statutory Assessment

7.1 Introduction

The proposal has been examined in the context of the following environmental legislation:

- State Environmental Planning Policy No. 44 – Koala Habitat Protection;
- The *Environmental Planning and Assessment Act 1979*, specifically:
  - Section 5A (Significant effect on threatened species, populations or ecological communities, or their habitats); and
  - Section 5C (Application of Act with respect to threatened species conservation—fish and marine vegetation);
- The *Threatened Species Conservation Act 1995*;
- The *Fisheries Management Act 1994*;
- The *Native Vegetation Act 2003*; and
- The *Environment Protection and Biodiversity Conservation Act 1999*.

Further information on relevant legislation is discussed at Sections 7.2 to 7.6.

7.2 NSW Environmental Planning and Assessment Act 1979

7.2.1 SEPP 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 (SEPP 44) encourages the conservation and management of areas that provide habitat for Koalas to ensure permanent free-living populations will be maintained over their present range. The Policy requires that any development to a council completes an assessment as below.

Does the subject land occur in a Local Government Area identified in Schedule 1?

The land is within the Ballina Local Government Area, which is listed in Schedule 1.

Is the land to which the development application applies smaller than 1 hectare in area?

The land is approximately 49 ha in area.

Does the site contain areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15 percent of the total number of trees in the upper or lower strata of the tree component?

Two Koala feed tree species listed in schedule 2 of SEPP 44 occur (Scribbly Gum, Swamp Mahogany) and form the primary species within naturally occurring patches of sclerophyll forest.

Is the land potential Koala habitat?

Yes, as per the Policy definitions and based on the above.

Is there core habitat on the subject land?

The Policy defines core habitat as *"...an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population".*

The Koala survey recorded no signs of use and no recent records occur in the locality (Wildlife Atlas). On this basis, core habitat does not occur.

Is there a requirement for the preparation of a Plan of Management for identified core Koala habitat?

No, as core habitat does not occur.

7.2.2 Section 5A of the Environmental Planning and Assessment Act 1979

The *Threatened Species Conservation Amendment Act 2002* establishes the Assessment of Significance (7-part test) in Section 5A of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act), Section 94 of the *Threatened Species Conservation Act 1995* and Section 220ZZ of the *Fisheries Management Act 1994*. The Assessment of Significance requires consideration when determining whether a proposed action (development) is likely to have a significant effect upon listed threatened species, populations or ecological communities, or their habitats, therefore determining if a Species Impact Statement (SIS) is required.

Assessments of Significance were completed for the EEC 'swamp sclerophyll forest on floodplain' Hairy Jointgrass, Southern Swamp Orchid and 18 threatened fauna species recorded at the block or considered as having potential to occur (as indicated at Table 4.5), and are attached at Appendix G.

The Assessment of Significance concluded that the proposed works would not result in significant impacts to any threatened species, population or community and hence a Species Impact Statement (SIS) would not be required.

7.3 Threatened Species Conservation Act 1995

The appropriate provisions prescribed in Section 94 of the *Threatened Species Conservation Act 1995* are identical to those found in the EP&A Act and are addressed above at Section 7.2.2.

7.4 Fisheries Management Act 1994

Section 220C of the *Fisheries Management Act 1994* (Schedules 4 & 5) lists a number of threatened species, populations and communities (refer Table 7.1).

Table 7.1 Species, populations and communities listed under the FM Act 1994

Matters in the FM Act 1994	
Species presumed extinct	
Bennetts Seaweed	*Vanvoorstia bennettiana*
Green Sawfish	*Pristis zijsron*
Haswells caprellid	*Metaprotella haswelliana*
Marine Worm	*Hadrachaeta aspeta*
Critically endangered species	
Fitzroy Falls Spiny Crayfish	*Euastacus dharawalus*
Flathead Galaxias	*Galaxias rostratus*
Grey Nurse Shark*	*Carcharias taurus*
Marine Brown Alga	*Nereia lophocladia*
Marine Slug	*Smeagol hilaris*
Murray Hardyhead	*Craterocephalus fluviatilis*
Endangered species	
Adams Emerald Dragonfly	*Archaeophya adamsi*
Eastern Freshwater Cod*	*Maccullochella ikei*
Macquarie Perch	*Macquaria australasica*
Oxleyan Pygmy Perch*	*Nannoperca oxleyana*
Purple Spotted Gudgeon	*Mogurnda adspersa*
River Snail	*Notopala sublineata*
Scalloped Hammerhead Shark	*Sphyrna lewini*
Southern Bluefin Tuna	*Thunnus maccoyii*
Southern Pygmy Perch	*Nannoperca australis*
Sydney Hawk Dragonfly	*Austrocordulia leonardi*
Trout Cod*	*Maccullochella macquariensis*
Vulnerable species	
Black Rockcod	*Epinephelus daemelii*
Bousfield Marsh Hopper	*Microrchestia bousfieldi*
Buchanans Fairy Shrimp	*Branchinella buchananensis*
Great Hammerhead Shark	*Sphyrna mokarran*
Great White Shark*	*Carcharodon carcharias*
Silver Perch	*Bidyanus bidyanus*
Endangered populations	
Western population of Olive Perchlet (*Ambassis agassizii*)	
Snowy River population of River Blackfish (*Gadopsis marmoratus*)	
Murray-Darling Basin population of Eel-tailed Catfish (*Tandanus tandanus*)	
Posidonia australis - Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie populations.	
Endangered ecological communities	
Lowland Murray River aquatic ecological community	
Lowland Darling River aquatic ecological community	
Lowland Lachlan River aquatic ecological community	
Snowy River aquatic ecological community	

The following Key Threatening Processes (KTPs) are also listed in the FM Act:

- Current shark meshing program in NSW waters
- Hook and line fishing in areas important for the survival of threatened fish species
- Human-caused climate change
- The introduction of fish to fresh waters within a river catchment outside their natural range
- The removal of large woody debris from NSW rivers and streams
- The degradation of native riparian vegetation along New South Wales water courses
- Instream structures and other mechanisms that alter natural flow
- Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales

Section 220ZZ of the *Fisheries Management Act 1994* lists the factors (Assessment of Significance) requiring consideration when determining whether a proposed action (development) is likely to have a significant effect upon threatened species, populations or ecological communities, and their habitats, therefore determining if a Species Impact Statement is required (as also required under Section 5C of the EP&A Act).

An Assessment of Significance with regard to the provisions of Section 220ZZ of the *Fisheries Management Act 1994* and Section 5C of the EP&A Act has not been completed as:

- None of the threatened species, populations or ecological communities and their habitats occur or would be likely to occur at the site, and
- The proposal is not characteristic of any Key Threatening Process.

7.5 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) regulates the clearing of native vegetation on all land in NSW except for land listed in Schedule 1 of the Act. Excluded land includes:

- National Parks and other conservation areas
- State Forests and reserves, and
- Urban areas

Urban areas include areas zoned residential (but not rural residential), village, township, industrial or business. Since the proposal occurs on land zoned for rural purposes the provisions of the *NV Act* and the *Native Vegetation Regulations 2005* require consideration.

Under the NV Act and the Regulations, most clearing requires consent apart from:

- Excluded clearing – Clearing listed in Section 25 of the NV Act does not require approval because it is authorised or permitted under other legislation.
- Permitted clearing – Permitted clearing requires no approval under either the NV Act or, except in the case of clearing certain groundcover, the *Threatened Species Conservation Act 1995*.

Excluded clearing includes clearing under:

- The *Rural Fires Act 1997* when done on accordance with a bush fire management plan under the Act or in relation to emergency fire-fighting;
- The *Roads Act 1993*;
- The *Surveying Act 2002* that is undertaken by or under the direction of a surveyor; and
- A licence, permit, authority or approval under the Water Management Act 2000.

Permitted clearing includes:

- Construction of a single dwelling (Part 2 (4) (6) in the Regulations): Clearing is permitted of the minimum amount of native vegetation needed to comply with a current Development Consent for the construction of a single dwelling.
- Routine agricultural management activities (Part 4 in the Regulations): Routine Agricultural Management Activities (RAMAs) cover a wide range of day-to-day farming and farm safety activities, and the construction and operation of rural infrastructures. Clearing of native vegetation associated with RAMAs is permitted without approval:
  - when undertaken to the minimum extent necessary and within specified distance limitations where they apply, and
  - so long as any other approvals necessary for the work, such as building approval, are first obtained.
- Clearing of non-protected regrowth: Non-protected regrowth is any native vegetation which has grown since January 1990.

The proposal would not require consent under the *Native Vegetation Act 2003* for the removal of disturbed pasture dominated by exotic species. Where any native species occur, these are accepted as 'regrowth' as defined by the Act, and based on historical management by slashing.

7.6 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth mechanism for national environment protection and biodiversity conservation is the EPBC Act. The EPBC Act provides for:

- Identification and listing of Threatened Species and Threatened Ecological Communities;
- Development of Recovery Plans for listed species and ecological communities;
- Recognition of Key Threatening Processes; and where appropriate; and
- Reducing these processes through Threat Abatement Plans.

The EPBC Act states that a person must not, without approval under the act, take an action that has or will have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES). MNES matters include:

- The world heritage value of a declared World Heritage property;
- The national heritage value of a National Heritage Place;
- The ecological character of a declared Ramsar wetland;
- An action in a Commonwealth Marine Area;
- A Threatened Ecological Community listed under the Act;
- A Threatened Species listed under the Act; and
- A Migratory Species listed under the Act.

The EPBC Act also identifies a number of Other Matters it protects, including:

- Commonwealth Lands;
- Commonwealth Heritage Places;
- Places on the Register of the National Estate;
- Listed Marine Species;
- Whales and other Cetaceans;
- Critical Habitats, and
- Commonwealth Reserves.

