CENTENNIAL

Biodiversity Management Plan
Extraction Plan LW 30-31
Mandalong Mine

June 2021

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DOCUMENT CONTROL

DOCUMENT DETAILS	Name:	Extraction Plan Biodiversity Management Plan
	Author:	RPS Australia East
	Number:	147476
	Revision No.:	2
	Document Status	Final

APPROVAL DETAILS

Revision No.	Date Sent	Details of Approval	Approved By	Approval Date
R0	01/12/2020	Draft for Client review	Lauren Eather	01/12/2020
R1	21/12/2020	Final	Lauren Eather	21/12/2020
R2	18/06/2021	Final addressing BCD's comments	Mark Aitkens	11/06/2021

CIRCULATION DETAILS

Name	Department	Circulation Date

Abbreviations

AUSRIVAS	Australian River Assessment System
AHD	Australian Height Datum
BAM	Biodiversity Assessment Method (2020)
BCF	Biodiversity Conservation Fund
Before After Control Impact	BACI
Biodiversity Conservation Act 2016	BC Act
Biodiversity Conservation Division	BCD
Biodiversity Management Plan	BMP
Centennial Mandalong Pty. Limited	Centennial Mandalong
Department of Agriculture, Water and the Environment	DAWE
Department of Environment	DoE
Department of Planning, Industry & Environment	DPIE
Endangered Ecological Community	EEC
Environmental Impact Statement	EIS
Environmental Protection and Biodiversity Conservation Act 1999	EPBC Act
Environmental Planning and Assessment Act 1979	EP&A Act
Groundwater Dependent Ecosystem	GDE
High Ecological Value	HEV
Longwall	LW
Mandalong Mine	Mandalong

Mandalong Mine Access Site	MMAS
Matters of National Environmental Significance	MNES
Mining Lease	ML
Mandalong South Surface Site	MSSS
Modification 9 to SSD-5144	MOD 9
Office of Environment and Heritage	OEH
Plant Community Type	PCT
State Significant Development	SSD
Threatened Ecological Community	TEC
Trigger Action Response Plan	TARP
Water Management Act 2000	WM Act

1 BACKGROUND

1.1 Introduction

Mandalong Mine is an existing underground longwall coal mine that produces thermal coal for domestic and export markets. It is located approximately 35 kilometres (km) south-west of Newcastle, near Morisset in New South Wales.

Mandalong Mine is fully owned and operated by Centennial Mandalong Pty. Limited (Centennial Mandalong), a subsidiary of Centennial Coal Company Limited. Centennial Coal Company Limited is a subsidiary of Banpu Public Company Limited.

Mandalong Mine operates under Development Consent SSD-5144, which was granted on 12 October 2015 by the NSW Planning Assessment Commission under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act). This approval provides for an extension of the mining area to allow a production limit of 6.5 million tonnes per annum of coal to be extracted from the West Wallarah and Wallarah-Great Northern Seams. SSD-5144 supersedes DA97/800, however Centennial Mandalong is still required to meet the requirements of this earlier consent.

Centennial Mandalong recently submitted an application to modify SSD-5144, pursuant to Section 4.55(2) of the EP&A Act. The modification (Modification 9; hereafter 'MOD 9') involved a change to Mandalong's approved mine plan, including reorientating some of the approved longwall (LW) panels (including LW 30-31), removing longwalls that will not be developed and renumbering the longwalls accordingly. This modification was sought since Centennial Mandalong recently encountered poor geological conditions within part of the Mandalong Southern Extension Area, including a fault zone and igneous sill. MOD 9 was a response to these conditions and was required in order for Centennial to maintain coal production, improve mining conditions and improve the financial viability of Mandalong Mine.

Centennial Mandalong has prepared an Extraction Plan to address the requirements of Schedule 4, Condition 6 of SSD-5144. This Biodiversity Management Plan (BMP) supports the Extraction Plan by providing a framework for the environmental management of LW 30-31, which is shown in **Figure 1**.

Mandalong Mine currently comprises the following underground workings and surface infrastructure:

- The Mandalong Mine Access Site (MMAS), encompassing underground workings and associated surface infrastructure near Morisset.
- Delivery of run-of-mine coal from the underground workings to the Cooranbong Entry Site. The Cooranbong Entry Site coal handling and processing facilities are approved under the Northern Coal Logistic Project (SSD-5145).
- Delivery of run-of-mine coal from the underground workings to the Delta Entry Site, located near Wyee at the Vales Point Rail Unloader Facility. The coal handling facility is approved under DA35-2-2004.
- Mandalong South Surface Site (MSSS), which is currently under construction, encompassing ventilation shafts, ventilation fans and underground delivery boreholes located approximately 6 km south-west of the Mandalong Mine Access Site.
- Construction of a 33 kV powerline from MSSS to MMAS.

2 CONSULTATION

In accordance with the requirements of Condition 6(j) of Schedule 4 of Development Consent SSD-5144, this BMP has been provided to Department of Planning Industry and Environment (DPIE) for review and comment during the consultation process. This correspondence contained in **Appendix 1**.

3 PURPOSE

The purpose of this BMP is to outline the monitoring and management measures, including the prescribed actions and responsibilities, required to detect and appropriately manage potential subsidence-related impacts to biodiversity resulting from LW 30-31.

4 SCOPE

This document has been specifically prepared to cover the requirements for a BMP for inclusion within the Extraction Plan for LW 30-31 in accordance with Schedule 4, Condition 6(j) of SSD-5144.

This BMP applies to the management of biodiversity located within the LW 30-31 extraction area (herein referred to as the Extraction Plan Area; **Figure 1**). The Extraction Plan Area has been calculated by combining the areas bound by the outer edge of LW 30-31 and the 26.5° angle of draw line plus 20 mm (subsidence limit) from the outer edge of these longwall panels.

This BMP addresses the monitoring and management of potential subsidence-related impacts to habitats, threatened flora and fauna, Threatened Ecological Communities (TECs) and aquatic ecosystems resulting from the secondary extraction of LW 30-31.

5 REGULATORY REQUIREMENTS

Centennial Mandalong expects that activities at its operations are conducted in accordance with relevant legislation and requirements of statutory authorities. Legislative and regulatory requirements are recognised through the imposition of conditions on the development consent, licences or mining approvals.

Centennial Mandalong's operations will be conducted in accordance with applicable State approvals (SSD-5144). Centennial Mandalong will maintain a register of relevant environmental legislative and regulatory requirements which will be reviewed and maintained in the Centennial Compliance Database.

Centennial Mandalong operates under several different approvals identified in the Environmental Management Strategy. The approval requirements specific to this BMP are presented below.

5.1 Development Consent and Statement of Commitments

The Development Consent (SSD-5144) conditions provide details of the biodiversity matters which need to be provided for in this BMP. These matters, together with the section of this BMP in which each matter is addressed, are set out in **Table 1**.

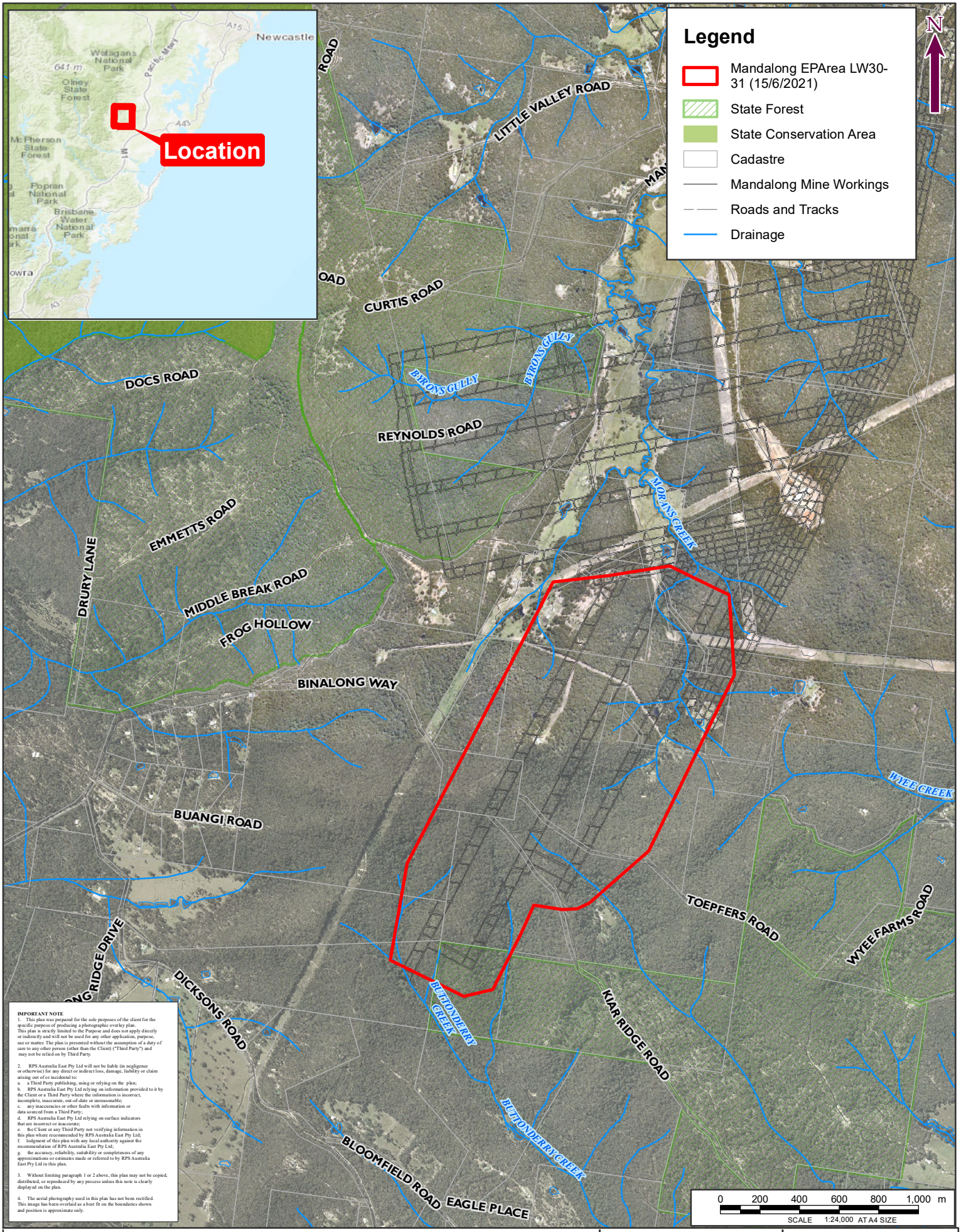

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FIGURE 1: EXTRACTION PLAN AREA FOR LW30-31

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 18/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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Table 1 Development Consent SSD 5144 Conditions

Development Consent	Development Consent Condition	Section Addressed
Development Consent SSD-5144	Schedule 4 Condition 1 Performance Measures – Natural and Heritage Features Table 6 … Biodiversity (Threatened species, threatened populations and endangered ecological communities) – Negligible environmental consequences	Section 7 Section 8 Section 9
	Schedule 4 Condition 3 Offsets If the Applicant exceeds the performance measures in Table 6 and the Secretary determines that: (a) it is not reasonable or feasible to remediate the impact or environmental consequences; or (b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence, then the Applicant must provide a suitable offset to compensate for the impact or environmental consequence, to the satisfaction of the Secretary. *Note: An offset required under this condition must be proportionate with the significance of the impact or environmental consequence.*	Section 5.1.3.1
	Schedule 4 Condition 6 Extraction Plan (j) Biodiversity Management Plan which has been prepared in consultation with the Biodiversity Conservation Division (BCD), which establishes baseline data for existing habitat, including water table depth, vegetation condition, stream morphology and threatened species habitat, and provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats; endangered ecological communities and water dependant ecosystems.	Section 6 Section 9

Note: Since consent was granted, OEH has become the Biodiversity Conservation Division (BCD) of the Department of Planning, Industry and Environment (DPIE) and DoE has become Department of Agriculture, Water and Environment (DAWE).

5.1.1 Mining Lease

Mining Leases (ML) 1722 and 1744 are the MLs within the Extraction Plan Area to which this document pertains.

5.1.2 Extraction Plan Guidelines

Version 5 of the Extraction Plan Guidelines (NSW Department of Planning & Environment, 2015) identifies requirements for Extraction Plan Sub Plans. The requirements from the Guideline are presented in **Table 2** below.

Table 2 Extraction Plan Guideline Requirements

Extraction Plan Guideline Requirement (Sub-Plans)	Section Addressed
An overview of all landscape features, heritage sites, environmental values, built features or other values to be managed under the component plan	Section 6.1
Setting out all performance measures included in the development consent relevant to the features or values to be managed under the component plan	Section 7
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements (including relevant safety legislation)	Section 3 and 4

Extraction Plan Guideline Requirement (Sub-Plans)	Section Addressed
Proposing performance indicators to establish compliance with these performance measures and statutory requirements	Section 7
Describe the landscape features, heritage sites and environmental values to be managed under the component plan, and their significance. It should be noted that a full description of such features, sites and values would commonly have been provided and considered in a recent environmental impact assessment. Consequently, this section can be relatively brief, and focus on the presentation of appropriate figures and/or graphical plans	Section 6
Describe all currently-predicted subsidence impacts and environmental consequences relevant to the features, sites and values to be managed under the component plan	Section 6.2
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the applicant's commitments	Section 9.1
Describe the existing baseline monitoring network and the current baseline monitoring results, including pre-subsidence photographic surveys of key landscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginal heritage sites);	Section 8
Fully describing the proposed monitoring of subsidence impacts and environmental consequences;	Section 8
Describe the proposed monitoring of the success of remediation measures following implementation;	Section 8
Describe adaptive management proposed to avoid repetition of unpredicted subsidence impacts and/or environmental consequences;	Section 9
Describe contingency plans proposed to prevent, mitigate or remediate subsidence impacts and/or environmental consequences which substantially exceed predictions, or which exceed performance measures;	Section 10
Listing responsibilities for implementation of the plan; and	Section 11
An attached Trigger, Action, Response Plan (effectively a tabular summary of most of the above).	Appendix 2

5.1.3 Subsidence Performance Measures

This BMP provides the management strategies, controls and monitoring programs to be implemented for the management of potential impacts and environmental consequences on land and landforms affected by subsidence from the Mandalong Mine Extraction Plan. The BMP aims to ensure the performance measures in **Table 3** are not exceeded.

Table 3 Performance Criteria (SSD-5144)

Land	Performance Criteria
Threatened species, threatened populations and endangered ecological communities and groundwater dependant ecosystems	Negligible environmental consequences

"Negligible" is defined as per the SSD-5144 "small and unimportant, such as not to be worth considering".

5.1.3.1 **Offsets**

In accordance with Schedule 4 Section 3 of the Development Consent SSD 5144 Conditions, if the performance measures in Table 6 of those Conditions (relevant criteria repeated in **Table 3** above) and the Secretary determines that:

(a) it is not reasonable or feasible to remediate the impact or environmental consequences; or
(b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence,

then a suitable offset to compensate for the impact or environmental consequence would be determined to the satisfaction of the Secretary.

Any offset required under this condition would be proportionate with the significance of the impact or environmental consequence. In the case that offsets are required, the offset requirements would be quantified using BAM (2020) and be commensurate with change quantified in the monitoring results. The offset calculation would have regard for the baseline condition state, as determined through the monitoring program, and Section 8.5 of the BAM (2020; i.e. Adaptive management for addressing uncertain biodiversity impacts). An adaptive management plan to identify and respond to any triggers is factored into the TARP (as provided in **Appendix 2**).

If offsets are required, the credit obligation would be met by:

- Retiring credits owned by Centennial (if suitable credits available);
- Identifying and purchasing the required 'like for like' credits in the market and then retire those credits; or
- Using the offsets payment calculator to determine the cost of the credit obligation, and transfer this amount to the Biodiversity Conservation Fund (BCF).

6 BIODIVERSITY FEATURES AND PREDICTED IMPACTS

This section provides an overview of the key biodiversity features overlying the Extraction Plan Area. A description of the relevant features, including habitats, threatened flora and fauna, groundwater dependent ecosystems (GDEs) and aquatic ecology is provided in **Section 6.1**. This information is based on the following sources (baseline data):

- Mandalong Southern Extension Project – Flora and Fauna Assessment (RPS 2013);
- Mandalong Transmission Line TL24 Relocation Project: Flora and Fauna and Biodiversity Assessment (RPS 2016c);
- Mandalong LW22-24a Annual Biodiversity Monitoring Report (Hunter Eco 2013a, 2013b, 2013c, 2016a, 2016b; RPS 2016a, 2016b, 2016d, 2017a, 2017b, 2018b and 2019a);
- Mandalong LW25-29 Annual Biodiversity Monitoring Report (RPS 2017, 2018c and 2019b);
- 33kV Biodiversity Development Assessment Report (RPS 2018a);
- Preliminary Biodiversity Stewardship Site Application Report (RPS 2018d); and
- Baseline BMP data collection for LW 30-33 (RPS 2019c and 2020).

Section 6.2 describes the predicted subsidence-related impacts on the features described in **Section 6.1**; thus, backgrounds the narrative for management and monitoring measures described in this BMP.

6.1 Relevant Features

6.1.1 Overview

The majority of the surface of the Extraction Plan Area is private land holdings with some Forest NSW (i.e. Olney State Forest) areas to the south of LW 30-31. The Extraction Plan Area has seven rural residential properties (including three dwellings), land owned by Centennial and Central Coast Council, and includes part of Olney State Forest. The western portion of the Extraction Plan Area is located on steeply undulating terrain and is largely undeveloped bush land. Several 1st to 3rd order streams are present, associated with Morans (1st to 3rd), Mannering (1st only) and Buttonderry Creeks (1st and 2nd).

6.1.2 Terrestrial Ecology

Ecological surveys have been conducted over the Extraction Plan Area by RPS (2019c and 2020) to form a baseline dataset to inform the scope of future monitoring. Other large-scale assessments, such as the Mandalong Southern Extension Project, have also been used to inform the design of the survey program.

6.1.2.1 **Vegetation Communities**

Vegetation mapping by Lake Macquarie City Council (Bell and Driscoll 2015; and corresponding PCT conversion table by Bell 2016) was used as a base layer, then updated using field surveys. In total, five vegetation communities were identified within the Extraction Plan Area (see **Table 4** and **Figure 2**). Monitoring programs will be designed utilising this vegetation mapping.

A total of 24 floristic plots were undertaken in accordance with the Biodiversity Assessment Methodology (BAM) as a baseline survey effort within Extraction Plan Area. These baseline floristic plot surveys were undertaken in 2019 and 2020. These plots were spatially stratified to ensure they were representative of ecologically sensitive vegetation communities present. That is, plots were located to target GDEs (including TECs) where ponding impacts associated with LW 30-31 have been predicted. Vegetation communities and locations of baseline plots are shown in **Figure 2**.

Table 4 Vegetation Communities and corresponding Plant Community Types (PCTs) within the Site

Plant Community Types (PCTs)	Commensurate Threatened Ecological Community (TEC)	Impact Area (ha)
PCT 1528 Jackwood - Lilly Pilly -Sassafras riparian warm Temperate rainforest of the Central Coast	Lowland Rainforest in NSW North Coast and Sydney Basin Bioregions	6.69
PCT 1556 – Tallowwood – Smooth-braked Apple – Blackbutt grass tall open forest of the Central and lower North Coast	None	62.54
PCT 1568 Blackbutt – Turpentine Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	None	23.44
PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	None	2.89
PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast.	None	98.72
Sub-total		194.22
Cleared areas		14.54
Total		**208.77**

One Threatened Ecological Communities (TEC) was found within the Extraction Plan Area, being Lowland Rainforest in NSW North Coast and Sydney Basin Bioregions (PCT 1528; BC Act: Endangered EPBC Act: Not Listed). Note that although PCT 1556 can be commensurate of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC, as the Extraction Area is not located on a floodplain, this vegetation is not considered to be consistent with this TEC.

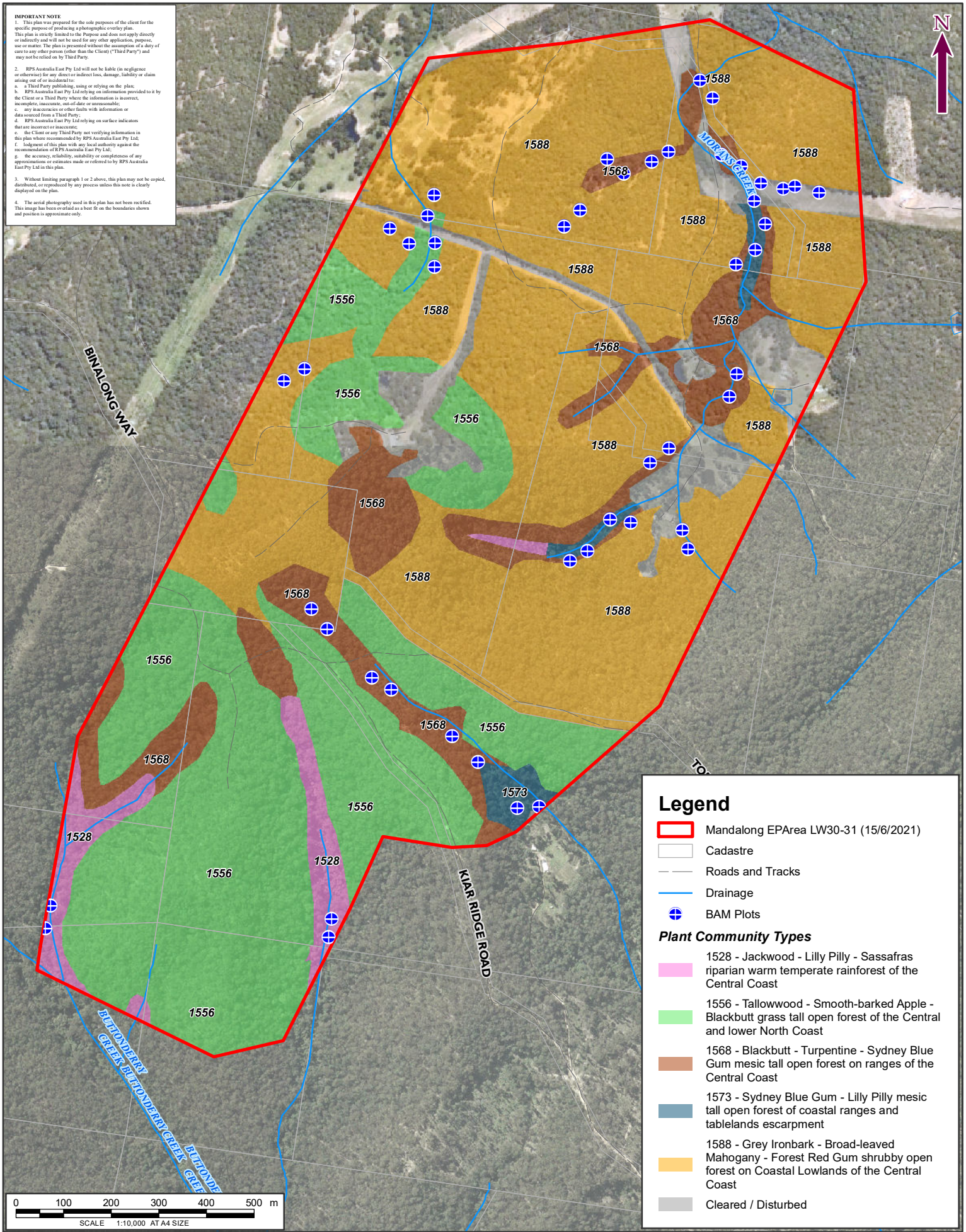

FIGURE 2 : VEGETATION COMMUNITIES

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 17/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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6.1.2.2 **Threatened flora**

Targeted flora surveys focused on species associated with the GDEs that may be impacted by mining-related ponding. Based on the PCTs in **Table 4**, the threatened flora species listed in **Table 5** are considered as having potential to occur. As a precaution, other threatened species with a sporadic distribution and cryptic nature that may occur in the Extraction Plan Area were also surveyed for, which included *Aperula asthenes* (Trailing Woodruff); *Genoplesium insigne* (Variable Midge Orchid); *Thelymitra adorata* (Wyong Sun Orchid); *Syzygium paniculatum* (Magenta Lilly Pilly); *Dendrobium melaleucaphilum* (Spider Orchid); and *Rhizanthella slateri* (Eastern Australian Underground Orchid). All other potential threatened species are non-cryptic or were easily identifiable outside of their flowering period.

Table 5 Threatened Flora species with the potential to be present within the Extraction Plan Area

Scientific Name	Common Name	BC Act	EPBC Act	Records within 10km[1]
Angophora inopina	Charmhaven Apple	V	V	901
Asperula asthenes	Trailing Woodruff	V	V	0
Corybas dowlingii	Red Helmet Orchid	E	-	12
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	5
Cynanchum elegans	White-flowered Wax Plant	E	E	0
Dendrobium melaleucaphilum	Spider Orchid	E	-	0
Diuris praecox	Rough-tail Doubletail Orchid	V	V	0
Eucalyptus parramattensis subsp. *parramattensis*	Parramatta Redgum in Wyong and Lake Macquarie LGAs	E-pop	-	107
Genoplesium insigne	Variable Midge Orchid	CE	CE	18
Maundia triglochinoides	-	V	-	9
Melaleuca biconvexa	Biconvex Paperbark	V	V	695
Melaleuca groveana	Grove's Paperbark			0
Persicaria elatior	Tall Knotweed	V	V	1
Rhizanthella slateri	Eastern Australian Underground Orchid	V	E	0
Rhodamnia rubescens	Scrub Turpentine	CE	-	144
Rhodomyrtus psidioides	Native Guava	CE	-	4
Rutidosis heterogama	Heath Wrinklewort	V	V	166
Syzygium paniculatum	Magenta Lilly Pilly	E	V	2
Tetratheca juncea	Black-eyed Susan	V	V	715
Thelymitra adorata	Wyong Sun Orchid	CE	CE	109

Notes: (V) = Vulnerable Species, (E) = Endangered Species, (CE) = Critically Endangered Species, (E-Pop) = Endangered Population. 1. Search conducted on 30 July 2020 for North: -33.11 West: 151.34 East: 151.49 South: -33.26.

Targeted surveys were undertaken in October and December 2019, May 2020, August 2020, and September 2020 to detect threatened flora species with a moderate or greater likelihood of occurring (see **Section 6.1.1.3;** and survey effort in **Appendix 3**). Targeted surveys were also undertaken on Lot 195 DP755238 during June and August 2018. These surveys were focused on riparian-associated species, in areas where ponding impacts are predicted. Surveys undertaken within private lands were restricted to areas where access permission was granted.

Of these species with potential to occur, *Corybas dowlingii* (Red Helmet Orchid) and *Rhodamnia rubescens* (Scrub Turpentine) were detected. *Tetratheca juncea* (Black-eyed Susan) was found just outside the Extraction Plan Area. **Figure 3** shows the locations of these threatened plants.

6.1.2.3 Groundwater Dependent Ecosystems

GDEs are well defined by Eamus (2009) with a summary definition for these systems provided below:

"There are many types of GDEs, but they can all be classed into one of two types. The first class of GDE relies on the surface expression of groundwater. Swamps, wetlands and rivers are ecosystems that rely on the discharge of groundwater to the surface, either into a river or into a swamp or wetland. Rivers and streams that flow all year (perennially flowing) are generally groundwater dependent because a significant proportion of their daily flow is derived from groundwater discharging into the river course. When groundwater availability declines, river flow is reduced and swamps and wetlands may become dry, temporarily or permanently. The second class of GDEs rely on the availability of groundwater below the surface but within the rooting depth of the vegetation. These terrestrial ecosystems include riparian forests all across Australia, banksia woodlands of Western Australia, eucalypts on the floodplains of the Murray River and plantation forests in South Australia, Victoria and New South Wales. They all require a supply of groundwater within the root zone."

Some vegetation communities are present within the Extraction Plan Area that are consistent with the second class of GDE, as defined by Eamus (2009; as above). That is, some vegetation types within the Extraction Plan Area are dependent on sub-surface flows (i.e. have rooting zones which overlap the sub-surface water interface, such as floodplain vegetation) or are located such that surface flows originate from sub-surface flows (e.g. areas of impeded drainage such as Melaleuca stands).

The potential GDEs within the Extraction Plan Area include:

- PCT 1528 Jackwood - Lilly Pilly -Sassafras riparian warm Temperate rainforest of the Central Coast;
- PCT 1556 Tallowwood – Smooth-braked Apple – Blackbutt grass tall open forest of the Central and lower North Coast;
- PCT 1568 Blackbutt – Turpentine Sydney Blue Gum mesic tall open forest on ranges of the Central Coast; and
- PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment.