Table 7.2 summarises MNES and Other Matters listed under the EPBC Act, based on a search using the Protected Matters Search Tool within a 5km radius of the site. An assessment has been completed with regard to potential impacts of the proposal on MNES in Table 7.2.

The draft referral guidelines for the Wallum Sedge Frog (DSEWPC 2011) were reviewed to determine whether the project may require referral. The Wallum Sedge Frog population at the site is not considered representative of an *'important population'* as described in the EPBC Act Significant Impact Guidelines (2009), ie. *'a population necessary for a species' long-term survival and recovery'*. This is based on the likelihood of the population at the block being small (due to the limited habitat present) and the isolation of the block from the locally known population within nearby Newrybar Swamp (refer Lewis & Goldingay 2005, Goldingay & Taylor 2003). Due to the habitat for the species at the block being completely isolated, it is unlikely that it would serve as an important source for breeding and dispersal. Wallum Sedge Frogs at the block are likely to have persisted as part of an outlying population west of Tyagarah Swamp which has become isolated over time, but which would not be expected to be genetically distinct from the local source population some 2.5 km to the north-east within Newrybar Swamp.

Given the substantial habitat and extensive records of the species within Newrybar Swamp it is likely that this habitat would support what could be considered an *important population* as defined in the Guidelines. Table 2 (p. 13) of the referral guidelines indicates an action should be referred if a change in ecological character or hydrology occurs within 100 metres of habitat of an *important population* of the Wallum Sedge Frog. As an important population is not considered as occurring at the block referral is therefore not considered as being required.

The proposed works would clearly have no impacts on the important population of the Wallum Sedge Frog within Tyagarah Swamp and hence referral to the Minister for the Environment for approval is not required.

Table 7.2 Assessment of impacts on MNES and other matters in the EPBC Act

MNES	Potential impact
Any Environmental Impact on a World Heritage Property?	
No World Heritage Properties occur within a 5km radius of the site.	Nil
Any Environmental Impact on National Heritage Places?	
No National Heritage places occur within a 5km radius of the site.	Nil
Any Environmental Impact on Wetlands of International Significance?	
No Wetlands of International Significance occur within a 5km radius of the site.	Nil
Any Environmental Impact on the Great Barrier Reef Marine Park?	
The site does not occur within or adjacent to the Great Barrier Reef Marine Park	Nil
Any Environmental Impact on a Commonwealth Marine Area?	
No Commonwealth Marine Areas occur within a 5km radius of the site.	Nil
Any Environmental Impact on Threatened Ecological Communities?	
Two Threatened Ecological Communities occur in the locality (Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, Subtropical Lowland Rainforest of Australia). Neither community occurs at the site.	Nil
Any Environmental Impact on Threatened Species?	
The EPBC database records potential habitat for 46 threatened species within a 5km radius of the site. Two threatened species (Grey-headed Flying-fox, Olongburra Frog/Wallum Sedge Frog) were recorded at the site. With the exception of the Koala, it is unlikely that any other listed threatened species would occur based on the habitat present.	Low: No habitat for the Grey-headed Flying-fox would be removed; habitat for the Olongburra Frog/Wallum Sedge Frog would be separated from the development site with vegetated bunds and hydrology appropriately managed to maintain water quality. No Koala habitat would be removed and no barriers to movement or genetic exchange will occur.
Any Environmental Impact on Migratory Species?	
The EPBC database records potential habitat for 21 migratory species within a 5km radius of the site. Three listed migratory species were recorded (Cattle Egret, Rainbow Bee-eater, Latham's Snipe), with potential for several other migratory species to occur within the locality on an opportunistic and seasonal basis.	Negligible, as no habitat of importance would be removed for any migratory species.
Any Environmental Impact on Commonwealth Land?	
One known area of Commonwealth Land occurs within a 5km radius of the site (Telstra).	Nil
Any Environmental Impact on Commonwealth Heritage Places?	
No Commonwealth Heritage Places occur within a 5km radius of the site.	Nil
Any Environmental Impact on Marine Species?	
The EPBC database records potential habitat for 18 marine species within a 5km radius of the site. The redevelopment of the site is limited to terrestrial works and no impacts to marine species are likely to occur.	Nil

MNES	Potential impact
Any Environmental Impact on Whales and Other Cetaceans?	
No whale/cetacean species have been recorded within a 5km radius of the site.	Nil
Any Environmental Impact on Critical Habitats?	
No Critical Habitat occurs within a 5km radius of the site.	Nil
Any Environmental Impact on Commonwealth Reserves?	
No Commonwealth Reserves occur within a 5km radius of the site.	Nil
Any Environmental Impact on a Place on the RNE?	
Ballina Nature Reserve is the closet RNE place to the site (one of five Places in the locality). The proposed works would not affect the Reserve.	Nil
Any Environmental Impact on State and Territory Reserves?	
Two listed state reserves occur within 5km of the site. The proposal would not affect these Reserves.	Nil
Any Environmental Impact on Regional Forest Agreements?	
One Regional Forest Agreement operates in northern NSW. The proposal would not affect this RFA.	Nil
Any Environmental Impact on Invasive Species?	
13 invasive species are recorded as occurring within a 5km radius of the site. The proposal would not create conditions for the spread of invasive species and these would be managed on-site.	Nil
Any Environmental Impact on Nationally Important Wetlands?	
No Nationally Important Wetlands occur within 5km of the site.	Nil
Any Environmental Impact on Key Ecological Features (Marine)?	
No Key Ecological Features (Marine) occur within 5km of the site.	Nil

8 Summary and Conclusion

This Ecological Assessment has been prepared for the establishment of a quarry at Lot 32 DP1151612 at Newrybar Swamp Road, Tintenbar. Following a detailed assessment and consideration of the proposed works required, it is concluded that:

- The block has been significantly disturbed with much of the native vegetation and habitat removed or modified.
- No threatened flora species were recorded.
- Vegetation communities have been highly modified by clearing, underscrubbing and routine slashing. A small area of isolated wet heathland occurs. One Endangered Ecological Community occurs (Swamp sclerophyll forest on floodplains) occurs.
- Eight threatened fauna species were recorded (Wallum Froglet, Olongburra Frog, Masked Owl, Grey-headed Flying-fox. Eastern Long-eared Bat, Spotted Harrier, Greater Broad-nosed Bat, Little Bentwing-bat), with potential for several other threatened species to occur on an opportunistic/seasonal basis. The wet heath community provides core on-site habitat for acid frogs, while other more mobile fauna species are likely to range widely in the immediate locality.
- Assessment under SEPP 44 – Koala Habitat Protection determined that core Koala habitat does not occur and hence a Koala Plan of Management is not required.
- Assessments of Significance completed for EECs and threatened flora and fauna species considered as potentially occurring at the block determined that the impacts of the proposal would not be significant and therefore a Species Impact Statement (SIS) is not required.
- The proposed works are unlikely to have any significant impact on any Matters of Environmental Significance (MNES) listed in the *EPBC Act 1999* and hence referral to the Minister for approval is not required.

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Appendix A – Flora and Fauna Survey Requirements (DECCW 2010)

7. Flora & Fauna Impacts

Flora

An assessment of vegetation on the site must include:

- A comprehensive description of the vegetation on the site. This will include an assessment of the condition of the plant communities present, including the designation of conservation significance at a local, regional and State level, and an assessment of the likely occurrence of any threatened species, populations or ecological communities listed under Schedules 1 or 2 of the *Threatened Species Conservation Act 1995* and any Rare or Threatened Australian Plant (ROTAP) species.
- A plan showing the distribution of any threatened or ROTAP species and the vegetation communities on the site, and the extent of vegetation proposed to be cleared. This plan should be at the same scale as the plan of the area subject to development in order to assist in the assessment the impact of the proposal on the existing vegetation.
- Where the assessment concludes that threatened species, populations or ecological communities, or their habitats, exist on or in proximity to the subject land, the effect of the proposed development should be determined in accordance with the Assessment Of Significance described in Section 5A of the *Environmental Planning and Assessment Act* 1979. An assessment of the impact of the development on the plant communities and/or ROTAP species should also be provided.
- A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the plant communities, threatened and ROTAP species.

Fauna

An assessment of fauna on site must include:

- A fauna survey to identify the distribution and abundance of fauna species known or likely to utilise the site, including a description of available fauna habitats and an assessment of the conservation status of each of the faunal components at a local, regional and State level.
- A plan showing the results of the above survey. This plan should be at the same scale as the plan of the area subject to development to assist in the assessment of the impact of the proposal on fauna.
- An assessment of the impact of the development on the identified fauna.
- An assessment of the existence or likely occurrence of threatened species, populations or ecological communities, or their habitats on the subject land. Where the assessment concludes that threatened species, populations or ecological communities, or their habitats exist on or in proximity to the subject land, the effect of the proposed development should be determined in accordance with the Assessment Of Significance described in Section 5A of the Environmental Planning and Assessment Act 1979.
- A description of the measures proposed to mitigate and/or ameliorate the impact of the development on fauna.

Surveys & Assessments

- Surveys and assessments should be undertaken by suitably qualified persons and the qualifications and experience of the persons undertaking the work detailed.
- Dates, site locations, design, methodology, analysis techniques, and weather conditions at the time of the assessments and surveys must be described. The limitations of surveys should be identified and the results interpreted accordingly.
- Conclusions drawn in surveys and assessments should be substantiated by evidence resulting from those surveys and assessments. The document being supported by the surveys and assessments should reflect these conclusions and clearly state where recommendations of the survey and assessments have been incorporated in the proposal.

Appendix B – Survey Methods

Flora Survey

As vegetation at the block is generally highly modified, fragmented and linear in nature and maintained by slashing, most flora survey was completed using a random meander within each of the subject communities and recording species occurrence and frequency using a Braun-Banquet index.