The locations of these vegetation communities are shown on **Figure 2**.

There are no GDEs within the Extraction Plan Area and greater Southern Extension Area that are listed in Schedule 4 of the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009. The shallowest depth of cover between a potential GDE and the coal seam is approximately 305 m (DgS 2020).

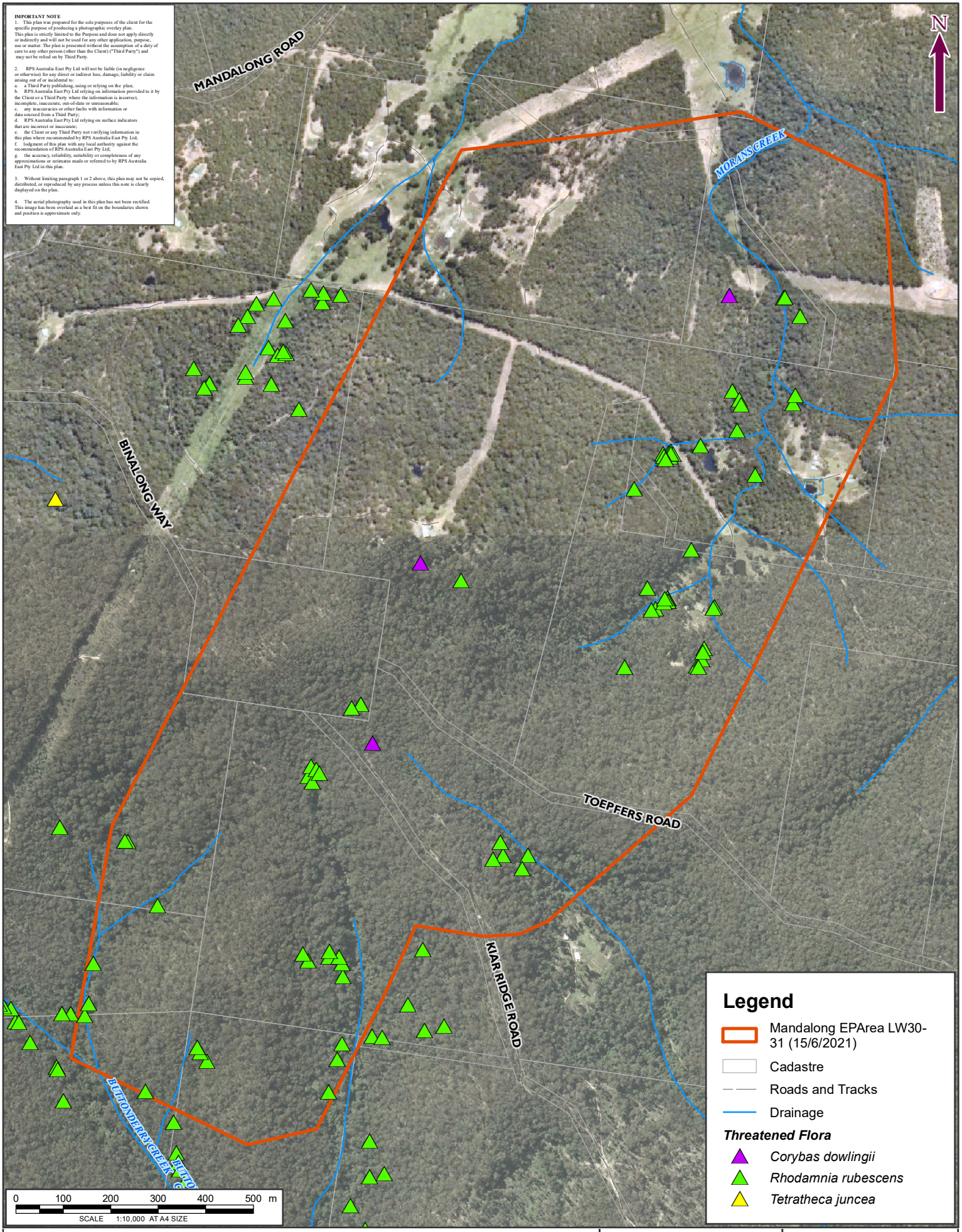

FIGURE 3 : THREATENED FLORA

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 16/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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6.1.2.4 **Fauna**

The results of database searches using the NSW DPIE Atlas of NSW Wildlife (accessed July 2020) and the EPBC Protected Matters Search (accessed July 2020) indicated that 65 threatened fauna species have been previously recorded within 10 km of the Extraction Plan Area and/or have potential habitat within the Extraction Plan Area. Fauna surveys were also conducted as part of the Mandalong Southern Extension EIS (RPS 2013) using the following techniques:

- Terrestrial Elliot trapping;
- Anabats;
- Avifauna Surveys;
- Herpetofauna Surveys; and
- Spotlighting and Call Playback.

This study identified 139 fauna species across the wider Southern Extension Area, comprising 17 mammals, eight species of positively identified microchiropteran bats, 90 birds, five reptiles and 14 amphibians. During that survey effort the following threatened species were detected: Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Gang-gang Cockatoo (*Callocephalon fimbriatum*), Little Lorikeet (*Glossopsitta pusilla*), Powerful Owl (*Ninox strenua*), Varied Sittella (*Daphoenositta chrysoptera*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Yellow-bellied Glider (*Petaurus australis*), Little Bentwing-bat (*Miniopterus australis*) and the Golden-tipped Bat (*Phoniscus papuensis*).

Threatened species detected either within or nearby the Extraction Plan Area by RPS (2019, 2020a and 2020b) were:

- Brown Treecreeper;
- Glossy Black-Cockatoo;
- Grey-headed Flying Fox;
- Sooty Owl;
- Masked Owl;
- Squirrel Glider;
- White-bellied Sea Eagle; and
- Yellow-bellied Glider.

Threatened fauna found within the Extraction Plan Area are shown in **Figure 4**, whilst **Table 6** lists the Threatened fauna species (including those detected; as listed above) that may occur within the Extraction Plan Area.

Table 6 Threatened Fauna species with a moderate or greater likelihood of occurring within the Extraction Plan Area

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records within 10 km
Frogs				
Crinia tinnula	Wallum Froglet	V	-	51
Heleioporus australiacus	Giant Burrowing Frog	V	V	0
Mixophyes balbus	Stuttering Frog	E	V	25
Mixophyes iteratus	Giant Barred Frog	E	E	11
Pseudophryne australis	Red-crowned Toadlet	V	-	1
Litoria aurea	Green and Golden Bell Frog	E	V	3

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records within 10 km
Litoria brevipalmata	Green-thighed Frog	V	-	7
Litoria littlejohni	Littlejohn's Tree Frog	V	V	0
Reptiles				
Hoplocephalus stephensii	Stephens' Banded Snake	V	-	2
Hoplocephalus birorquatus	Pale-headed Snake			0
Birds				
Anthochaera phrygia	Regent Honeyeater	CE	E	11
Botaurus poiciloptilus	Australasian Bittern	E	E	1
Burhinus grallarius	Bush Stone-curlew	E	-	3
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	19
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	50
Chthonicola sagittata	Speckled Warbler	V	-	1
Climacteris picumnus victoriae	Brown Treecreeper	V	-	4
Daphoenositta chrysoptera	Varied Sittella	V	-	22
Dasyornis brachypterus	Eastern Bristlebird	E	E	0
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	19
Epthianura albifrons	White-fronted Chat	V	-	0
Falco subniger	Black Falcon	V	-	0
Grantiella picta	Painted Honeyeater	V	-	0
Glossopsitta pusilla	Little Lorikeet	V	-	37
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	0
Hieraaetus morphnoides	Little Eagle	V	-	4
Irediparra gallinacea	Comb-crested Jacana	V	-	2
Ixobrychus flavicollis	Black Bittern	V	-	8
Lathamus discolor	Swift Parrot	E	E	5
Lophoictinia isura	Square-tailed Kite	V	-	2
Neophema pulchella	Turquoise Parrot	V	-	0
Ninox connivens	Barking Owl	V	-	1
Ninox strenua	Powerful Owl	V	-	39
Oxyura australis	Blue-billed Duck	V	-	0
Pandion cristatus	Eastern Osprey	V	-	1
Petroica boodang	Scarlet Robin	V	-	2
Petroica phoenicea	Flame Robin	V	-	0
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	0
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-	0
Ptilinopus superbus	Superb Fruit-Dove	V	-	1

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Records within 10 km
Rostratula australis	Australian Painted Snipe	E	V	0
Stagonopleura guttata	Diamond Firetail	V	-	0
Tyto novaehollandiae	Masked Owl	V	-	20
Tyto tenebricosa	Sooty Owl	V	-	37
Mammals				
Cercartetus nanus	Eastern Pygmy-possum	V	-	5
Dasyurus maculatus	Spotted-tailed Quoll	V	E	12
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	0
Isoodon obesulus	Southern Brown Bandicoot (eastern)	E	E	0
Phascolarctos cinereus	Koala	V	V	10
Petaurus australis	Yellow-bellied Glider	V	-	183
Petaurus norfolcensis	Squirrel Glider	V	-	129
Potorous tridactylus	Long-nosed Potoroo	V	V	0
Macropus parma	Parma Wallaby	V	-	1
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	1
Pseudomys novaehollandiae	New Holland Mouse	-	V	2
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	129
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	16
Micronomus norfolkensis	Eastern Costal Freetail-bat	V	-	62
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	7
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	22
Phoniscus papuensis	Golden-tipped Bat	V	-	18
Miniopterus australis	Little Bentwing-bat	V	-	80
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	0
Myotis macropus	Southern Myotis	V	-	38
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	41
Vespadelus troughtoni	Eastern Cave Bat	V	-	1
Notes: (V) = Vulnerable Species, (E) = Endangered Species, (CE) = Critically Endangered Species, (E-Pop) = Endangered Population				

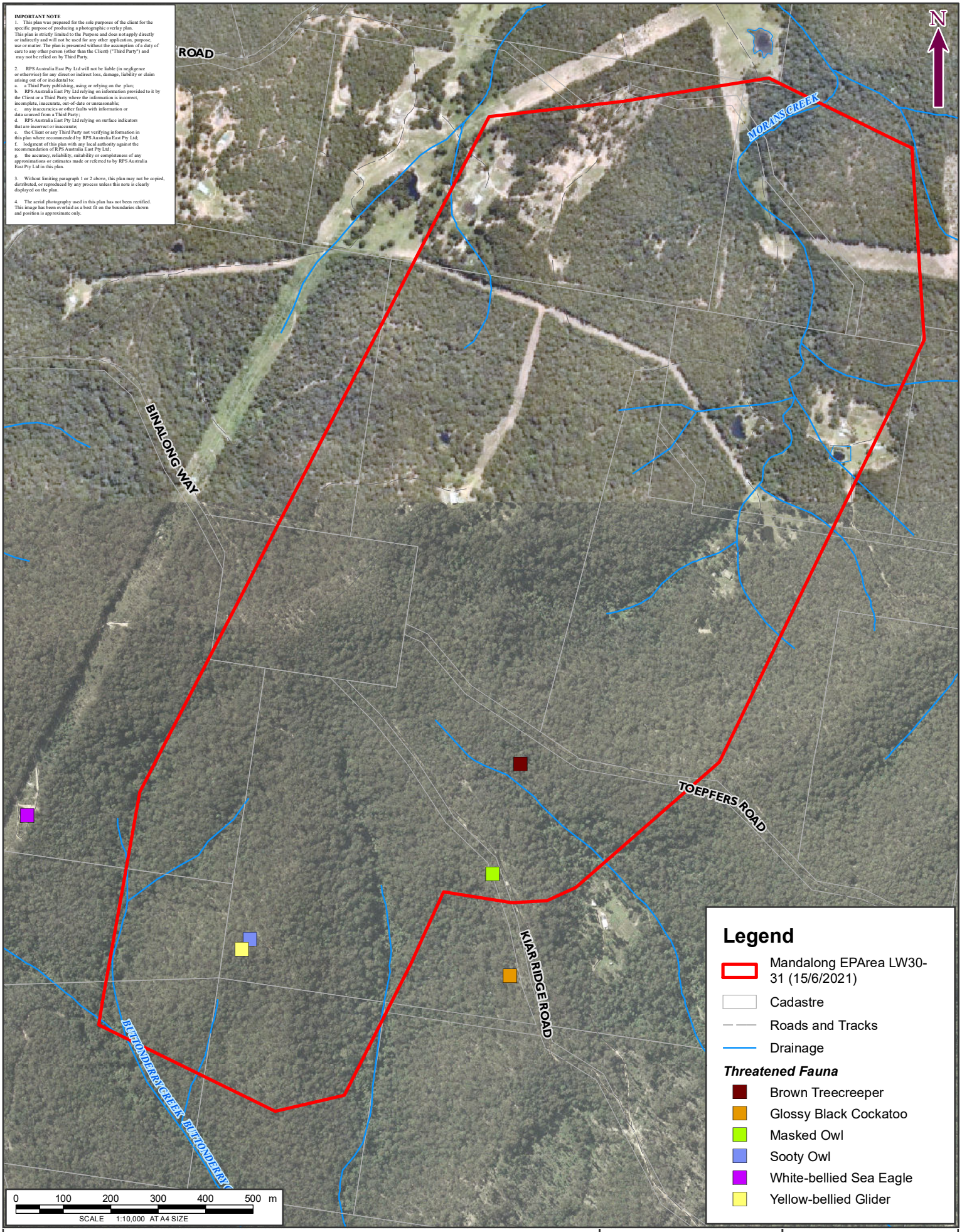

FIGURE 4 : THREATENED FAUNA

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 17/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
Unit 2A, 45 Fitzroy Street, Carrington, NSW, Australia, 2294 PO Box 120, Carrington, NSW, 2294
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6.1.3 Aquatic Ecology

The aquatic habitats associated with the Extraction Plan Area include small farm dams and small (mostly first and second ephemeral) creeks. Areas containing beneficial habitat features for aquatic fauna within and around these creeks include large rocks, fallen logs, dense vegetation and overhanging native plants.