Single line transects of 50 x 5m were completed along the spoil bank for Scribbly Gum and Swamp Mahogany communities, while a representative 50m x 10m transect was completed in the northern swamp sclerophyll community. All transects recorded species occurrence and frequency using a Braun-Banquet index as for random meander surveys.

Fauna Survey

A summary of fauna survey methods is discussed below and summarised at Table B.1, and a plan of survey effort completed is shown at Figure B.1. All traps were inspected and cleared within 2 hours of dawn each morning. All fauna records were entered into standard proforma and the locations of any threatened species recorded by GPS (WGS84).

Cage trapping: Six cage traps were deployed over 4 nights, with traps nestled into vegetation and covered with hessian. Three traps were baited with meat, and three baited with fruit. Cages were re-baited halfway through the survey period.

Ground mammal trapping: Small (type A) Elliott traps were set out in transects with an average distance of 10m between traps. All traps were baited with a standard mix of peanut butter, honey oats and vanilla essence. A line of large (type B) Elliott traps was also established as above.

Arboreal mammal trapping: Large (type B) Elliot traps were installed on bracket supports in mature eucalypts within regrowth forest and along windrows. A diluted honey mixture was sprayed on the trunks of all subject trees and re-applied after the third day of survey.

Hair Tubes: Faunatech hair funnels were deployed in a single long transect as per Elliott traps, and baited with the same peanut butter/oat mixture. Hair wafers were sent to Georgeanna Story (Scats About) for expert analysis.

Pitfall traps: Pitfall traps comprised 20 litre plastic buckets spaced approximately 5 metres apart in a linear transect. A drift fence of damp course was installed along the length of the transect and continued at least 5m beyond the first and last buckets.

Harp traps: Two harp traps were deployed over the survey period. Due to the lack of opportunities for harp net trapping, both traps were deployed at the same locations for the duration of the survey.

Anabat: An Anabat SD1 recorder (Titley Electronics) was used along roaming nocturnal transects while spotlighting on all nights. All night recording was completed on one occasion due to inclement weather during other nights. Anabat files were sent to Greg Ford (Balance Environmental) for expert analysis.

Spotlighting: A 55 watt spotlight was used along roaming nocturnal transects of the site. Typically 2 hours was spent spotlighting each night.

Call playback (owls): A single central location was used as the point for broadcast of the calls of the Masked and Eastern Grass Owl. Calls were broadcast for a five minute period using a TOA amplified megaphone connected to a Sony Walkman compact disc player, followed by a three minute listening period.

Call playback (frogs): Calls of the Wallum Froglet were broadcast (as above) at a number of locations where potential habitat may occur. Calls of the Olongburra Frog were broadcast within the wet heath community at three locations where habitat was suitable (deeper water with established sedges/rushes).

Diurnal bird survey: Targeted bird surveys were completed using the "area search" method. One observer using 10x42 binoculars sampled three selected sites, where species present and numbers of each were recorded during a 20-minute census period. Each census was conducted during the early morning and involved a walking search of a two-hectare area (100m x 200m) with regular stationary periods. Bird species recorded outside of the survey sites and outside of the standard census period were recorded as opportunistic records. Two sites (Sites 1 and 2) were surveyed every morning of the survey (4 events), with one site surveyed on three occasions (Site 3).

Koala scat survey: The Spot Analysis Technique ('SAT'; Phillips & Callaghan 2011) was utilised, with two SAT sites assessed. At each SAT site a total of 30 trees of dbh >10cm were surveyed for Koala scats, with approximately 2 minutes spent searching the ground within a 1 metre radius of each tree. All trees in proximity to SAT sites were searched with binoculars.

Scat, Track and Stag Surveys: Opportunistic searches for footprints, scats, nests and scratches were undertaken using a random meander method and were typically combined with bird surveys, reptile searches (see below) and the daily checking of traps. The site was also searched for dens, stags and other tree hollows.

Herpetofauna and Habitat Searches: Searches of areas representing potential habitat for reptiles, amphibians and mammals were conducted at all parts of the site and involved:

- Searching leaf litter and turning over logs and other ground cover. Care was taken to replace debris as found. Loose bark was removed from trees when encountered; and
- General searches for scats, tracks and scratches of mammals and other fauna. This included time devoted to searching under trees for signs of foraging such as trees bearing sap incisions for glider chewings and owl regurgitation pellets.

In addition, routine checks amongst leaf litter were made for frogs and reptiles via spotlighting searches. Reptiles were searched for on an opportunistic basis throughout the survey while travelling between survey sites and while conducting other survey techniques such as checking traps, bird counts and vegetation assessment. Litter searches during SAT assessments also

dedicated time to reptile survey.

The presence of frog species was determined by listening for their calls, spotlighting and pitfall trapping. Active searches for amphibians were conducted by a walking survey along all of the main boundary drains and the central drain, in addition to traverses of the wet heath community.

In addition to all of the above methods, opportunistic survey was also completed during vegetation assessment, trap installation and pack-up, and all other activities at the block.

Table B.1 Summary of fauna survey effort completed

Survey Method	Effort	Total survey effort
Cage trapping	6 x traps over 4 nights	24 cage trap nights
Ground mammal trapping	50 x Type A Elliott traps over 4 nights 5x Type B Elliott traps over 4 nights	200 trap nights 20 trap nights
Arboreal mammal trapping	6x Type B Elliott traps over 4 nights	24 trap nights
Hair tubes	20 Hairtubes deployed over 6 nights	120 hair tube nights
Pitfall traps	3 lines of pitfall traps (5 buckets per line) over 4 nights	60 bucket nights
Harp traps	2 x harp traps over 4 nights	Approx. 40 hours harp trapping
Anabat	Nightly meandering transects over four nights, one all night recording session	Approx. 16 hours Anabat survey
Spotlighting	Nightly meandering transects over four nights	5.85 hours spotlighting
Call playback (owls)	one site over 4 nights	
Call playback (frogs)	9 sites over 4 nights	
Diurnal bird survey	3 sites dawn survey, 20 minutes at each site (one site only surveyed 3 times)	3 hrs 40 mins
Koala scat survey	Two SAT sites	2 hours scat searches (60 trees)

Survey Limitations and Adequacy

The survey effort for all methods mostly met or exceeded the DEC (2004) standards in all areas (refer Section 2). The survey did not meet requirements in two areas – for arboreal mammals (hair tubes) and for call playback (Masked Owl, Eastern Grass Owl). With the exception of the Koala, no threatened arboreal mammal species (Squirrel Glider, Yellow-bellied Glider) have been recorded in the locality due to the absence of suitable habitat. Spotlighting and arboreal Elliott trapping allocated some effort to the detection of arboreal mammals, with nil results. This effort is considered sufficient to satisfy investigative efforts.

For both owl species, four nights call playback were completed rather than five night (Masked Owl) or eight nights (Eastern Grass Owl), as recommended in the Guidelines. However the early record of a Masked Owl nullified the need to complete further playback (and the species has been

recorded within CURA Precinct B approximately 1.3 km from the block). Although the site appears generally unsuitable for the Eastern Grass Owl given the combination of regular slashing practices and a low prey base, the species is considered as potentially foraging at the site on a precautionary basis given the limited call playback completed.

Review of the DECCW criteria (Appendix A) confirms that the survey has been adequately completed as follows:

- Vegetation at the block has been comprehensively assessed and described, and 7 part tests completed for threatened flora species considered as having potential to occur.
- Measures to mitigate against impacts to plant communities have been described.
- Fauna survey employed a range of methods and detailed the habitat utilised by threatened/migratory species listed under the TSC Act and/or EPBC Act.
- Potential impacts on threatened fauna have been identified.
- Threatened fauna not recorded, but considered as having potential to occur based on the habitat present have been identified.
- Measures to mitigate against impacts to fauna have been described.
- Survey methodology is adequately described, including any limitations.
- Conclusions drawn from the surveys are considered appropriate and described appropriately in the report.

Weather Conditions

Weather conditions during the survey were warm during the days and mild at nights. Light rainfall occurred on every evening of the survey and a few very brief daytime showers occurred. Prior to the survey commencing substantial rainfall occurred. Weather data sourced from BoM (Ballina Airport weather station) are summarised at Table B.2.

Table B.2 Summary of weather conditions (Source: BoM: Ballina Airport monitoring station); survey period highlighted in bold

Date	Temp °C (min)	Temp °C (max)	Rainfall
8/12/11	16.8	24.5	79.0
9/12/11	16.4	25.1	14.6
10/12/11	17.8	24.3	1.6
11/12/11	17.7	26.7	2.2
12/12/11	19.3	26.2	1.8
13/12/11	15.9	26.1	16.0
14/12/11	19.1	24.6	3.0
15/12/11	17.7	23.4	3.4
16/12/11	17.5	24.5	0.4

A full moon occurred during the survey period, however cloud cover obscured this to a substantial degree when undertaking nocturnal survey. The weather and abiotic conditions are unlikely to have significantly affected the survey outcomes. Rainfall events prior to and during the survey created excellent conditions for frog survey and increased the potential for detection considerably.