The Extraction Plan Area is located within the Lake Macquarie and Tuggerah Lakes Catchment, which covers an area of 1,630 km^2. The catchment is bound by a series of east flowing streams in the north and the Sugarloaf Ranges to the north-west. The Hawkesbury River acts as a boundary to the south, while the Hunter Range separates the Lake Macquarie and Tuggerah catchments from the Mangrove Creek catchment (DPI 2017).

Surface watercourses of the area are primarily ephemeral, characterised by fast flows during rainfall events and low to no flow throughout the remainder of the year. Morans Creek was the only permanent waterway identified during baseline surveys. When flowing, creeks are known to offer important habitat for frogs and reptiles that associate with water bodies. A variety of small ponds and dams exist across the Extraction Plan Area, especially in the lower areas such as PCTs 1528; 1568 and 1573, and provide habitat for pond breeding frogs and reptiles that inhabit wetter areas (RPS 2017). Within the Extraction Plan Area, Buttonderry Creek and Mannering Creek are ephemeral system, with pooled water generally lacking, except after considerable rainfall.

A baseline aquatic ecology assessment was undertaken using AUSRIVAS protocols. One survey point was surveyed at Morans Creek and Buttonderry Creek in September 2019/2020 and 2020, respectively (i.e. during Spring). The Buttonderry Creek site was located downstream of the Extraction Plan Area since permanent water was lacking upstream.

The results for the baseline 2019 Morans Creek site survey are reported within RPS (2019; site code MA-M03T). The results of the 2020 second Morans Creek baseline and initial Buttonderry Creek survey will be reported within the 2020 Mandalong Annual Aquatic Monitoring Report. Locations of these aquatic monitoring sites are provided in **Figure 5**.

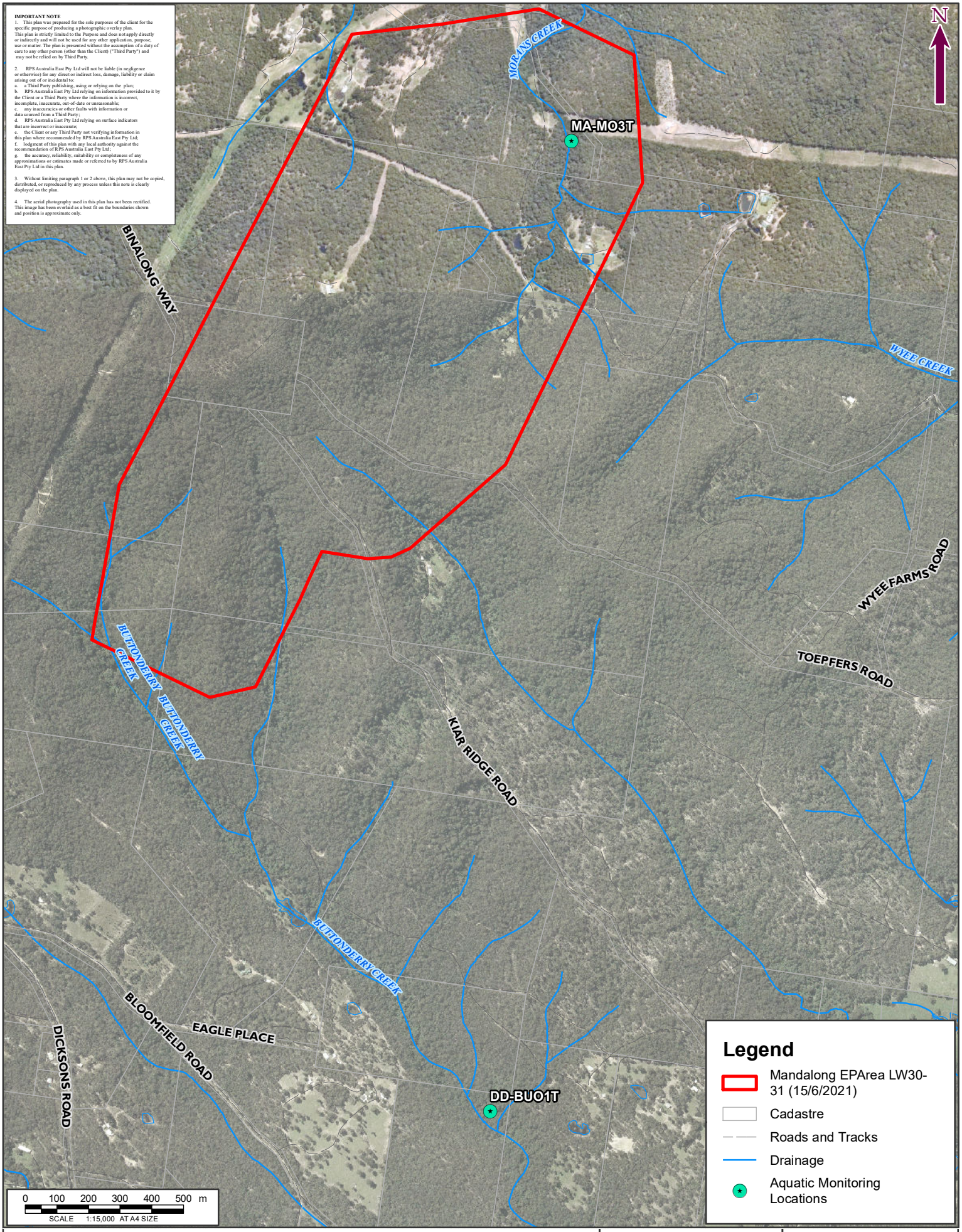

FIGURE 5 : AQUATIC MONITORING SITES

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 18/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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6.2 Predicted Impacts

6.2.1 Predicted Subsidence Impacts and Environmental Consequences

The Extraction Plan Area consists of an undulating landscape (i.e. topographic relief ranges from 40 m to 252 m AHD). Dry woodland typically dominates ridge tops grading to wet sclerophyll forest and rainforest toward the valley floor where first and second order tributaries of Morans, Mannering and Buttonderry Creeks occur. As such, extraction on LW 30-31 has potential to impact terrestrial and aquatic habitat. Subsidence could modify these habitats through surface cracking, erosion resulting from slope changes and modifying hydrological regimes.

As per the DgS (2020), the maximum subsidence expected for the LW 30-33 Extraction Plan Area (inclusive of LW 30-31) ranges from 0.78 to 1.28 m. These values are within 5% of the predictions previously presented in the Mandalong South Extension EIS (GSS Environmental 2013). Additional Subsidence predictions for the Extraction Plan Area are provided in **Table 7**. The potential impacts to biodiversity related to this subsidence are discussed below, as taken from DgS (2013; and 2020).

Table 7 Subsidence Predictions for LW 30-31 (taken from DgS 2020)

Maximum Vertical Panel Subsidence	Maximum Panel Tilt	Maximum Panel Strain
1.28 m	20 mm/m	7 mm/m

6.2.1.1 **Cracking**

Based on the predictions, surface cracks ranging from 30 mm to 70 mm width may occur where shallow or exposed rock exists. Cracking is unlikely to occur where deep soil or alluvium profiles exist, as the strain will be more uniformly distributed and absorbed.

It is noted that surface cracking has been rare above the Mandalong mining panels to-date. Any cracking is likely to be due to the presence of thinly bedded, near surface strata of the Tuggerah and Patonga Claystone Formations that tend to 'shear' into thinner beams during subsidence development, instead of generating fresh vertical cracks. Surface cracking has also been controlled by the panel geometries and the 'strain absorbing' properties of surface alluvium along 3rd and 4th order streams to-date.

The main habitat types that are considered to be affected by surface cracking are those that are permanently or semi-permanently waterlogged, either by surface or groundwater influences. DgS (2013) considers that the creek beds of 3rd and 4th order streams, which would contain these habitats, are very unlikely to develop cracks due to the 'strain absorbing' properties of surface alluvium along these streams. Therefore, freshwater aquatic or swamp habitats are unlikely to be affected by surface cracking.

Temporary sub-surface runoff diversion may also occur if surface cracks develop and interact with open strata bedding and joints. This may temporarily divert surface water from habitats, however outside of the low-lying wetter areas, the majority of habitats within the Southern Extraction Area are naturally dry and free draining, particularly on the steep slopes where cracking depths are predicted to be greatest.

Whilst cracking may cause changes to the characteristics of the landscape, particularly upon slopes, this should result in only minor modifications to habitats. The generally steep slopes of the Extraction Area are generally dry with well-drained soil and underlying strata types. Whilst cracking may divert some surface water flows, these would be localised. Given that the habitats over these sloping areas

are drier habitat types, those species reliant on them are unlikely to be significantly affected by minor changes in surface hydrology as a result of cracking.

The wetter habitat types, including GDEs within 3rd or higher order streams are unlikely to be affected by surface or subsurface cracking, both in terms of water availability and quality. This is supported by the maintenance of both groundwater level and quality for previously mined areas within the wider Mandalong lease area. Therefore, any flora and fauna species that may be reliant on these habitat resources are unlikely to be affected by cracking caused by underground mining.

6.2.1.2 **Ponding**

As reported by DgS (2013), minor cracking in first and second order creek beds may occur where shallow bed rock exposures exist and cause some shallow, sub-surface re-routing of surface flows. Valley closure movements of less than 200 mm are expected across the creeks and gullies; however, cracking impacts due to these are considered unlikely.

Changes to surface gradients along creek beds of approximately ±2% or 1° will result in only minor erosional impacts as previously described in the Mandalong Southern Extension Project EIS (GSS Environmental 2013).

In-channel ponding is likely to decrease slightly along Morans Creek (<2%) as a result of the proposed modification. Existing ponding depths range from 0.5 m to 1.14 m along Morans Creek. At the completion of LW 30-31, potential ponding depths are expected to range from 0.47 m to 0.63 m (DgS 2020).

These changes in ponding patterns and erosion may lead to localised impacts upon the following GDEs, which boarder tributaries in the Extraction Plan Area:

- PCT 1528 Jackwood - Lilly Pilly -Sassafras riparian warm Temperate rainforest of the Central Coast;
- PCT 1566 Tallowwood – Smooth-braked Apple – Blackbutt grass tall open forest of the Central and lower North Coast;
- PCT 1568 Blackbutt – Turpentine Sydney Blue Gum mesic tall open forest on ranges of the Central Coast; and
- PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment.

Modified flow conditions and extent of ponding, as a result of the predicted subsidence may have some unexpected impacts on aquatic ecosystems within Morans Creek.

DgS (2020) report that no pre- or post-mining ponding or erosion impacts are expected along the Buttonderry Creek tributary.

As a result of the limited potential for changes to water quantities, including annual flow volumes, baseflows and environmental flows, Umwelt (2020) also concluded that downstream users are unlikely to experience significant changes to water availability due to the Modification 9 (which includes assessment of flooding arising from subsidence related to LW30-31).

7 PERFORMANCE MEASURES AND INDICATORS

Compliance with the biodiversity performance measures is determined through the comparison of monitoring data with the performance indicators. Performance indicators for the Extraction Plan Area are outlined in **Table 8** together with the corresponding monitoring program described in **Section 9** and **10**. The monitoring program will be used to demonstrate that the environmental performance satisfies relevant performance indicators.

7.1 Assessment of Subsidence Performance Measures

A summary of subsidence performance measures is presented in **Table 8** below. Additional performance and monitoring measures include the measurement of subsidence underground and on the surface.

Table 8 Performance Measures

Parameter: Biodiversity	Performance Criteria	Performance Indicators	Action response
Aquatic habitat and ecology	Negligible (as defined by the consent) environmental consequences	The performance indicators for escalating risk conditions are detailed within the TARP (see **Appendix 2**). In general, various TARP responses will be triggered if: • Subsidence monitoring identifies a significant exceedance in subsidence values or trend; • A change is identified by biodiversity monitoring for related management plans that is greater than negligible; • A change in measured outcomes that is not negligible occurs.	If the performance indicators are triggered the data will be reviewed against the control site data to infer whether the performance indicator exceedance is mining related. If impacts are deemed to be mining related further investigations will be undertaken. Targeted monitoring of sensitive biodiversity features in the affected area will be undertaken where appropriate. Monitoring will be designed at the time (as soon as possible) of detected triggers for impact in relation to the impacted habitat types and relevant threatened species.
Threatened species, threatened populations, EECs and groundwater dependent ecosystems	Negligible (as defined by the consent) environmental consequences	The performance indicators for escalating risk conditions are detailed within the TARP (see **Appendix 2**). In general, various TARP responses will be triggered if: • Subsidence monitoring identifies a significant exceedance in subsidence values or trend; • A change is identified by biodiversity monitoring for related management plans that is greater than negligible; • A change in measured outcomes that is not negligible occurs.	If the performance indicators are triggered the data will be reviewed against the control site data to infer whether the performance indicator exceedance is mining related. If impacts are deemed to be mining related further investigations will be undertaken. Targeted monitoring of sensitive biodiversity features in the affected area will be undertaken where appropriate. Monitoring will be designed at the time (as soon as possible) of detected triggers for impact in relation to the impacted habitat types and relevant threatened species.

8 BIODIVERSITY MONITORING PROGRAM

Monitoring within the Extraction Plan Area is to be performed prior to the commencement of secondary extraction from LW 30-31. The monitoring program performed in relation to the secondary extraction of coal will collect data prior to the initiation of longwall mining (i.e. 'baseline') and after mining (i.e. impact or after data). The monitoring of control or reference sites may also be performed for a detailed analysis of impacts. Information contained in this BMP is limited to two matters (i.e. Terrestrial and Aquatic biodiversity). Reference to relevant components of other monitoring programs is made, where needed, to address specific parts of the conditions of consent. Monitoring frameworks for these areas is outlined in the following sections.

8.1 Monitoring Design

Centennial Mandalong will continue to employ the management strategies and mitigation measures that are currently in place at Mandalong Mine to manage subsidence and mitigate associated impacts, including monitoring of surface features and infrastructure above active mining areas. Subsidence management will continue to be via mine design developed by geotechnical experts, with on-going monitoring providing the mechanism to confirm predictions and identify any impacts.

8.1.1 Monitoring Design

This monitoring program has been developed considering a BACI (Before-After, Control-Impact) methodology where practical and feasible. The principles of a BACI monitoring design has been adopted in this BMP. A BACI design involves data collection at monitoring sites where impacts are expected and corresponding control/ reference sites before and after the impact event (Underwood 1991). This monitoring design is preferred over a simple Before-After monitoring model as it has capacity to assign causation to observed change (e.g. distinguish between the effects of mining or some other unrelated environmental factor) rather than simply detect change.