LEGEND

- CAGE TRAP
- H — HARP TRAP
- ELLIOTT TRAP (E)
- ARBOREAL ELLIOTT
- P — PITFALL TRAP
- A — ANABAT (STATIONARY)
- # — SAT SITE
- BSS — BIRD SURVEY SITE (200*100m AREA)
- CPB — CALL PLAYBACK (OWLS)
- CPB — CALL PLAYBACK (ACID FROGS)
- HAIR TUBES
- SPOTLIGHTING/ANABAT TRANSECT

METRES
100 50 0 100 200 300 400
75 25
SCALE 1:5000

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NORTH POINT

DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY PROJECT SUPERVISOR. SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS

REV.	ISSUE / AMENDMENTS	DATE

DESIGNED IC
DRAWN
CHECKED IC

PROJECT
BALLINA SANDS
ENVIROMENTAL IMPACT STATEMENT

DRAWING
APPENDIX 1
FAUNA SURVEY METHODS

DWG No. *AWC_1-10090_06*

CAD FILE No. *1-10090_06 Appendix D.dwg*

SCALE *1:5 000 @ A3*

DRAWING CREATED *15/5/2012*

REV. ***B***

Appendix C – Flora Inventory

Table C.1 Flora inventory

Scientific name	Common name	Vegetation Community							
		1	2	3	4	5	6	7	8
Acacia longifolia subsp. sophorae	Coast Wattle							I	
Acacia melanoxylon	Sally Wattle		I	I	I		I		
Acacia suaveolens	Sweet Wattle		I						
Acacia ulicifolia	Prickly Moses	I						I	
Acmena hemilampra	Broad-leaved Lilly Pilly			I	I				
Acmena smithii	Common Lilly Pilly			I					
*Ageratina adenophora**	Crofton Weed							I	
*Ageratum houstonianum**	Billygoat Weed						I	O	
*Ambrosia artemisiifolia**	Annual Ragweed							I	
*Andropogon virginicus**	Whisky Grass	I	I					O-C	
*Anredera cordifolia**	Madeira Vine							I	
Aotus ericoides	Aotus	I	O	I	I		I	I	
Archontophoenix cunninghamiana	Bangalow Palm			I					
Asplenium australasicum	Bird's Nest Fern				O				
Austromyrtus dulcis	Midyim	I		I			O		
*Axonopus compressus**	Carpet Grass							O	
*Axonopus fissifolius**	Carpet Grass							O	
*Baccharis halimifolia**	Groundsel Bush			I					
Backhousia myrtifolia	Grey Myrtle			I					
Baeckea frutescens	Baeckea	I		I					
Baloskion pallens							O		
Baloskion tetraphyllum subsp. *meiostachyum*	Plume Rush	I	O-C	I		C	O	I	I
Baumea rubiginosa	Twig-rush					C			
*Bidens pilosa**	Farmer's Friends							O	
Blechnum indicum	Water Fern		O	I		VC	I		I
Breynia oblongifolia	Coffee Bush		I		I		I		
Callicoma serrulata	Black Wattle			I					
Callistemon pachyphyllus	Swamp Bottlebrush					I			
Callistemon salignus	Willow Bottlebrush			I	I				
Calochlaena dubia	Rainbow Fern			I	O				
Cassytha glabella	Devil's Twine	O-C	O-C			I	I		
Caustis recurvata	Curly Wigs	I					I		
Centella asiatica	Pennywort							I	
*Chloris gayana**	Rhodes Grass							I	
*Cinnamomum camphora**	Camphor Laurel			O	O		I		
*Commelina benghalensis**	Hairy Commelina			I				I	I
Commelina cyanea	Scurvy Weed			I			I	I	
Commersonia bartramia	Brown Kurrajong								
*Conyza parva**	Fleabane							I	
*Conyza sumatrensis**	Fleabane							I	
Cordyline stricta	Narrow-leaved Palm Lily				O				
Corymbia intermedia	Pink Bloodwood	I							
*Crassocephalum crepidioides**	Thickhead					I	I	O	
*Crotalaria lanceolata**	Rattlepod							I	
Cryptostylis erecta	Bonnet Orchid		O						
Cupaniopsis anacardioides	Tuckeroo			I	I		I		
*Cuphea carthageninsis**	Cuphea							C	O
Cynodon dactylon	Couch							C	
*Cyperus brevifolius**	Mullumbimby Couch							I	

		Vegetation Community							
Scientific name	Common name	1	2	3	4	5	6	7	8
Cyperus polystachyos	Bunchy Sedge					O		C	O-C
*Cyperus sesquiflorus**									I
Cyperus stradbrokensis	Sand Sedge				I			I	
Desmodium heterocarpon var. *heterocarpon*	Bush Pea			I					
Dianella caerulea	Flax Lily	O	O	I	I		I	I	
Dicranopteris linearis									I
Diplazium australe	Ground Fern				I				
Drosera spatulata	Sundew					I		I	
Duboisia myoporoides	Corkwood		I	I	I	I	I		
Elaeocarpus obovatus	Hard Quandong			I					
Elaeocarpus reticulatus	Blueberry Ash	O	O	I	I	I	I		
Eleocharis equisetina	Spike-rush								C
Entolasia marginata	Wiry Panic	I	O	I	I	O	I	I	I
Epacris pulchella	Wallum Heath	I				I			
Eragrostis brownii	Brown's Lovegrass							I	
Eucalyptus robusta	Swamp Mahogany		VC			I	C	I	
Eucalyptus signata	Scribbly Gum	VC					I		
Ficus watkinsiana	Strangler Fig				I				
Fimbristylis dichotoma	Rusty Sedge							I	I
Flindersia bennettiana	Bennett's Ash				I				
Gahnia clarkei	Saw-sedge	I	I	O-C	I	C	I	I	
Geitonoplesium cymosum	Scrambling Lily				O				
Gleichenia dicarpa	Coral Fern								I
Glochidion ferdinandi	Cheese Tree			I					
Glochidion sumatranum	Umbrella Cheese Tree			I	I				
Gonocarpus micranthus subsp. *ramosissimus*	Creeping Raspwort		O			O	I	O	
Guioa semiglauca	Guioa			I	I		I		
Hardenbergia violacea	False Sarsaparilla	O	I	I			I	I	
Hibbertia scandens	Twining Guinea Flower	C	C				O	I	
Hibiscus diversifolia	Swamp Hibiscus							I	
Histiopteris incisa	Batswing Fern					I			
Homalanthus populifolius	Bleeding Heart	I				I	I		
*Hypochaeris radicata**	Flatweed							O	
Hypolepis muelleri	Harsh Ground Fern			I					I
Imperata cylindrica	Blady Grass	I						I	
*Ipomoea cairica**	Coastal Morning Glory			I				I	
*Ipomoea purpurea**	Morning Glory							I	
Isachne globosa	Swamp Millet								O
Jagera pseudorhus	Foambark			I					
Juncus usitatus	Pin Rush							O	O
Kennedia rubicunda	Postman's Pea							I	
Lachnagrostis filiformis	Blown Grass								I
*Lantana camara**	Lantana			I	I				
Leersia hexandra	Swamp Ricegrass								C
Leptospermum juniperinum	Prickly Teatree					I			
Leptospermum liversidgei	Lemon-scented Teatree					I			
Leptospermum polygalifolium subsp. *cismontanum*	Teatree	O	I				I	I	
Leptospermum trinervium	Black Teatree	I	I				I		

Scientific name	Common name	Vegetation Community							
		1	2	3	4	5	6	7	8
Lepyrodia scariosa	Lepyrodia					O			
Leucopogon lanceolatus	Beard Heath	O	O				I	I	
Leucopogon margarodes	Beard Heath	I	I						
Leucopogon parviflorus	Beard Heath		I						
Litsea reticulata	Brown Bolly Gum			I	I				
Lomandra longifolia	Mat-rush	I		O			I	I	
Lophostemon confertus	Brush Box		I	I	I		I		
Lophostemon suaveolens	Swamp Box	I		I			I		
Ludwigia octovalvis	Willow Primrose								I
Ludwigia peploides subsp. *montevidensis*	Water Primrose								I
Lycopodiella lateralis	Slender Clubmoss								I
Lygodium microphyllum	Climbing Snake Fern			O	I				
Marsdenia rostrata	Milk Vine	I		I			I		
Melaleuca quinquenervia	Broad-leaved Paperbark	I	I	VC	I	I	I	I	
Melastoma affine	Bluetongue			I			I		I
Melicope elleryana	Pink-flowered Doughwood		I						
*Melinis repens**	Natal Grass							I	
*Melinis minutiflora**	Molasses Grass	I							
Nematolepis squamea subsp. *squamea*	Satinwood	O	O	I				I	
*Neonotonia wightii**	Glycine			I				I	
*Nymphae capensis**	Cape Water Lily								I
Oplismenus aemulus	Basket Grass			I					
Oxylobium robustum	Shaggy Pea	C	O	I	I		O		
Parsonsia straminea	Common Silkpod	I		O	I		I		
*Paspalum conjugatum**	Sour Grass							I	
*Paspalum dilatatum**	Paspalum			I				O	
*Paspalum mandiocanum**	Broad-leaved Paspalum							C	
*Paspalum notatum**	Bahia Grass							C	
*Paspalum urvillei**	Vasey Grass							C	
*Passiflora edulis**	Edible Passionfruit			I					
*Passiflora subpeltata**	White Passionfruit				I				
Patersonia sericea	Silky Purple-flag					I			
*Pennisetum clandestinum**	Kikuyu							C	
Persicaria attenuata	Princess Feathers							I	
Persicaria decipiens	Slender Knotweed					I		O	O
Persicaria strigosa	Knotweed								C
Persoonia stradbrokensis	Geebung	I	O	I	I		I	I	
Philydrum lanuginosum	Frogsmouth								VC
*Physalis peruviana**	Cape Gooseberry							I	
*Phytolacca octandra**	Inkweed				I			I	
Pilidiostigma glabrum	Plum Myrtle			I					
Pimelea linifolia	Slender Rice-flower	O	I					I	
Pittosporum undulatum	Sweet Pittosporum			I			I		
Pomax umbellata	Pomax	O-C	O				I	O	
*Psidium cattleianum**	Cherry Guava				I				
Pteridium esculentum	Bracken Fern	C	C	I			O	O	
*Richardia brasiliensis**	Mexican Clover							I	
*Rivina humilis**	Coral Berry				I				
*Saccharum officinarum**	Sugar Cane							I	