Baseline (before) data will be collected to supplement existing datasets. Repeated sampling of BACI monitoring sites would be performed over time for the purposes of detecting and quantifying change. This process will evaluate the effectiveness of management activity and, where relevant, provide insight into how the management regime may be adapted to achieve the objectives of the BMP.

The following sections outline the methodological and analytical elements of the monitoring program.

8.1.2 Baseline Data

The purpose of monitoring is to evaluate the actual impact of the project against the performance criteria/ measures specified in the development consent (see **Section 5.1**). To allow detection of impacts, a baseline monitoring dataset was collected. This baseline data set focused on areas where ponding is predicted, and included:

- Targeted flora searches (according to **Table 5**);
- BAM plots (according to **Section 6.1.1.1**);
- Establishment of monitoring plots (or recording of individuals if applicable) for threatened flora species (according to **Section 6.1.1.2**);
- Identification of bat roosts and establishment of monitoring locations (a cave survey was undertaken to identify potential threatened bat roosts); and
- AUSRIVAS Aquatic ecology survey (according to **Section 6.1.2**).

Locations of baseline monitoring efforts are provided in **Appendix 3**. Ongoing monitoring activities will be consistent with the sampling methods, locations and timing specified in the above investigations.

8.1.3 Monitoring Program

8.1.3.1 Routine monitoring

Each biodiversity value is to be monitored two years prior to, during mining and for two years after mining. **Table 9** and **Table 10** describe the monitoring stratification, parameters and frequency for each biodiversity value.

Table 9 Monitoring Program – Terrestrial Biodiversity

Biodiversity Value	Monitoring locations/ Stratification Units	Monitoring Parameters	Monitoring Frequency
Rhodamnia rubescens, *Corybas dowlingii* and any other threatened flora species identified during ongoing surveys with potential to occur in riparian areas (e.g. species listed in **Table 5**)	Representative sample of known locations of *R. rubescens*, ideally monitored against reference populations.	Persistence/ condition assessments	Annually
Vegetation communities and threatened species habitat assessments (EECs and GDEs) to assess potential impacts from predicted ponding	PCT 1528 PCT 1556 PCT 1568 PCT 1573	BAM plots to assess vegetation condition	Annually
Cave-associated threatened bats (e.g. species listed in **Table 6**)	Representative sampling of bat activity adjacent to suitable cave habitat, ideally monitored against reference populations.	Bat activity levels (i.e. bat echolocation call frequency) Cave entrance watch at dusk; Harp trapping (if maternity roost of threatened cave-associated bat suspected)	Annually
Brush-tailed Rock Wallaby	Representative sampling of Brush-tailed Rock Wallaby adjacent to suitable habitat, ideally monitored against reference populations.	Brush-tailed Rock Wallaby activity using infrared camera traps (if found to be present during baseline monitoring)	Annually
Note: for each monitoring parameter a single sample t-test comparing baseline with current data should be conducted, where any significant differences (P≤0.10) will be reported (where replication is sufficient).			

Table 10 Monitoring program – Aquatic Biodiversity

Biodiversity Value	Monitoring locations/ Stratification Units	Monitoring Parameters	Monitoring Frequency
Water Quality and Macroinvertebrate Surveys	Larger Creeks with permanent flows within the Extraction Plan Area (or immediately downstream if permanent water is not sufficiently available in this area)	Invertebrate species diversity and water quality – pH, EC (In accordance with NSW AUSRIVAS)	Annually (during Spring)
Amphibian Surveys	Creeks and dams within the Extraction Plan Area	Diurnal and nocturnal amphibian searches during spring and summer over four nights	Ideally following rainfall (Oct – Mar). Sampling to occur following 100mm or more rain within a 24hr period, if possible.
Note: for each monitoring parameter a single sample t-test comparing baseline with current data should be conducted, where any significant differences (P≤0.10) will be reported (where replication is sufficient).			

8.1.3.2 Investigative Monitoring

Additional monitoring may be warranted in the event of a 'condition RED' exceedance in the Trigger Action Response Plan (TARP) (see **Section 10** and **Appendix 2**). **Table 11** outlines the survey methods, effort per stratification unit and duration/ timing to be performed if a condition RED TARP exceedance is encountered.

Table 11 Monitoring Methods, Locations and Timing

Biodiversity Value	Survey Method	Survey Effort	Survey Period
Threatened fauna species	1 trapline consisting of: - Terrestrial Elliot A traps (25 per line) - Terrestrial Elliot B traps (25 per line) - Arboreal Elliot Trapping (6 per line) - Harp Trap (1 per line) - Anabat (1 per line)	One trapline per stratification unit	Conducted Spring or Summer annually
	Spotlighting (two nights)	Conducted over suitable habitat within entire Extraction Plan Area	
	Call Playback (two nights)		
	Diurnal Bird Surveys (four)		
	Herpetofauna searches (four)		

8.1.4 Species Specific Monitoring

Species with potential to be impacted by subsidence are focal species for monitoring. **Table 12** describes the recommended survey times for known or potentially occurring threatened flora. Threatened flora identified during these survey efforts will be subject to ongoing monitoring, in attempt to detect mining-related impacts if they occur.

Two threatened flora species, *Rhodamnia rubescens* (Scrub Turpentine) and *Corybas dowlingii* (Red-helmet Orchid), were identified within the Extraction Plan Area (refer to **Figure 3**), which are to be monitored in accordance with **Table 9**. Future monitoring events may identify additional species to be monitoring, which are listed below in **Table 12**. If any of the below listed species are identified during ongoing monitoring, they will require monitoring if a RED TARP exceedance is encountered.

Table 12 Known and Potentially Occurring Threatened Flora Flowering Periods

Threatened Flora Species	Recommended Survey Time[1, 2]											
	January	February	March	April	May	June	July	August	September	October	November	December
Angophora inopina	■	■	■	■	■	■	■	■	■	■	■	■
Asperula aesthenes										■	■	■
Corybas dowlingii[3]						■	■					
Cryptostylis hunteriana											■	■
Cynanchum elegans	■	■	■	■	■	■	■	■	■	■	■	■
Dendrobium melaleucaphilum								■	■			
Diuris praecox								■				
Eucalyptus parramattensis subsp. *parramattensis*	■	■	■	■	■	■	■	■	■	■	■	■
Genoplesium insigne									■	■	■	
Maundia triglochinoides											■	■
Melaleuca biconvexa	■	■	■	■	■	■	■	■	■	■	■	■
Melaleuca groveana	■	■	■	■	■	■	■	■	■	■	■	■
Persicaria elatior	■	■	■	■	■							■
Rhizanthella slateri										■	■	■
Rhodamnia rubescens[3]	■	■	■	■	■	■	■	■	■	■	■	■
Rhodomyrtus psidioides	■	■	■	■	■	■	■	■	■	■	■	■
Rutidosis heterogama	■	■	■	■	■	■	■	■	■	■	■	■
Syzygium paniculatum			■	■	■							
Tetratheca juncea								■	■			
Thelymitra adorata								■	■			

1. Survey periods adopted from DPIE's BioNet (as of 30 July 2020).
2. Boxes show timing of threatened species searches during baseline survey efforts.
3. Species found by RPS inside Extraction Plan Area (2019, 2020a and 2020b).

8.1.5 Statistical Analysis

Depending on suitability, the statistical analysis methods listed below will be performed on monitoring data to evaluate if a mining related change has occurred:

- Hierarchical agglomerative cluster analysis (producing a similarity matrix);
- Permutational multivariate analysis of variance (PERMANOVA) to test for statistical differences amongst years and or treatment (i.e. Extraction Plan Area vs Controls);
- Non-Metric Dimensional Multidimensional Scaling (nMDS) to visualise patterns in the data; and or
- SIMPER analysis to examine which habitat components most contribute to observed change (if detected).

Statistical analysis would be performed in a software package such as Plymouth Routines in Multivariate Ecological Research (PRIMER).

8.2 Groundwater Monitoring

The LW 30-31 mine plan has been designed with the intention of not creating continuous cracking from the underground mine workings to the alluvium, which would cause draining of the alluvium into the workings. The Munmorah Conglomerate plays an important role in terms of limiting sub-surface cracking and it appears very unlikely that continuous cracking will extend above the conglomerate beam with the longwall widths being limited to 200 m (DgS 2013).

A comprehensive groundwater and surface water monitoring program has been developed by Mandalong Mine, as detailed in the Mandalong Mine: Water Management Plan (GHD 2019). The main objective of surface and groundwater monitoring is to confirm that the performance of water management measures implemented function as designed. The monitoring requirements specifically for LW30-31 are outlined in the LW30-31 Extraction Plan Water Management Plan (GHD 2020), which includes:

- Surface water quality monitoring is undertaken within Morans Creek and Stockton Creek;
- Surface water flow monitoring on Morans Creek approximately 8 km downstream of Longwall 30;
- Flood path monitoring for each reach above longwall panels to define the pre-mining channel condition and subsidence induced changes to stream characteristics;
- Monitoring of flooding occurs following rainfall events that exceed 100 mm in 24 hours, which is equivalent to the one year average recurrence interval (ARI), 24 hour storm event; and
- Monitoring of groundwater bores MSGW03A, MSGW03B, MSGW03C, MSGW04A, MSGW04B and MSGW04C will allow for the assessment of potential change during the mining of Longwalls 30 to 31 due to proximity (within 2 km) to the longwalls.

9 ADAPTIVE MANAGEMENT

An Adaptive Management Framework provides for flexible decision making, adjusted to consider uncertainties as management outcomes are understood. Through feedback to the management process, the management procedures are changed in steps until monitoring shows that the desired outcome is obtained. The monitoring program has been developed so that there is statistical confidence in the outcome.

In adaptive management the goal to be achieved is set, so there is no uncertainty as to the outcome, and conditions requiring adaptive management do not lack certainty, but rather they establish a regime which would permit changes, within defined parameters, to the way the outcome is achieved.

The Centennial Adaptive Management Framework is a process of ongoing testing, learning, monitoring and managing and relies on:

- Description of the environmental value and its role in the landscape, including aspects of an operation that may result in a significant impact to the environmental value (not all aspects of a project will generate impacts);
- A model of the environmental response to certain management actions/decisions, supported by the description of the environment;
- Mechanisms to test the model;
- Engagement with relevant stakeholders in the description of the environment and development of models, model outcomes and management actions/decisions;
- Identification of clear management objectives for each environmental value;
- Monitoring the system using best available technologies and multiple lines of evidence to:
    - Evaluate progress against objectives;
    - Determine the status of the system;
    - Increase our understanding of the system; and
    - Refine the modelling where applicable.

An adaptive management response would be detailed in an 'Investigation Report' prepared as a response to issues identified in the monitoring program. A management response may be developed and would be based on the monitoring data as supplemented by expert advice, if sought.

Specific performance criteria may be specified for these matters in this investigation report to reflect the management specifications provided and are termed 'investigation performance criteria'. These 'investigation performance criteria' are designed to evaluate the effectiveness of remedy management actions, are designed to be temporary and are supplementary to the performance and completion criteria specified in this BMP.

9.1 Measures to be Implemented to Remediate Potential Impacts

Due to the minimal subsidence and mine design criteria as presented in **Section 6.3**, the need to implement remediation measures for potential impacts are considered unlikely. However, in the event that remediation is required, Mandalong will undertake remediation in consultation with the relevant land holders and NSW Government Agencies.

A Response Strategy will be adopted if a significant impact is detected as a result of mining activities within the LW 30-31 Extraction Plan Area. This will involve the consideration of offsets subject to the satisfaction of the Secretary (see **Section 5.1.3.1**).

10 CONTINGENCY PLAN

A Trigger Action Response Plan (TARP) has been developed using the performance indicators for land management (**Appendix 2**). The contingency plan where a performance indicator has been exceeded is outlined in the TARP. A trigger will result in additional investigations to determine if the exceedance is related to non-mining-factors or is a consequence of mining activity. The response to these exceedances will follow the TARP. Management / corrective actions can be implemented where required to remedy these non-conformities and report accordingly.

11 ROLES AND RESPONSIBILITIES

The responsibility for implementation, monitoring and review of the BMP lies with the Environment and Community Coordinator. The ultimate responsibility for the implementation of the BMP lies with the Mine Manager, who shall make appropriate resources available. The roles and responsibilities for the Mandalong Mine BMP are outlined in **Table 13**.

Table 13 Key Personnel and Accountabilities

Position	Responsibility
Mine Manager	• Ensuring that sufficient resources are available to implement and execute the requirements of this BMP; • Reporting triggers/non-conformances to external stakeholders; and • Approving revised versions of this BMP.
Environment and Community Coordinator	Implementation, monitoring and review of this BMP, including: • Coordinate environmental monitoring, reporting, inspections, environmental training, authority liaison, maintaining complaints register, community liaison; • The implementation and adherence to this BMP; • Reporting triggers/non-conformances internally to the Mine Manager as appropriate; • Consultation during the review process with relevant stakeholders and distributing this BMP; • Coordinating any remediation work as required; • Coordinating the generation and submission of formal reporting requirements outlined in this BMP (e.g. Six-monthly Environmental Monitoring Report and the Annual Review); and • Reviewing this BMP.

12 REPORTING

Reporting will be completed in accordance with the Guidelines for the Preparation of Extraction Plans, as summarised in **Table 14** below. Reports will be completed by the Mining Approvals Coordinator or Environment and Community Coordinator.

Table 14 Reporting Requirements

Report	Trigger	Requirements
Incident Reporting	Any occasion or incident in accordance with consent condition or TARP.	In accordance with requirements of consent condition or TARP.
Bi-Monthly Subsidence Impact Reporting	If a new impact is identified, compile after monthly subsidence.	Distinguish impact: • within predictions; • those which exceed predictions but remain within performance measures and/or performance indicators; and • those which exceed performance measures and/or performance indicators. Report to include: • full description; • location identification using aerial photos with mining layout superimposed; • photos of the impact; and • preliminary characterisation of the impact in accordance with the relevant TARP(s).
Annual Review	Annual Report required under development consent.	Report to include: • Reports of impacts and environmental monitoring results; and • summary of subsidence impacts.

13 CONTINUAL IMPROVEMENT AND REVIEW

In accordance with the requirements of Schedule 6, Condition 7 of Development Consent SSD-5144, Centennial Mandalong will review this Plan within three months of the following:

a) Submission of an incident report;
b) Submission of an Annual Review;
c) Submission of an Independent Environmental Audit; or
d) The approval of a modification to the conditions of SSD-5144.

Continual improvement shall be achieved through monitoring, internal and external communication with stakeholders, implementation of corrective and preventative actions and through monitoring progress against the objectives included in the environmental management plans. During each report submission, a test of this document will be undertaken through comparing the predicted negligible impacts of subsidence on biodiversity values against actual outcomes.

Each variation to this Plan will be identified in the Document Control Table at the beginning of this document.

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APPENDIX 1 - Consultation with DPIE

----- Forwarded by Jeffrey Dunwoodie/CentennialCoal on 10/02/2021 01:00 PM -----

From: "Steven Cox" <Steven.Cox@environment.nsw.gov.au>
To: "Jeffrey Dunwoodie" <Jeffrey.Dunwoodie@centennialcoal.com.au>
Cc: "Robert Gibson" <Robert.Gibson@environment.nsw.gov.au>
Date: 09/02/2021 02:31 PM
Subject: RE: Centennial Mandalong LW30-31 Extraction Plan - Biodiversity Management Plan

---

Hi Jeff,

Apologies for the delayed response. I thought I had replied earlier, but clearly I didn't.

Thank you for providing the Biodiversity and Conservation Division (BCD) of the Department of Planning, Industry and Environment (DPIE) with the opportunity to comment on the Centennial Mandalong LW30-31 Extraction Plan - Biodiversity Management Plan. However, on this occasion BCD has been unable to review the plan (due to workload pressures) and will not be providing comment on the plan.

Please provide a copy of the plan to the relevant division of DPIE without comment from BCD.

While we were unable to comment on this occasion, we look forward to any potential opportunity to comment on future versions/revisions of the plan.

Regards
Steven

Steven Cox
Senior Team Leader Planning, Hunter Central Coast Branch

Biodiversity and Conservation Division | Department of Planning, Industry and Environment
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Currently working from home during Covid-19 restrictions and can be contacted on both above phone numbers.

NSW GOVERNMENT | Planning, Industry & Environment

From: no-reply@majorprojects.planning.nsw.gov.au <no-reply@majorprojects.planning.nsw.gov.au>
Sent: Monday, 7 June 2021 4:45 PM
To: James Wearne <James.Wearne@centennialcoal.com.au>
Cc: james.mcdonough@dpie.nsw.gov.au
Subject: Mandalong Coal Southern Extension - Extraction Plan LW30-31 SSD-5144-PA-34 - Request for Additional Information

Dear James Wearne,

The Department is requesting that you provide additional information in relation to the Mandalong Coal Southern Extension - Extraction Plan LW30-31.

Please access your profile for details of this request and to upload your response. You are requested to provide this response by 5/07/2021 .

If you have any enquiries, please contact James McDonough on 02 9585 6313 /at james.mcdonough@dpie.nsw.gov.au .

To sign in to your account click here or visit the Major Projects Website.

Please do not reply to this email.

Kind regards

The Department of Planning, Industry and Environment

The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and loca...

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Planning, Industry & Environment

Mr James Wearne
Group Environment & Approvals Manager
Centennial Mandalong Pty Limited
PO Box 1000
TORONTO NSW 2283

07/06/2021

Dear Mr Wearne

Mandalong Southern Extension Project (SSD-5144)
Extraction Plan – Longwalls 30 - 31
Request for Information

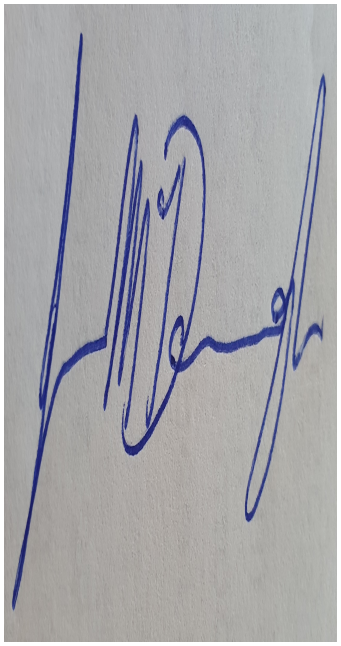
I refer to the Extraction Plan (EP) dated March 2021, and subsequent EP variation dated 26 May 2021, for Longwalls 30 and 31 at the Mandalong Mine, submitted in accordance with condition 6 of Schedule 4 of the Mandalong Southern Extension Project development consent (SSD-5144).

The Department has reviewed the EP in consultation with the Department of Planning, Industry and Environment's Biodiversity and Conservation Division (BCD) and Heritage NSW. Review comments for your attention are provided in Attachments A, B and C. The Department is satisfied that these matters can be addressed in a timely manner, however they are important to the effective management of impacts to the natural and built features within the proposed EP area.

The attached comments must be addressed to the satisfaction of the Secretary prior to the Department granting its final approval of the EP (as varied). Please upload revised versions of the EP and relevant sub-plans to the Major Projects portal at your earliest convenience.

If you have any questions, please contact James McDonough on 02 9585 6313.

Yours sincerely



James McDonough
Team Leader
Resource Assessments (Coal & Quarries)

Attachments:
Attachment A – DPIE Review Comments
Attachment B – Heritage NSW advice
Attachment C – Biodiversity and Conservation Division advice

Attachment A
Mandalong Southern Extension Project SSD5144
Extraction Plan Longwalls 30-31
Review Comments – 07 June 2021

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
6. The Applicant must prepare an Extraction Plan for all second workings on site, to the satisfaction of the Secretary. Each Extraction Plan must:	-	Extraction Plan (EP) for Longwalls 30-31 submitted to the Department on 21 April 2021.	Nil
(a) be prepared by suitably qualified and experienced persons whose appointment has been approved by the Secretary;	Yes	On 22 October 2020 the Secretary approved the appointment of Mr Phil Enright to prepare the Extraction Plan main document, Built Features MP, Property Subsidence MPs, Land MP, Public Safety MP, Subsidence Monitoring Program, TARPs and Contingency Plans. Also approved various specialists for WMP, BMP and HMP.	Nil
(b) be approved by the Secretary before the Applicant carries out any of the second workings covered by the plan;	Yes	Secondary extraction is scheduled to start in July 2021 for LW30 and complete LW31 in April 2022.	-
(c) include detailed plans of existing and proposed first and second workings and any associated surface development;	Yes	Graphical Plans of existing and proposed workings, as well as surface features, are included as attachments to the main Extraction Plan.	Nil
(d) include detailed performance indicators for each of the performance measures in Tables 6 and 7;	Yes	• Main EP - Section 3.5 - includes the performance measures and indicators and are high level and general. However, it is noted that the Trigger Action Response Plans (TARPs) for water, land, biodiversity, heritage, built features, public safety and properties are included in the Individual MPs, and are detailed and reflect the performance measures in Tables 6 and 7. See comments on triggers below. • Section 4.2 references the following key component plans and which have been submitted in support of the Main EP: o Built Features MP o Property Subsidence MP o Water MP o Biodiversity MP o Land MP o Heritage MP	Nil

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
		○ Public Safety MP ○ Subsidence Monitoring Program and ○ Trigger Action Response Plans. Each key component plan has been reviewed individually below.	
(e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since the commencement date of this consent;	Yes	Subsidence predictions are provided as part of the main EP document. They are also provided as part of the EP variation dated 27 May 2021.	Update the main EP document to make reference to the most recent subsidence prediction report, as per the EP variation lodged 27 May 2021.
(f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 6 and 7, and manage or remediate any impacts and/or environmental consequences;	Yes	High-level subsidence management strategies (including avoidance, adaptive management and the use of TARPs) are described in Section 3.7 of the main EP document. More detailed subsidence management and remedial strategies for each natural and built feature are provided in the relevant management plans. Considered adequate.	Nil
(g) include a Built Features Management Plan, which has been prepared in consultation with RR and the owners of affected built features, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which:	Partial	An Built Features Management Plan (BFMP) for LWs 30 to 31 is outlined in Section 4.7 of the main EP, and provided in Volume 3 of the EP. The BFMP includes the following sub-plans which have been provided in full: • Public Roads Management Plan – identifies two public roads and some unnamed Crown Roads and two private access roads to be impacted. Pre and post mining management measures adequate and Crown Lands and LMCC consulted. TARP satisfactory. • Communication Management Plan – Telstra has both overhead cables and underground pits and conduits through EP area. Adequate monitoring program accepted by Telstra. TARP satisfactory. • Powerline Management Plan – note: an Ausgrid 11kV line traverses the EP area, supplying a limited number of properties. Three power poles are predicted to be impacted with between 0.5 m to 1.2 m of vertical subsidence. Mitigation measures proposed by Ausgrid & Centennial committed to implementing. Ongoing monitoring of subsidence crosslines, and annual reporting. TARP satisfactory.	• Powerline MP – Figures 1, 2 and 3 do not label/number the individual Transgrid local powerlines to reference against subsidence impacts included in Table 9. Please update the figures accordingly.

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
		Section 4.2 and Table 4.2 of the main EP document summarises the consultation undertaken with the Resources Regulator, Crown Lands, Ausgrid, Telstra in relation to the BFMP. Consultation is further described in each respective management plan and copies of the correspondence is appended to the plans.	
• addresses in appropriate detail all items of key public infrastructure (with particular consideration to tension/angle/suspension towers on transmission lines), and other public infrastructure;	Yes	All key items of public infrastructure in the EP area appear to have been addressed.	Nil
• has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;	Yes	Section 4.2 and Table 4.2 of the main EP document summarises the consultation undertaken with the Resources Regulator, Crown Lands, Ausgrid, Telstra in relation to the BFMP. Table 4.2 of the main EP indicates that the owners have endorsed and/or indicated satisfaction with the plans. Further discussion on consultation and copies of correspondence is provided in the appendices to the individual management plans.	Note: Main EP document - Section 8.1 contains an incorrect reference to Table 10, should be Table 9 – please amend.
• recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and	Partial	Section 5.5 and Section 3.5.2 of the main EP document contains performance indicators and TARPs for each built feature, including remedial measures respectively. **Note:** It is not clear in the main EP document where the timeframes for notification to agencies and relevant stakeholders following the trigger of a relevant TARP and the implementation of actions required under the TARPs is mentioned or located.	Please include clear reporting timeframes and notification obligations relating to the TARPs in both the main EP document and cross check all individual TARPs for measurable notification timeframes. These should reflect the requirements in Schedule 5 of SSD-5144.
• in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner), and provides for annual auditing of compliance and effectiveness during extraction which may impact the infrastructure;	Yes	• Section 7 of the BFMP confirms that Centennial Mandalong has adopted the Stature Risk Assessment Program which is consistent with ISO 31000. The company completed this risk assessment process for the built features affected by subsidence from extraction of LWs25 to 31, with the results summarised in Appendix 4 of the EP and Section 7 of the BFMP. • Section 15 provides a commitment to annual auditing of the requirements of the BFMP.	Nil

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
(h) include a Property Subsidence Management Plan for each privately-owned property affected by the proposed second workings, prepared in consultation with the landowner, which includes:	Partial	Electronic copies of the Property Subsidence Management Plans (PSMPs) for all nine properties located within the EP area have been provided in Volume 3 of the EP. Considered adequate. Section 4.2 (Table 4.2) of the main EP document summarises the consultation undertaken with the privately-owned property owners potentially affected. Further details of consultation are provided in Section 3 of each PSMP.	Update each PSMP to reflect the subsidence predictions that accompanied Centennial's EP variation request lodged on 27 May 2021. This includes updating the predicted subsidence set out in the figures within each PSMP. The figures should also be labelled to identify the individual property that is the subject of the relevant PSMP.
□ a detailed structural inspection of residences and all other structures on the property;	Yes	Structural assessment of properties confirmed in individual PSMPs (Section 3).	Nil
□ a detailed subsidence impact assessment for the property, including (where relevant): - a flood impact assessment, including a prediction of the minimum freeboard of the residence in a 1 in 100 year ARI flood event, and, where this prediction shows the minimum freeboard at the residence to be less than 0.5 m in a 1 in 100 year ARI flood event: □ recommends such works to raise, remediate or relocate the residence and/or provide suitable access to the property, prior to undermining the residence; or □ where these works are unable to be undertaken, offers to acquire the whole of the property, or such part of the property requested by the landowner where subdivision is approved, in accordance with conditions 3 and 4 of Schedule 5; - slope stability assessments at the properties shown in Figure 2 of Appendix 5, or at any other property as nominated by the Secretary, which must: □ be undertaken at least 12 months prior to undermining the property; □ be undertaken in consultation with RR, by a suitably qualified geotechnical expert; □ recommend measures to manage and/or mitigate the risks and impacts associated with slope instability and rock roll-out at the residence, and the	Yes	Section 3 of the PSMPs lists the subsidence, flooding, slope stability assessments undertaken for each property. Section 4 of the PSMPs summarises the predicted subsidence impact for each property. Section 5 of the PSMPs summarises the predicted flooding impact for each property. Section 6 of the PSMPs summarises the proposed mitigation requirement for each property. All PSMPs include a TARP. Section 6 of the PSMPs include mitigation, remedial and compensation measures applicable to each property. Refer to comment above in relation to the timing to implement individual action/responses and remedial measures.	Nil

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
risk to the safety of persons; and □ include a timeframe for the implementation of the recommended measures; - soil erosion assessment, which recommends measures to avoid, mitigate and otherwise respond to increased soil erosion (including tunnel erosion) impacts; and			
□ appropriate measures, commitments and timeframes to mitigate, repair, replace or otherwise compensate the impacts to the property;	Yes	Section 6 of the PSMPs include mitigation, remedial and compensation measures applicable to each property.	Nil
(i) include a Water Management Plan, which has been prepared in consultation with EPA and DPIE Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including:	Partial	• Water Management Plan (WMP) dated December 2020 is included in Volume 3 of the EP. Table 4.2 of the main EP document summarises the consultation undertaken with the EPA and DPIE Water and NRAR on the EP, including the WMP. No response has been recorded from DPIE Water and NRAR, and Appendix A of the WMP does not provide evidence of consultation with DPIE Water and NRAR.	Please follow up the consultation with DPIE Water as it is a requirement of condition 6 of Schedule 4 of SSD-5144.
• detailed baseline data on groundwater levels, yield and quality in the region, and in privately owned groundwater bores that could be affected by the second workings;	Yes	• Baseline groundwater data is summarised in Section 3 and presented in detail in Appendix B and C of the WMP. • Only three bores were located within 1 km of LW30-13 and are mine-owned.	Nil
• surface water and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;	Partial	• Impact assessment criteria and triggers for surface water and groundwater are included in Section 4 of the WMP. • Surface water criteria derived from both site-specific and default guideline values as presented in ANZECC (2000) guidelines. • Groundwater level values are derived from site-specific monitoring data and modelling. Trigger values for water levels are only provided for two bores, with several other bores cited to have no trigger values due to being dry and/or low water levels or insufficient data. • Section 4.2 - Groundwater quality triggers based on historic monitoring data and further investigations triggered if adjacent landowners complain about declining groundwater levels.	• WMP Section 4.2 - Please review groundwater trigger levels provided in Table 4-2 and update to be consistent with the approved Water Management Plan for SSD-5144 (GHD, 2019). • Section 4.2.2 - Please review Table 4-3 to Table 4-6 and update as necessary to address any inconsistencies with the approved WMP for SSD-5144 (GHD, 2019). • Please review and update criteria and triggers reflected in the TARP of the WMP.