		Vegetation Community							
Scientific name	Common name	1	2	3	4	5	6	7	8
Sacciolepis indica	Indian Cupscale Grass							I	
*Sagittaria platyphylla**	Sagittaria								I
*Schefflera actinophylla**	Umbrella Tree			I	I				
Schoenoplectus mucronatus	Star Sedge								I
Schoenoplectus validus	Club-rush								I
Selaginella uliginosa	Swamp Selaginella					O-C			
*Senecio madagascariensis**	Fireweed							I	
*Setaria sphacelata**	Setaria							VC	O
*Sida rhombifolia**	Paddy's Lucerne							I	
Smilax australis	Prickly Smilax		I	O	I				
*Solanum americanum**	Glossy Nightshade							I	
*Solanum capsicoides**	Devil's Apple							I	
*Solanum mauritianum**	Wild Tobacco			I		I	I	I	
*Solanum nigrum**	Blackberry Nightshade							I	
*Sorghum halepense**	Jonson Grass							I	
Sparganium subglobosum									I
*Sphagneticola trilobata**	Singapore Daisy			I				I	
Sticherus flabellatus var. *flabellatus*	Fan Fern			I					
*Syagrus romanzoffiana**	Cocos Palm	I		I	I				
Symplocos stawellii	White Hazelwood			I					
Syncarpia glomulifera	Turpentine						C		
Syzygium luehmannii	Riberry				I				
Trachymene composita	Wild Parsnip	I	I				I	O-C	
Trema tomentosa var. *viridis*	Native Peach					I			
*Trifolium repens**	White Clover							I	
Trochocarpa laurina	Tree Heath			I					
Xanthorrhoea fulva	Swamp Grass Tree		O			C			
Xyris operculata	Tall Yellow-eye					O			

* Introduced species

I = Infrequent; O= Occasional; C = Common; VC = Very Common

Appendix D – Photographs

Plate 1. Small patch of Scribbly Gum open forest in south east of block.

Plate 2. Wet heath community with *Blechnum indicum* in foreground.

	Plate 3. Small patch of Swamp Mahogany open forest in south east of block.
	Plate 4. Inner 'core' of wet heath with *Baumea rubiginosa* in depression.
	Plate 5. Typical drainline vegetation dominated by *Philydrum lanuginosum*.

	Plate 6. Grassland community in ex-cane paddock where quarry is proposed.
	Plate 7. Northern paperbark community.
	Plate 8. Sound mound dominated by *Setaria sphacelata* along Newrybar Swamp Road. The access road will require removal of part of the mound.

Appendix E – Anabat Analysis Results

Appendix F – Summary of Bird Survey Results

Table F.1 Summary of bird survey results (refer to Drawing B.1 for survey sites)

Common name	Scientific name	Site 1	Site 2	Site 3	Opportunistic records
Australian Magpie	*Cracticus tibicen*	✓	✓	✓	
Australian Hobby	*Falco longipennis*		✓		
Australian White Ibis	*Theskiornis moluccana*				✓
Australian Wood Duck	*Chenonetta jubata*				✓
Bar-shouldered Dove	*Geopelia humeralis*			✓	
Barn Owl	*Tyto alba*				✓
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*				✓
Black-shouldered Kite	*Elanus axillaris*				✓
Brown Quail	*Coturnix ypsilophora*				✓
Brown Thornbill	*Acanthiza pusilla*		✓		
Brush Turkey	*Alectura lathami*				✓
Cattle Egret	*Ardea ibis*	✓	✓		
Cicadabird	*Coracina tenuirostris*				✓
Common Koel	*Eudynamys scolopacea*				✓
Common Mynah	*Acridotheres tristis*				✓
Dollarbird	*Eurystomus orientalis*			✓	
Crested Pigeon	*Ocyphaps lophotes*				✓
Double-barred Finch	*Taeniopygia bichenovii*				✓
Dusky Woodswallow	*Artamus cyanopterus*			✓	
Eastern Rosella	*Platycerus eximius*				✓
Eastern Whipbird	*Psophodes olivaceus*				✓
Eastern Yellow Robin	*Eopsaltria australis*			✓	
Fairy Martin	*Hirundo ariel*			✓	
Figbird	*Sphecotheres viridis*	✓		✓	
Galah	*Cacatia roseicapilla*			✓	
Golden-headed Cisticola	*Cisticola exilis*			✓	
Golden Whistler	*Pachycephala pectoralis*			✓	
Green Catbird	*Ailuroedus crassirostris*				✓
Grey Butcherbird	*Cracticus torquatus*	✓			
Grey Fantail	*Rhipidura fuliginosa*		✓	✓	
Grey Shrike-thrush	*Colluricincla harmonica*			✓	
House Sparrow	*Passer domesticus*				✓
King Quail	*Coturnix chinensis*				✓
Latham's Snipe^	*Gallinago hardwickii*				✓
Lewin's Honeyeater	*Meliphaga lewinii*	✓	✓	✓	
Little Pied Cormorant	*Phalacrocorax melanoleucos*	✓			
Magpie-lark	*Grallina cyanoleuca*	✓	✓		
Masked Lapwing	*Vallenus miles*	✓	✓		
Masked Owl*	*Tyto novaehollandiae*				✓

Common name	Scientific name	Site 1	Site 2	Site 3	Opportunistic records
Nankeen Night Heron	*Nycticorax caledonicus*			✓	
Noisy Miner	*Manorina melanocephala*	✓			
Pacific Black Duck	*Anas supercilliosa*				✓
Pheasant Coucal	*Centropus phasianinus*	✓			
Pied Butcherbird	*Cracticus nigrogularis*		✓		
Pied Currawong	*Strepera graculina*				✓
Plumed Whistling Duck	*Dendrocygna eytoni*		✓		
Purple Swamphen	*Porphyrio porphyrio*				✓
Rainbow Bee-eater	*Merops ornatus*				✓
Rainbow Lorikeet	*Trichoglossus haematodus*				✓
Red-backed Fairy-wren	*Malurus melanocephalus*	✓	✓	✓	
Red-browed Finch	*Neochmia temporalis*		✓	✓	
Richard's Pipit	*Anthus novaeseelandiae*			✓	
Rufous Whistler	*Pachycephala rufiventris*				✓
Satin Flycatcher	*Myiagra cyanoleuca*			✓	
Shining Bronze Cuckoo	*Chrysococcyx lucidus*				✓
Spangled Drongo	*Dicrurus bracteatus*				✓
Spotted Harrier*	*Circus assimilis*				✓
Superb Fairy-wren	*Malurus cyaneus*	✓	✓		
Tawny Frogmouth	*Podargus strigoides*				✓
Torresian Crow	*Corvus orru*	✓	✓	✓	
Variegated Fairy-wren	*Malurus lamberti*		✓		
Welcome Swallow	*Hirundo neoxena*				✓
White-browed Scrubwren	*Sericornis frontalis*	✓	✓	✓	
White-faced Heron	*Egretta novaehollandiae*				✓
White-throated Gerygone	*Gerygone olivacea*				✓
Willie Wagtail	*Rhipidura leucophrys*		✓		

Appendix G – Assessments of Significance

Assessments of Significance have been completed for:

- Two threatened flora species (Hairy Jointgrass, Southern Swamp Orchid).
- One EEC: Swamp Sclerophyll Forest.
- Eighteen (18) threatened fauna species: Wallum Froglet, Olongburra Frog, Spotted Harrier, Little Eagle, Black-necked Stork, Brolga, Grey-crowned Babbler, Eastern Grass Owl, Masked Owl, White-eared Monarch, Greater Broad-nosed Bat, Grey-headed Flying-fox, Little Bentwing-bat, Eastern Bentwing-bat, Eastern Long-eared Bat, Eastern Freetail Bat, Southern Myotis and Koala.

Threatened Flora

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Hairy Jointgrass	Vulnerable - TSC Act 1995
Habitat description/ life cycle components	Annual grass which occurs in moist and shady habitats, in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps. Flowering occurs Feb-April and seed is set at the end of this period. Die back occurs in winter flowering seeding.
Sensitivities	Hairy Jointgrass is at threat from: • Clearing of habitat for agriculture and development. • Inappropriate fire regimes. • Over-grazing by domestic stock. • Competition from introduced grasses. • Slashing or mowing of habitat.
Likelihood of local extinction	The proposed development would result in the loss of approximately one third of the disturbed grassland community at the site which provides marginal habitat for Hairy Jointgrass due to a history of cane production, weed invasion, ongoing slashing and unsuitable hydrology and underlying geology (free-draining sands). The habitat within the proposed footprint area for the quarry is not significant given known habitat requirements for the species in the locality and similar habitat occurs within retained land over the entirety of the grassland community. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Southern Swamp Orchid	Endangered - TSC Act 1995
Habitat description/ life cycle components	Swampy grassland or forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas. Flowering occurs September to October.
Sensitivities	The Southern Swamp Orchid is at threat from: • Illegal collection. • Clearing and fragmentation of habitat for development, agriculture and roadworks. • Drainage of swamps, or pollution from nutrient run-off. • Frequent fire. • Grazing and trampling by domestic stock and feral pigs. • Invasion of habitat by introduced weeds.
Likelihood of local extinction	The proposed development would not result in the disturbance, loss or modification of any areas of habitat suitable for the Southern Swamp Orchid. Disturbed grassland does not comprise suitable habitat for the species and as such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No threatened populations occur within Ballina LGA.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Refer to separate assessment for endangered ecological communities.

d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Hairy Jointgrass: Approximately one third of the disturbed grassland community which comprises very marginal habitat for the species would be removed for the proposal. All other remaining areas of grassland at the site will be retained.