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
• a program to monitor and report on stream morphology and stream flows, and assessment of any changes resulting from subsidence impacts, including scouring and ponding;	Partial	• Section 4.3.2 – Table 4-8 has been updated to reflect contemporary commitments to watercourse subsidence impacts following Mod 9. • Section 2.1.3 describes the monitoring of stream, flow path and ponding. Figure 2-2 shows the monitoring locations. However these do not reflect the additional two ponding locations identified following approval of Mod 9. • Section 4.3 – details performance criteria for watercourses, stream health (including geomorphic condition and waterway stability).	• Please update Section 2.1.3 and Figure 2-2 to reflect the two predicted additional ponding locations occurring above LW30 as identified in MOD 9. • Figure 2-2 - Please review and align monitoring points with Table 2-2. ie. is location C or G?
• a program to monitor flooding (including updated flood modelling); with recommendations to minimise, manage and mitigate (whether prospectively or retrospectively) flood impacts on residences, private properties, roads, other infrastructure and other built features;	Yes	• Section 5 - summarises the updated and revised flood model used to predict impacts on the flooding regime in the Mandalong Valley from mining in LWs 1 to 31. • Section 2.1.4 - The model was updated to compare the potential impacts of the MOD 9 of SSD 5144 on flooding and watercourse stability to the approved SSD 5144 MOD 5 (Umwelt 2020). MOD 9 included the reorientation of renamed Longwalls 30 to 31. • Section 5.2 - describes the predicted changes to flooding regimes for the changes to LW 30 – 31. • Section 5.3 – notes the predicted ponding impacts and proposed mitigation measures. Measures to minimise, manage and mitigate flooding impacts described in the LMP and BFMP, including the PSMPs.	Nil – see comments above.

• a groundwater monitoring program which:
 - includes a comprehensive monitoring bore network, ensuring all bore casings are above ground level and are purged before sampling;
 - samples on a monthly basis for the first two years of the development, and quarterly thereafter, unless directed by the Secretary;
 - monitors and reports on:
  groundwater inflows to the mine;
  background changes in groundwater yield/quality against mine-induced changes;
	Yes	• Section 2.2 of the WMP describes the groundwater monitoring program. Figure 2-3 shows the groundwater bore monitoring locations.
		 • Section 2 - describes indicates that monitoring will be undertaken on a quarterly basis and that the bores will be purged before sampling.
		 • Section 2 - describes the monitoring procedures for groundwater inflows into the mine.
		 • Section 3.2 describes monitoring to assess impacts to regional and local (alluvial) aquifers.
			Nil

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
and □ impacts to: - regional and local (including alluvial) aquifers; - groundwater supply to private bores; and - groundwater dependent ecosystems and riparian vegetation;		• Section 4.2 and Table 4-2 provides groundwater level trigger values, including commitments to investigate if adjacent landowners complain about declining groundwater levels. See comments on trigger values in section above. • Section 3.2.3 - describes the GDE identified in the area. This has been further described and mapped in Section 6.1.1.3 and Figure 2 of the Biodiversity Management Plan (BMP). Potential impacts to and monitoring of GDEs and riparian vegetation is described in the BMP. Monitoring program considered adequate.	
• a program to validate the groundwater model for the development, and compare monitoring results with modelled predictions; and	Yes	Section 6 describes the groundwater model validation program (reviewed annually and re-calibrated every 3 years). Considered adequate.	Nil
• a plan to respond to any exceedances of the groundwater assessment criteria;	Yes	Mitigation plan included in Section 7. TARP included in Appendix F. Considered adequate.	Nil
(j) include a Biodiversity Management Plan, which has been prepared in consultation with BCD, which establishes baseline data for existing habitat, including water table depth, vegetation condition, stream morphology and threatened species habitat, and provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats; endangered ecological communities; and water dependent ecosystems;	Partial	Biodiversity Management Plan (BMP) dated December 2020 included in Volume 3 of the EP. Section 4.2 (Table 4.2) of the main EP document summarises the consultation undertaken with BCD on the EP, including the BMP. Appendix 1 of the BMP provides copies of correspondence. Table 4.2 indicates BCD declined to provide comment on the updated BMP. However, the Department provided a copy of the EP and BMP to BCD for review following Centennial's lodgement of the EP. BCD reviewed the BMP and provided a number of comments on the plan. It is recommended the BMP is updated to address BCD's comments. Baseline data is included in Section 6 of the BMP. Monitoring design based on Before-After, Control Impact methodology, which is considered adequate. Performance criteria, indicators and action response included in Table 8. TARP included in Appendix 2.	Update the BMP to address BCD's review comments (Attachment C), including: • updating the TARP to describe how condition 3 of Schedule 4 of the conditions of consent would be met, including how biodiversity values, and their offset requirements, would be quantified by use of the Biodiversity Assessment Method 2020 if any unexpected biodiversity impacts occur. • including measures to offset any unexpected biodiversity impacts.
(k) include a Land Management Plan, which has been prepared in consultation with any affected	Partial	Land Management Plan (LMP) dated March 2021 included in Volume 3, Appendix 2 of the EP.	Update the LMP to address Crown Lands' comments in relation to the

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general;		Section 4.2 (Table 4.2) of the main EP document and Section 4 of the LMP summarises the consultation undertaken with potentially affected public authorities. Additional evidence of how the LMP has been updated in response to Crown Lands' comments is required. LMP focuses on managing potential impacts on steep slopes, rock outcrops and agricultural land. Includes monitoring and management ponding impacts.	Yambo Trig Station, as per the correspondence provided in Appendix 2 of the plan. Include a reference in Section 4 as to where within the LMP the comments have been addressed.
(l) include a Heritage Management Plan, which has been prepared in consultation with Heritage NSW and Registered Aboriginal Parties, to manage the potential environmental consequences of the proposed second workings on both Aboriginal and non-Aboriginal heritage items, and reflects the requirements of condition 22 of Schedule 3 (see below); (c) include: □ a description of the measures that would be implemented to: - protect, monitor and/or manage Aboriginal Cultural Heritage sites/items (including any proposed archaeological investigations and/or salvage measures); - manage the discovery of previously unidentified Aboriginal items; - maintaining and managing reasonable access for Aboriginal stakeholders to heritage items on the Applicant's land; - ongoing consultation with Aboriginal stakeholders in the conservation and management of Aboriginal cultural heritage; □ a short-term and long-term strategy for the storage of any Aboriginal Cultural Heritage items salvaged on site; and □ a protocol for the management of impacts to Historic Heritage sites/items, including previously unidentified sites/items, including archival recording where impacts to Historic Heritage	Partial	A report titled *Mandalong Mine LW 30-31 Extraction Plan Heritage Management Plan* (HMP), dated April 2021 and prepared by Umwelt, has been provided as a component of the EP. The HMP indicates that there are no non-Aboriginal heritage items in the extraction area. Section 4.2 (Table 4.2) of the main EP document summarises the consultation undertaken with Heritage NSW on the HMP. No evidence of consultation with Heritage NSW is provided in either the main EP document or the HMP. Notwithstanding, the Department provided a copy of the EP and HMP to Heritage NSW for comment. See Attachment B for detailed comments. Section 2 of the HMP summarises the consultation undertaken with Registered Aboriginal Parties (RAPs). Evidence of consultation with RAPs is provided in Appendix 1. Section 7 and Figure 7.2 identifies the 25 Aboriginal cultural heritage sites within the extraction area. Section 11.2 describes the 3-phase monitoring program. Section 11.1 includes a number of non-committal passages where 'should' is used in lieu of words such as 'will' or 'must'. The use of 'should' suggests that a recommendation, rather than a firm commitment to undertake the action, has been made.	Update the HMP to address Heritage NSW's review comments (Attachment B). • Update Section 11.1 to replace non-committal words such as 'should' with words that provide a firmer commitment to undertake the action. E.g. will, must.

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
sites/items cannot be avoided.		Section 11.2.1 Monitoring protocols for grinding groove and rock shelters frequently uses non-committal language such as 'should be'. Section 11.3 Identification of Previously Unknown Aboriginal Cultural Heritage Sites frequently uses non-committal language such as 'should'. Section 11.4 Consultation with Registered Aboriginal Parties uses non-committal language such as 'should'.	• Update Section 11.2.1 to replace non-committal words such as 'should' with words that provide a firmer commitment to undertake the action. E.g. will, must. • Update Section 11.3 to replace non-committal words such as 'should' with words that provide a firmer commitment to undertake the action. E.g. will, must. • Update Section 11.3 to replace 'should' with a word that provides a firmer commitment to undertake the action. E.g. will, must.
(m) include a Public Safety Management Plan, which has been prepared in consultation with RR, to ensure that the proposed second workings do not impact on public safety;	Partial	• Public Safety Management Plan (PSMP) included in Volume 3, Appendix 6 of the EP. • No evidence of consultation with the Resources Regulator has been included, although Section 4.2 (Table 4.2) of the main EP document summarises the consultation undertaken with RR on the EP, including the PSMP. • The PSMP includes appropriate monitoring, mitigation and management measures, which are in-line with the respective BFMPs. Considered adequate.	• Section 5 – Table 2 and Section 6.4 contains outdated references to DRE. Please review entire document and update to align with contemporary agency names and accurate consolidated consent conditions produced after approval of MOD 9. • Replace Figure 4 with an updated figure showing numbered powerlines to reference subsidence impacts accurately. See comments on BFMP above.
(n) include a Subsidence Monitoring Program, which has been prepared in consultation with RR to: □ provide data to assist with the management of the risks associated with conventional and nonconventional subsidence; □ validate the subsidence predictions; □ analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and □ inform the Contingency Plan and adaptive management process;	Yes	Subsidence Monitoring Program (SMP) is summarised in Section 4.9 of the main EP document and included in Volume 3, Appendix 8 of the EP. Section 4.2 (Table 4.2) of the main EP document summarises the consultation undertaken with the RR on the EP, including the SMP. No evidence of consultation with RR has been provided in either the main EP document or the SMP. Notwithstanding, the Department sought and received advice on the draft EP (including the SMP) from the RR. The RR did not have any specific comments regarding mine safety or mine rehabilitation matters in relation to the EP. The	Nil

Extraction Plan: ***Condition 6, Schedule 4***	**Satisfactory (Yes/No)**	**Comment**	**Action Required**
		RR advised that the rehabilitation commitments outlined in any approved EP must be included in the Mining Operations Plan / Rehabilitation Management Plan regulated by the RR under the conditions of the mining lease and the *Mining Act 1992.* SMP includes baseline monitoring and a consolidated summary of subsidence movement and effects, built features and environmental monitoring.	
(o) Trigger Action Response Plans addressing all features in Tables 6 and 7, which contain: appropriate triggers to warn of the development of an increasing risk of exceedance of any performance measure; specific actions to respond to high risk exceedance of any performance measure to ensure that the measure is not exceeded; and an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures;	Partial	Trigger Action Response Plans (TARPs) for water, land, biodiversity, heritage, built features, public safety and properties are included in Volume 1, Appendix 3 of the EP and are appended to the relevant individual plans. Triggers reviewed and considered adequate, with the exception of the groundwater triggers in the WMP (see earlier comments) Actions and remedial measures reviewed and considered adequate.	Update groundwater triggers as per comments above.
(p) include a Contingency Plan that expressly provides for; adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 6 and 7, or where any such exceedance appears likely; and an assessment of the remediation measures that may be required if exceedances occur and the capacity to implement the measures;	Partial	Subsidence management strategies, including adaptive management framework, included in Section 3.6 of the main EP document. Considered adequate. Proposed remedial measures included in the TARPs and individual management plans.	Nil
(q) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 33 of Schedule 3; and	Partial	Section 5.3 of the main EP document describes the updates and approvals of the Rehabilitation Management Plan (RMP), which was most recently approved by the Department on 23 December 2020.	Update Section 5.3 to include details of the MOP/RMP that was submitted to the Department for approval on 31 May 2021
(r) include a program to collect sufficient baseline data for future Extraction Plans.	Yes	Baseline data for future Eps is described in the various component sub-plans. Considered adequate.	Nil
General Comments			
1. Main EP document – Sections 4.7.1 and 4.7.2 – reference “the following figure”. Please amend to reference the relevant figure’s number. 2. If comments on the EP are received by Centennial from any agencies prior to approval of the EP, please forward then to the Department for consideration, particularly if consultation is a requirement of a condition of SSD-5144. (ie. DPIE Water or the RR).			

Our ref: DOC21/313849-18
Your ref: SSD-5144

Mr James McDonough

Team Leader – Energy Resource Assessment
Planning and Assessment Division
Department of Planning, Industry and Environment
james.mcdonough@dpie.nsw.gov.au

Dear Mr McDonough

Mandalong Coal Southern Extension (SSD-5144) – Extraction Plan LW30-31

I refer to your e-mail dated 21 April2021 in which Planning and Assessment Division requested advice from Biodiversity and Conservation Division (BCD) in relation to the Mandalong Coal Southern Extension – Extraction Plan LW 30 – 31.