Southern Swamp Orchid: No suitable habitat would be modified or removed for the proposal.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

Hairy Jointgrass: The marginal habitat for the species (disturbed grassland) at the site occurs commonly at the site and in the locality. The proposed works would not significantly result in the fragmentation of the grassland community.

Southern Swamp Orchid: No areas of potential habitat would be fragmented or isolated for the proposal.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

Hairy Jointgrass: The habitat for to be removed is very marginal and is unlikely to be of any importance for the long-term survival of the species. The species is typically associated with basalt-derived soils subject to inundation as per CURA Precinct B (LandPartners 2010) and the local coastal study by Stewart & McKinley (2008), and as such the sandy, well-drained soils at the site provide very poor habitat for the species where potential dispersal vectors (eg. cattle, water) do not operate over the elevated paddocks in the west of the site.

Southern Swamp Orchid: The habitat to be removed comprises unsuitable habitat for the species and is unimportant for the long-term survival of the species in the locality.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No areas of critical habitat listed under the *TSC Act 1995* occur within Ballina LGA.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

An approved recovery plan has not been prepared for either species.

Three approved threat abatement plans (TAPs) have been prepared to date:

- Invasion of native plant communities by bitou bush and boneseed;
- Predation by the red fox; and
- Predation by the plague minnow.

None of the approved TAPs have relevance to either species with respect to the proposal.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The current list of Key Threatening Processes (KTPs) are listed at Table G.1 and discussed below.

TABLE G.1 KEY THREATENING PROCESSES

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes	Applicable to proposed works
Alteration of habitat following subsidence due to longwall mining	No
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	No
Anthropogenic Climate Change	No
Bushrock removal	No
Clearing of native vegetation	No
Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	No
Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	No
Competition from feral honey bees, Apis mellifera L.	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	No
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	No
Herbivory and environmental degradation caused by feral deer	No
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	No
Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972	No
Infection by Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species and populations	No
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	No
Infection of native plants by Phytophthora cinnamomi	No
Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	No
Invasion and establishment of exotic vines and scramblers	No
Invasion and establishment of Scotch Broom (Cytisus scoparius)	No
Invasion and establishment of the Cane Toad (Bufo marinus)	No
Invasion, establishment and spread of Lantana (Lantana camara L. sens. lat)	No
Invasion of native plant communities by African Olive (Olea europaea L. subsp. cuspidata)	No
Invasion of native plant communities by Chrysanthemoides monilifera	No
Invasion of native plant communities by exotic perennial grasses	No
Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	No
Loss of hollow-bearing trees	No
Loss or degradation (or both) of sites used for hill-topping by butterflies	No
Predation and hybridization by Feral Dogs (Canis lupis familiaris)	No
Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	No
Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	No
Predation by the Feral Cat Felis catus (Linnaeus, 1758)	No

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes	Applicable to proposed works
Predation by the Ship Rat Rattus rattus on Lord Howe Island	No
Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	No
Removal of dead wood and dead trees	No
Introduction and establishment of Exotic Rust Fungi	No

The proposed works are not characteristic of any of the KTPs listed above. While removal of the grassland community would result in the loss of a limited suite of native flora species, the KTP 'clearing of native vegetation' does not apply, as the affected community is a disturbed grassland dominated by introduced species.

Conclusion: The proposed works would not result in any significant impact to any of the subject threatened species or communities, and therefore a Species Impact Statement (SIS) is not required.

Endangered Ecological Communities

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not relevant to this assessment.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No threatened populations occur within Ballina LGA.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

One endangered ecological community occurs at the site: 'Swamp Sclerophyll Forest in the NSW North Coast, Sydney Basin and South East Corner bioregions'. No part of this community would be modified or removed for the proposal. As such the community would not be adversely affected, fragmented or modified such that its local occurrence is placed at risk of extinction.

d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

As stated above, no portion of the Swamp Sclerophyll Forest at the site would be removed, modified or isolated as a result of the proposal.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No areas of critical habitat listed under the *TSC Act 1995* occur within Ballina LGA.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

An approved recovery plan has not been prepared the subject community.

Three approved threat abatement plans (TAPs) have been prepared to date:

- Invasion of native plant communities by bitou bush and boneseed;
- Predation by the red fox; and
- Predation by the plague minnow.

None of the approved TAPs have relevance to the subject community with respect to the proposal.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The current list of Key Threatening Processes (KTPs) are listed at Table G.2 and discussed below.

TABLE G.2 KEY THREATENING PROCESSES

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes	Applicable to proposed works
Alteration of habitat following subsidence due to longwall mining	No
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	No
Anthropogenic Climate Change	No
Bushrock removal	No
Clearing of native vegetation	No
Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	No
Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	No
Competition from feral honey bees, Apis mellifera L.	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	No
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	No
Herbivory and environmental degradation caused by feral deer	No
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	No
Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972	No
Infection by Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species and populations	No
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	No
Infection of native plants by Phytophthora cinnamomi	No
Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	No
Invasion and establishment of exotic vines and scramblers	No
Invasion and establishment of Scotch Broom (Cytisus scoparius)	No

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes	Applicable to proposed works
Invasion and establishment of the Cane Toad (Bufo marinus)	No
Invasion, establishment and spread of Lantana (Lantana camara L. sens. lat)	No
Invasion of native plant communities by African Olive (Olea europaea L. subsp. cuspidata)	No
Invasion of native plant communities by Chrysanthemoides monilifera	No
Invasion of native plant communities by exotic perennial grasses	No
Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	No
Loss of hollow-bearing trees	No
Loss or degradation (or both) of sites used for hill-topping by butterflies	No
Predation and hybridization by Feral Dogs (Canis lupis familiaris)	No
Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	No
Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	No
Predation by the Feral Cat Felis catus (Linnaeus, 1758)	No
Predation by the Ship Rat Rattus rattus on Lord Howe Island	No
Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	No
Removal of dead wood and dead trees	No
Introduction and establishment of Exotic Rust Fungi	No

The proposed works are not characteristic of any of the KTPs listed above. While removal of the grassland community would result in the loss of a limited suite of native flora species, the KTP 'clearing of native vegetation' does not apply, as the affected community is a disturbed grassland dominated by introduced species.

Conclusion: The proposed works would not result in any significant impact to any of the subject threatened species or communities, and therefore a Species Impact Statement (SIS) is not required.

Threatened Fauna

Wallum Froglet, Olongburra Frog, Spotted Harrier, Little Eagle, Greater Broad-nosed Bat, Black-necked Stork, Brolga, Grey-crowned Babbler, Eastern Grass Owl, Masked Owl, White-eared Monarch, Grey-headed Flying-fox, Little Bentwing-bat, Eastern Bentwing-bat, Eastern Long-eared Bat, Eastern Freetail Bat, Southern Myotis and Koala.

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Eastern Freetail Bat	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests. Roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally. Diet not studied, probably insectivorous.
Sensitivities	The Eastern Freetail Bat is at threat from: • Loss of hollow-bearing trees. • Loss of foraging habitat. • Pesticide use in or adjacent to foraging areas.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Eastern Freetail bat. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Masked Owl	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Occurs in dry eucalypt forests and woodlands from sea level to 1100 m. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows (or sometimes caves) for nesting. The typical diet consists of tree-dwelling and ground mammals, especially rats.
Sensitivities	The Masked Owl is at threat from: • Loss of mature hollow-bearing trees and changes to forest and woodland structure. • Clearing of habitat for grazing, agriculture, forestry or other development. • A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests. • Secondary poisoning from rodenticides. • Vehicle strike.
Likelihood of local extinction	The proposed development would result in the loss of a small area of marginal habitat (~10 ha) which may harbour prey on which the Masked Owl feeds. Similar habitat for prey will be retained over the majority of the site and occurs widely in the locality. No loss or disturbance to roosting habitat would occur. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Eastern Grass Owl	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Occur in areas of tall grass, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' - a trampled platform in a large tussock or other heavy vegetative growth. Breeding occurs on the ground, with nests often accessed by tunnels through vegetation.
Sensitivities	The Eastern Grass Owl is at threat from: • Loss of habitat from grazing, agriculture and development. • Habitat disturbance and degradation by stock. • Pesticides use. • Frequent burning, which reduces ground cover needed for safe roosting and nesting, and can reduce prey abundance.
Likelihood of local extinction	The proposed development would result in the loss of a small area of marginal habitat (~10 ha) which may harbour prey on which the Eastern Grass Owl feeds. Similar habitat for prey will be retained over the majority of the site and occurs widely in the locality. No loss or disturbance to roosting habitat would occur as routine slashing of the site makes it unsuitable for the species. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Grey-crowned Babbler	Vulnerable - *TSC Act 1995*

Habitat description/ life cycle components	Typically inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Birds live in family groups that comprise a breeding pair and young from previous breeding seasons. A group may consist of up to fifteen birds. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. Feeds on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. The species builds several stick nests and these are used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round. Breeding occurs between July and February and two to three eggs are laid and incubated by the female. Territories range from one to fifty hectares (usually around ten hectares) and are defended all year.
Sensitivities	The Grey-crowned Babbler is at threat from: • Clearing of woodland remnants. • Heavy grazing and removal of coarse woody debris within woodland remnants. • Nest predation by species such as ravens and butcherbirds where populations are small and fragmented.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any of the open forest habitat which may be utilised by the Grey-crowned Babbler. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Black-necked Stork	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Typically occur on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. The species also forages within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation. Prey includes eels and other fish, frogs, turtles, snakes, and small invertebrates. Breeding typically occurs in late spring and summer. Nests may be built in a tall, live and isolated paddock tree, but also in other trees, including paperbarks, or even lower shrubs within wetlands.
Sensitivities	The Black-necked Stork is at threat from: • Degradation of wetland habitats through pollution and salinisation. • Loss of paddock trees used for nesting. • Mortality from striking overhead powerlines. • Modification or degradation of wetlands through changes in natural water flows. • Loss of wetland habitat through clearing and draining.
Likelihood of local extinction	The proposed development would not result the loss or disturbance of any significant habitat for the Black-necked Stork. Opportunistic foraging habitat would be retained in the north of the site, within drains and within the wet heath community. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Brolga	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Habitat includes shallow swamps, although the species will forage in dry grassland or ploughed paddocks. They feed on sedge roots and tubers, but will also take large insects, crustaceans, molluscs and frogs. The nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Two eggs are laid from winter to autumn.
Sensitivities	The Brolga is at threat from loss of wetland habitats from clearing and draining.
Likelihood of local extinction	The proposed development would not result the loss or disturbance of any significant habitat for the Brolga. Opportunistic foraging habitat would be retained in the north of the site, within drains and within the wet heath community. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Spotted Harrier	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Occurs in grassy open woodland, inland riparian woodland, grassland and shrub steppe. Most commonly recorded in native grassland, but also occurs in agricultural land including along edges of inland wetlands. A range of terrestrial mammals make up the diet (bandicoots, bettongs, rodents etc), birds and reptile, occasionally insects and rarely carrion. A stick nest is built and eggs laid in spring (or sometimes autumn), with young remaining in the nest for several months.
Sensitivities	The Spotted Harrier is at threat from: • Clearing and degradation of foraging and breeding habitat, particularly where prey densities may be affected. • Secondary poisoning from rodenticides and rabbit baiting.
Likelihood of local extinction	The proposed development would result in the loss of a small area of marginal habitat (~10 ha) which may harbour prey on which the Spotted Harrier feeds. Similar habitat for prey would be retained over the majority of the site and occurs widely in the locality. No loss or disturbance to roosting habitat would occur. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

White-eared Monarch	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	White-eared Monarchs occurs in rainforest (especially drier types, such as littoral rainforest) as well as wet and dry sclerophyll forests, swamp forest and regrowth forest. They appear to prefer the ecotone between rainforest and other open vegetation types or the edges of rainforest, such as along roads. They eat insects, but their diet is not well studied. Breeding occurs from September to March, with nests high in the canopy, and often at the edge of patches of rainforest.
Sensitivities	The White-eared Monarch is at threat from: • Inappropriate fire regimes that degrade habitat or allow invasion by weeds. • Degradation or loss of habitat through grazing of stock. • Clearing and increasing fragmentation and isolation of habitat, especially low-elevation subtropical rainforest, littoral rainforest and wet sclerophyll forest, through agricultural, tourist and residential development or forestry activities. • Forest management that results in conversion of multi-aged forests to young, even-aged stands. • Weed invasion of forests by weeds.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any habitat for the White-eared Monarch. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Wallum Froglet	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Wallum Froglets occur in acid paperbark swamps and sedge swamps of the coastal 'wallum' country. The species is a late winter breeder.
Sensitivities	The Wallum Froglet is at threat from: • Impact of pest vertebrate species • Destruction and degradation of coastal wetlands as a result of roadworks, coastal developments and sand mining. • Reduction of water quality and modification to acidity in coastal wetlands. • Grazing and associated frequent burning of coastal wetlands.
Likelihood of local extinction	The proposed development would not result the loss or disturbance of habitat for the Wallum Froglet and the wet heath community would be retained and protected (in addition to adjacent retreat areas dominated by Scribbly Gum and Swamp Mahogany). Existing surface flows into habitat for the species would remain unchanged, while potential for sedimentation would be mitigated by rock armouring within the decommissioned sediment pond for the existing quarry. The proposed quarry would utilise a detention and dispersal treatment which is hydrologically separate from the acid frog habitat area and hence there is little potential for changes in water quantity or quality affecting the area of core habitat. Bunding of the access road and fencing to reduce potential for any accidental vehicle access would further ensure that habitat remains secure. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Southern Myotis	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Primarily known from coastal environments and has been recorded from a wide variety of habitats in close proximity to water. The species has been recorded from mangroves, melaleuca swamps, rainforest, open woodland and wet and dry sclerophyll forest (Churchill 2008). They utilises bodies of water where they forage individually or hunt together over the water. Colonies roost during the day in caves, mines, tunnels, tree-hollows, disused bird nests, and under bridges and buildings (NPWS 2002).
Sensitivities	The Southern Myotis is at threat from: • Disturbance of cave roosts by recreational caving and tourism. • Destruction of caves that provide potential roosting sites. • Removal of tree-hollows. • Removal of old bridges used as roosting sites. • Changes to habitat. • Pesticide use. • Pollution of waterways.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Southern Myotis. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Little Eagle	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Occupies open eucalypt forest, woodland or open woodland in coastal NSW and preys on birds, reptiles and mammals, and occasionally large insects and carrion. Nests are located in tall living trees within a patch of remnant vegetation, where eggs are laid during spring and young fledge in early summer.
Sensitivities	The Little Eagle is at threat from: • Rural-residential subdivision and associated land uses (e.g. horse and goat grazing). • Secondary poisoning from rabbit baiting. • Urban expansion. • Clearing and degradation of foraging and breeding habitat
Likelihood of local extinction	The proposed development would result in the loss of a small area of marginal habitat (~10 ha) which may harbour prey on which the Little Eagle feeds. Similar habitat for prey would be retained over the majority of the site and occurs widely in the locality. No loss or disturbance to roosting habitat would occur. As such, there is little likelihood of the works contributing towards the local extinction of the species within the locality.

Koala	Vulnerable - *TSC Act 1995*
Habitat description/ life cycle components	Koalas inhabit eucalypt woodlands and forests where preferred feed tree species occur. Home range size varies with quality of habitat, ranging from less than two hectares to several hundred hectares in size. Preferred tree species in north-eastern NSW include Forest Red Gum (*E. tereticornis*), Swamp Mahogany (*E. robusta*), Red Mahogany (*E. resinifera*), Grey Gum (*E. propinqua*) and Tallowwood (*E. microcorys*).Females breed at two years of age and produce one young per year.
Sensitivities	The Koala is at threat from: • Human-induced climate change, especially drought • Loss, modification and fragmentation of habitat. • Predation by feral and domestic dogs. • Intense fires that scorch or kill the tree canopy. • Road-kill.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any potential habitat for the Koala, and no barriers to movement would occur. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Eastern Long-eared Bat	Vulnerable - *TSC Act 1995*

Habitat description/ life cycle components	The Eastern Long-eared Bat has been recorded using a variety of habitats from lowland subtropical rainforest to riparian woodland including wet and swamp eucalypt forest and extending into adjacent moist eucalypt forest favouring coastal rainforest and patches of coastal scrub (NPWS 2002). The species has been recorded roosting communally in tree hollows and in the roofs of buildings.
Sensitivities	The Eastern Long-eared Bat is at threat from: • Clearing, fragmentation and isolation of lowland subtropical rainforest, wet and swamp eucalypt forest and coastal scrub, particularly forest and scrub close to the coast, for agricultural, residential and other development. • Loss of hollow-bearing trees and stands of palms and rainforest trees used for roosting and maternity sites. • Invasion of habitat by weeds, particularly by Bitou Bush on the coast. • Use of pesticides.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Eastern Long-eared Bat. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Eastern Bentwing-bat	Vulnerable - TSC Act 1995
Habitat description/ life cycle components	Typically found in well-timbered habitats, including rainforest, wet and dry sclerophyll forest, open woodland and Melaleuca forest, where it forages above or within the tree-canopy (Churchill 2008). Roosts in caves, old mines, stormwater channels and occasionally buildings and forms large maternity colonies.
Sensitivities	The Eastern Bentwing-bat is at threat from: • Damage to or disturbance of roosting caves, particularly during winter or breeding. • Loss of foraging habitat. • Application of pesticides in or adjacent to foraging areas. • Predation by feral cats and foxes. •
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Eastern Bentwing-bat. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Little Bentwing-bat	Vulnerable - TSC Act 1995
Habitat description/ life cycle components	The Little Bentwing-bat prefers moist eucalypt forest, rainforest and dense coastal scrub including Banksia thickets and Melaleuca swamps. It is typically found in well-timbered habitats foraging beneath the canopy for small flying invertebrates (Churchill 2008). They are an obligate cave-dweller that congregate in large nursery colonies frequently shared with the Eastern Bent-wing Bat to help provide the high temperatures needed to rear its young (Strahan 1995). Several roost sites are used throughout the year including mines, tunnels, stormwater channels and tree-hollows (Dwyer 1995).
Sensitivities	The Little Bentwing-bat is at threat from: • Predation from foxes and feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges. • Disturbance of colonies, especially in nursery or hibernating caves. • Destruction of caves that provide seasonal or potential roosting sites. • Changes to habitat, especially surrounding maternity/nursery caves and winter roosts. • Use of pesticides.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Little Bentwing-bat. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Greater Broad-nosed Bat	Vulnerable - TSC Act 1995
Habitat description/ life cycle components	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though, most commonly found in tall wet forest. Open woodland habitat and dry open forest suits the direct flight of this species as it forages for beetles and other large, slow-flying insects. The species is also known to eat other bat species. Roosts in tree hollows, but also recorded from buildings. A single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees.
Sensitivities	The Greater Broad-nosed Bat is at threat from: • Disturbance to roosting and summer breeding sites. • Clearing of foraging habitat • Loss of hollow-bearing trees. • Pesticides and herbicide use • Changes to water regimes which may impact food resources
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Greater Broad-nosed Bat. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Olongburra Frog	Vulnerable - TSC Act 1995
Habitat description/ life cycle components	Olongburra Frogs are typically recorded amongst sedges and rushes in coastal wetlands of coastal "wallum" country where acidic waterbodies occur.
Sensitivities	The Olongburra Frog is at threat from: • Destruction and degradation of coastal wallum and coastal wetlands for roadworks, coastal developments and sand mining. • Reduction of water quality and changes to acidity in coastal wetlands. • Grazing and associated frequent burning of coastal wetlands.
Likelihood of local extinction	The proposed development would not result in the loss or disturbance of any foraging or roosting habitat for the Olongburra Frog, and the wet heath community would not be impacted by the development. Existing surface flows into habitat for the species would remain unchanged, while potential for sedimentation would be mitigated by rock armouring within the decommissioned sediment pond for the existing quarry. The proposed quarry would utilise a detention and dispersal treatment which is hydrologically separate from the acid frog habitat area and hence there is little potential for changes in water quantity or quality affecting the area of core habitat. Bunding of the access road to reduce potential for any accidental vehicle is proposed such that habitat remains secure. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

Grey-headed Flying-fox	Vulnerable - TSC Act 1995
Habitat description/ life cycle components	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands. The species forages on nectar and pollen of native trees, in particular Eucalypts, Melaleuca and fruits of rainforest trees and vines, in addition to cultivated gardens and fruit crops. Congregation camps of up to the tens of thousands are used for roosting, often in stands of riparian rainforest, Paperbark or Casuarina forest (NPWS 2002).
Sensitivities	The Grey-headed Flying-fox is at threat from: • Loss of foraging habitat. • Disturbance of roosting sites. • Unregulated shooting. • Electrocution on powerlines.
Likelihood of local extinction	The proposed development would not result in the loss of any foraging habitat for the Grey-headed Flying-fox. No roost camps or potential roost camps occur at the site. Potential foraging habitat occurs widely in the locality where extensive areas of eucalypt forest and roosting habitat occur. As such, there is little likelihood of the proposal contributing towards the local extinction of the species within the locality.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No threatened populations occur within Ballina LGA.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Refer to previous separate assessment.

d) in relation to the habitat of a threatened species, population or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposed development would not result in the removal of any habitat of significant importance to any of the subject species, primarily as most are highly mobile and forage widely, and also as disturbed pasture has relatively little value in their life-cycle requirements.

Habitat for acid frogs would be separated from development areas by a vegetated bund while the proposed water treatment methods for the proposed quarry would not affect the known habitat

area and hence modification of habitat due to changed hydrology would be unlikely to occur.

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The proposed works would not fragment or isolate any habitat which may be used by any of the subject species. The proposed access road already occurs and this area has been used as a transport route at the quarry for some time.

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The habitat to be removed is highly disturbed and modified and largely comprises exotic grasses and weeds and so is of little importance to any of the subject species. While the subject land within the development footprint may provide refuge for ground mammals which are prey items of the Masked Owl, Eastern Grass Owl and Little Eagle, retained pasture in the north of the site and heath in the south-east would continue to provide this role at the site. Even so, these areas are relatively marginal as refuge for prey as they are regularly slashed as part of farm maintenance.

The proposed development area has no value for acid frog species due to its significant disturbance, isolation by deep drains lacking typical habitat features and modified hydrology such that the subject land is freely draining and standing water is unlikely to persist for more than a few days.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No areas of critical habitat listed under the *TSC Act 1995* occur within Ballina LGA.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

An approved recovery plan has been prepared for the Masked Owl and Koala. The proposed development is not inconsistent with the objectives of either plan.

Three approved threat abatement plans (TAPs) have been prepared to date:

- Invasion of native plant communities by bitou bush and boneseed;
- Predation by the red fox; and
- Predation by the plague minnow.

None of the approved TAPs have relevance to any of the subject species with regard to the proposed development. While Plague Minnow occur in deeper surrounding drains, they do not appear to occur in the wet heath community, and so do not affect acid frog populations. As the

proposal would not divert or create new drains and/or drainage into this habitat there is little opportunity for the species to become established within this sensitive environment.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The current list of Key Threatening Processes (KTPs) are listed at Table G.3 and discussed below.

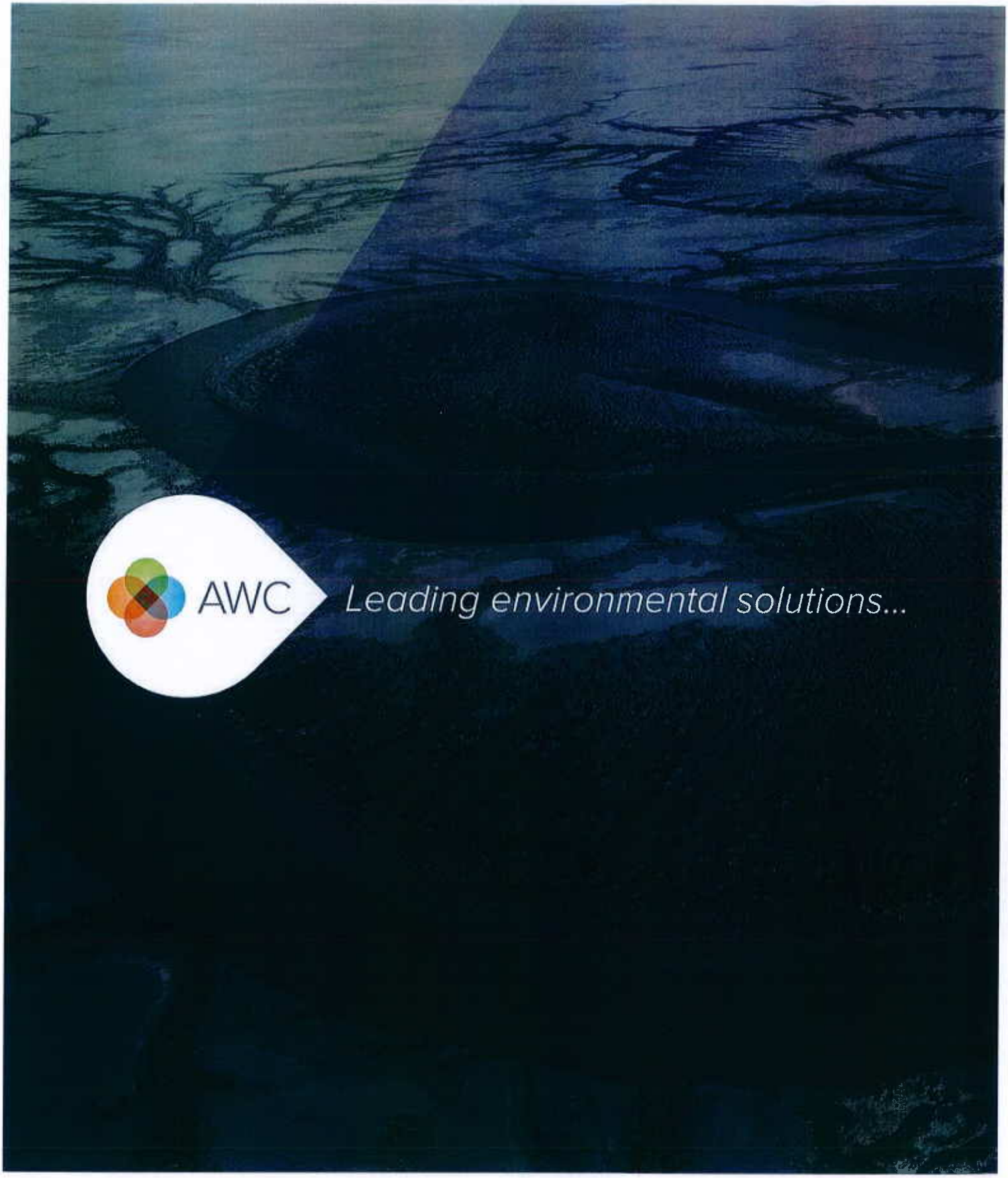
TABLE G.3 KEY THREATENING PROCESSES

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes	Applicable to proposed works
Alteration of habitat following subsidence due to longwall mining	No
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	No
Anthropogenic Climate Change	No
Bushrock removal	No
Clearing of native vegetation	No
Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	No
Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	No
Competition from feral honey bees, Apis mellifera L.	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	No
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	No
Herbivory and environmental degradation caused by feral deer	No
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	No
Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972	No
Infection by Psittacine Circoviral (beak and feather) disease affecting endangered psittacine species and populations	No
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	No
Infection of native plants by Phytophthora cinnamomi	No
Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	No
Invasion and establishment of exotic vines and scramblers	No
Invasion and establishment of Scotch Broom (Cytisus scoparius)	No
Invasion and establishment of the Cane Toad (Bufo marinus)	No
Invasion, establishment and spread of Lantana (Lantana camara L. sens. lat)	No
Invasion of native plant communities by African Olive (Olea europaea L. subsp. cuspidata)	No
Invasion of native plant communities by Chrysanthemoides monilifera	No
Invasion of native plant communities by exotic perennial grasses	No

Threatened Species Conservation Act 1995 Schedule 3 Key threatening processes	Applicable to proposed works
Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	No
Loss of hollow-bearing trees	No
Loss or degradation (or both) of sites used for hill-topping by butterflies	No
Predation and hybridization by Feral Dogs (Canis lupis familiaris)	No
Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	No
Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	No
Predation by the Feral Cat Felis catus (Linnaeus, 1758)	No
Predation by the Ship Rat Rattus rattus on Lord Howe Island	No
Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	No
Removal of dead wood and dead trees	No
Introduction and establishment of Exotic Rust Fungi	No

The proposed works are not characteristic of any of the KTPs listed above. While removal of the grassland community would result in the loss of a limited suite of native flora species, the KTP 'clearing of native vegetation' does not apply, as the affected community is a disturbed grassland dominated by introduced species which provides relatively poor habitat for any of the subject fauna species with regard to life-cycle requirements.

Conclusion: The proposed works would not result in any significant impact to any of the subject threatened species or communities, and therefore a Species Impact Statement (SIS) is not required.



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