BCD reviewed the Extraction Plan in relation to threatened biodiversity. BCD's recommendations are provided in **Attachment A** and detailed comments are provided in **Attachment B**. BCD's comments in relation to flood risk will be provided at a later date. If you require any further information regarding this matter, please contact Robert Gibson, Regional Biodiversity Conservation Officer, on 4927 3154 or via email at huntercentralcoast@environment.nsw.gov.au

Yours sincerely

14 May 2021

STEVEN COX
Senior Team Leader Planning
Hunter Central Coast Branch
Biodiversity and Conservation Division

Enclosure: Attachments A and B

Attachment A

BCD's recommendations

Mandalong Coal Southern Extension – Extraction Plan LW30-31

1. BCD recommend that the Biodiversity Management Plan, including the Trigger Action Response Plan are revised to includes details on how Schedule 4, consent condition 3 of the consent would be implemented, and that biodiversity values, and their offset requirements, are quantified by use of the Biodiversity Assessment Method 2020 if any unexpected biodiversity impacts occur.

Attachment B

BCD's detailed comments

Mandalong Coal Southern Extension – Extraction Plan LW30-31

Biodiversity

1. The Biodiversity Management Plan should include measures to offset any unexpected biodiversity impacts

Schedule 4, consent condition 3 states that if the applicant created greater than 'negligible' subsidence impacts on biodiversity from mining activities, and either it is not reasonable or feasible to remediate the impact, or if remediation measures implemented by the applicant fail to remediate the impact or environmental consequence then those impacts must be offset. However, the 'Biodiversity Management Plan: Extraction Plan LW 30-31: Mandalong Mine' prepared by Centennial (the BMP) (dated December 2020), including the 'Trigger Action Response Plan' presented in Appendix 2 of the BMP, do not refer to the option for the provision of biodiversity offsets for any unexpected impacts to threatened biodiversity.

BCD recommends that the BMP is updated to include the trigger for the provision of a biodiversity offset if any unexpected biodiversity impacts occur, and that the impact would be quantified, and the offset requirement specified, in accordance with the Biodiversity Assessment Method 2020.

Recommendation 1

BCD recommend that the Biodiversity Management Plan, including the Trigger Action Response Plan are revised to includes details on how Schedule 4, consent condition 3 of the consent would be implemented, and that biodiversity values, and their offset requirements, are quantified by use of the Biodiversity Assessment Method 2020 if any unexpected biodiversity impacts occur.

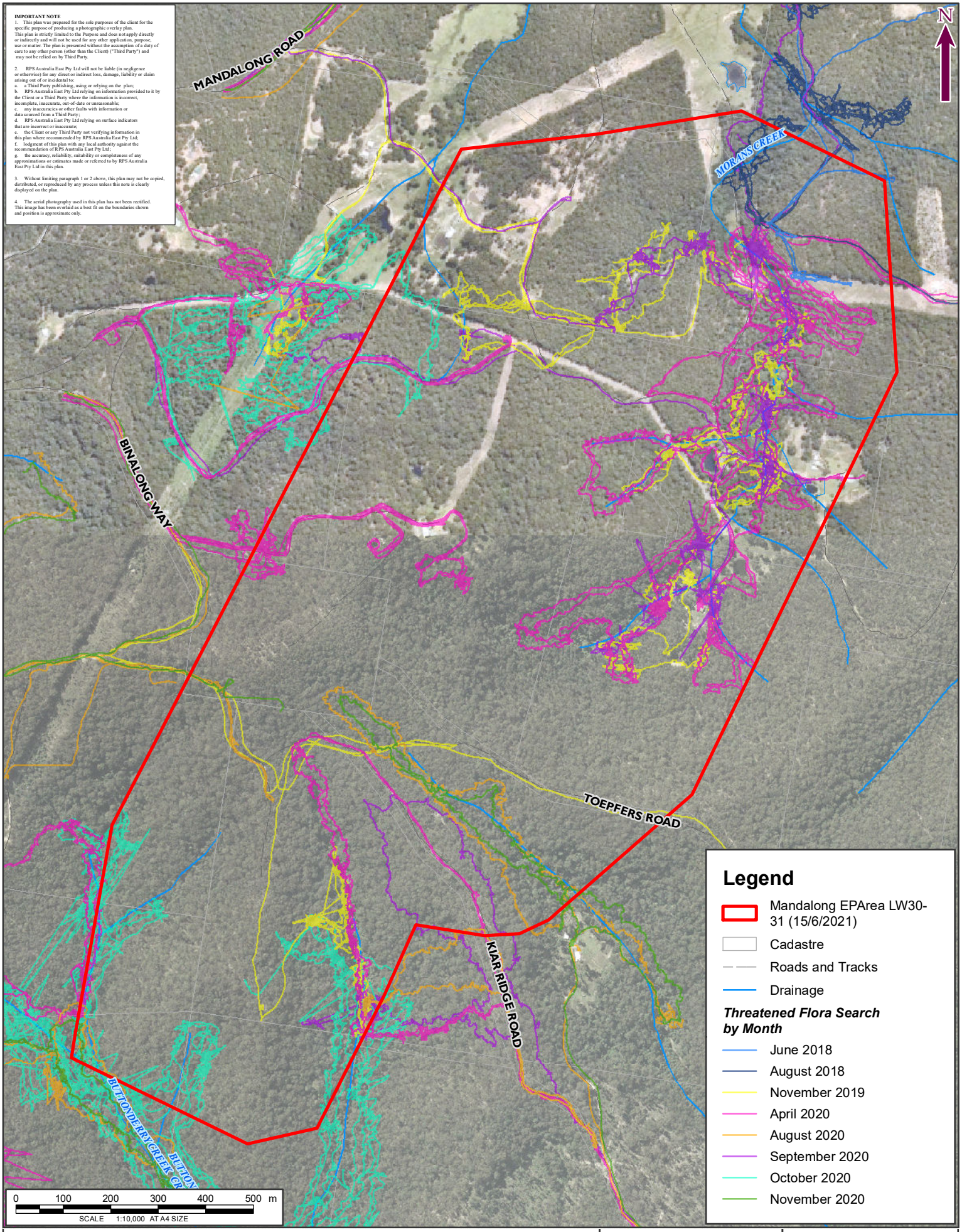
APPENDIX 2 - TARP

Biodiversity TARP

Key Element	Predictions / Commitments (EIS)	Consent Criteria	Triggers / Responses	Condition Green (Operations within Predictions & Approved Impacts)	Condition Amber (Operations within Approved Impacts but potentially exceeding predictions)	Condition Red (Operations Exceed Approved Impacts)
				Continue Operations & Monitoring as Normal	***Review Processes & Adaptive Management as Required***	***Adaptive Management Process Fully Engaged***
Sensitive biodiversity features: **TEC / GDE** **Threatened Species, populations and their habitats** **Aquatic Biodiversity**	No Adverse Impact	Generally in accordance with the EIS & SEE (for MOD 9). Negligible environmental consequence as per Table 6 in Condition 1, Schedule 4 of SSD-5144. *(refer adjacent column)*	**Trigger**	• **Mining induced impacts to creeks and alluvial groundwater <u>not</u> identified** by environmental monitoring (including surface flow gauging, water quality, related groundwater levels) and/or routine monitoring (as per Extraction Plan). • Monitoring indicates all parameters are within design criteria / Level Green trigger levels.	• Subsidence monitoring program **identifies *potential* for impact** at surface in the vicinity of sensitive vegetation / habitat areas; ***<u>however</u>*** • **Mining induced impacts to creeks and alluvial groundwater is <u>not</u> identified/not confirmed** by routine environmental monitoring (including surface flow gauging, water quality, related groundwater levels) and/or routine monitoring (as per Extraction Plan); ***And/or*** • Amber Level triggers for surface water/groundwater (including alluvium) are triggered (potential for riparian vegetation impact requiring further investigation/assessment);	• **<u>Mining induced impacts</u>** <u>(beyond negligible approved levels compared to baseline)</u> identified by: ○ environmental monitoring (including flow gauging, water quality and biodiversity) and/or ○ monitoring (as per Extraction Plan); and/or ○ by investigations and actions arising from Condition Amber; • Red Level triggers for surface water/groundwater (incl. alluvium and biodiversity) are triggered;
			Action	• **No Action required**	• Review and confirm monitoring data, cross check Biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Notify DPIE and relevant stakeholders of current findings and proposed approach for investigation upon identification of the potential trigger.	• **Implement Adaptive Management** process as detailed within the Extraction Plan and in accordance with Condition 8 of Schedule 6 of SSD-5144 immediately. • Take all necessary steps to ensure that the exceedance ceases and does not recur. • Targeted field inspection by a qualified ecologist and the Mandalong Environment & Community Coordinator with invitation to relevant stakeholders as soon as practicable after the trigger is confirmed to be mining induced. • Monitor impact for affected species/ ecological communities using relevant methods outlined in baseline dataset. • Investigate exceedance of subsidence prediction model. • Notify DPIE as per Condition 2 of Schedule 4 and Condition 10 of Schedule 6 of SSD-5144 and consult with relevant stakeholders as per Consent/ related approvals. • **Explore all remediation options** and submit a report to DPIE outlining them.
			Response	• No response required. • Continue Subsidence monitoring program. • Continue Biodiversity Monitoring Program.	• Implement responses as per relevant Amber Level trigger/responses above (where triggered) for surface water/groundwater elements. • Where review of subsidence monitoring data indicates *potential for mining-induced impact*, or there is insufficient data to quantify the above, undertake targeted monitoring inspection over the relevant surface area to confirm and quantify the scale/extent/nature of potential surface impacts. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related. • Assess need for any increase to monitoring frequency or additional monitoring where relevant. • Continue monitoring programs.	• Implement remediation measures to the satisfaction of the secretary. • Review of mining design / predictions against mine design criteria. • Written reporting as per Consent / relevant approvals. • Implement agreed ponding remediation in consultation with the landowner, using the most applicable options and best practice at the time (such as installing drains, sub-surface drains etc). • If in the case that: (a) it is not reasonable or feasible to remediate the impact or environmental consequences; or (b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence,

						then a suitable biodiversity offset to compensate for the impact or environmental consequence would be determined to the satisfaction of the Secretary. • If a biodiversity offset is required, it would be proportionate with the significance of the impact or environmental consequence. Any offset requirements would be quantified using BAM (2020) and be commensurate with monitoring results. The offset calculation would have regard for the baseline condition state, as determined through the monitoring program and Section 8.5 of BAM (2020; i.e. Adaptive management for uncertain biodiversity impacts). • If offsets are required, the credit obligation would be met by: o Retiring credits owned by Centennial (if suitable credits available); o Identifying and purchasing the required 'like for like' credits in the market and then retire those credits; or o Using the offsets payment calculator to determine the cost of the credit obligation and transfer this amount to the Biodiversity Conservation Fund (BCF).

APPENDIX 3 – Baseline surveys



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4. The aerial photography used in this plan has not been rectified. This image has been overlaid as a best fit on the boundaries shown and position is approximate only.

APPENDIX 1:THREATENED FLORA SURVEY EFFORT

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 17/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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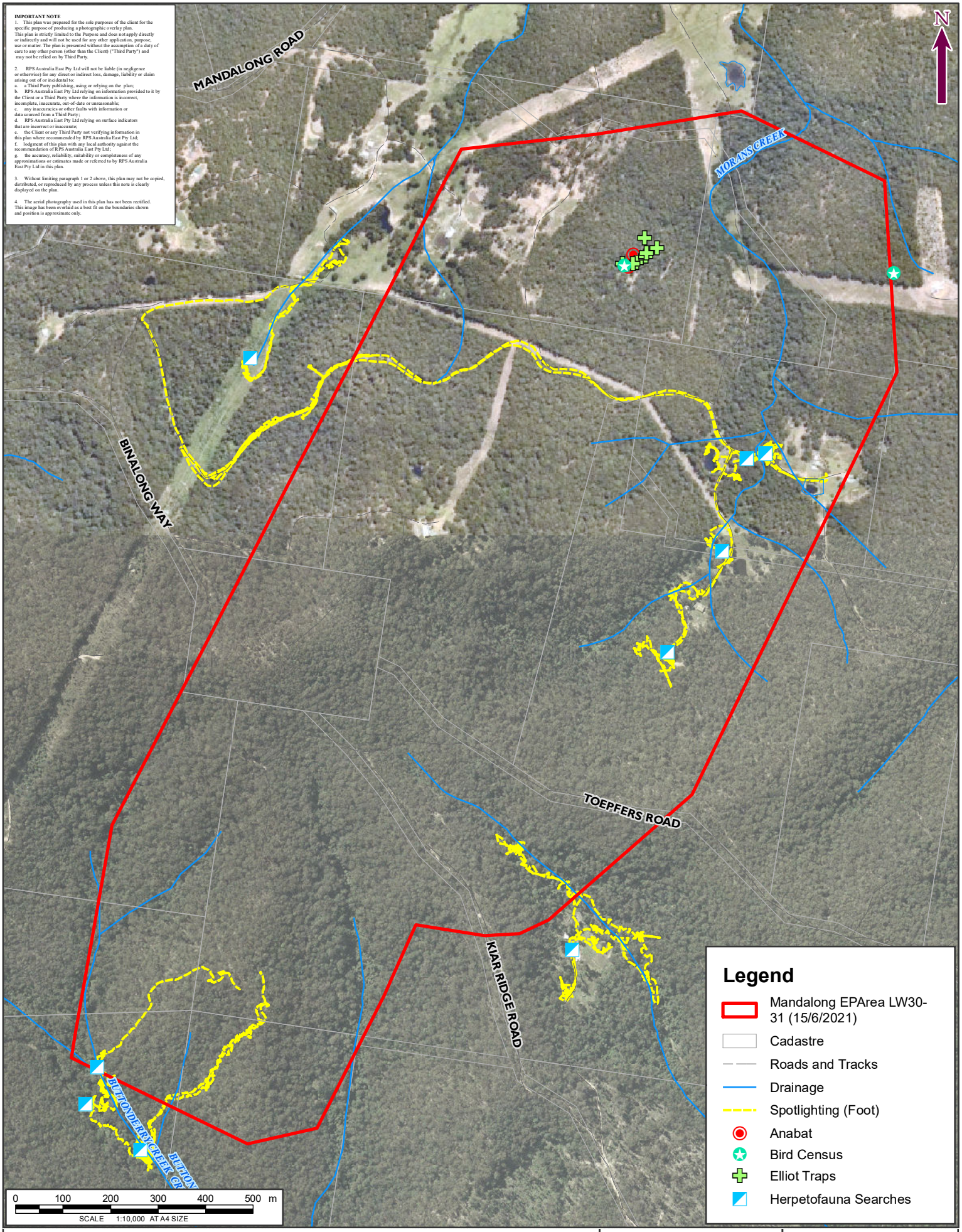

APPENDIX 2: THREATENED FAUNA SURVEY EFFORT

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 17/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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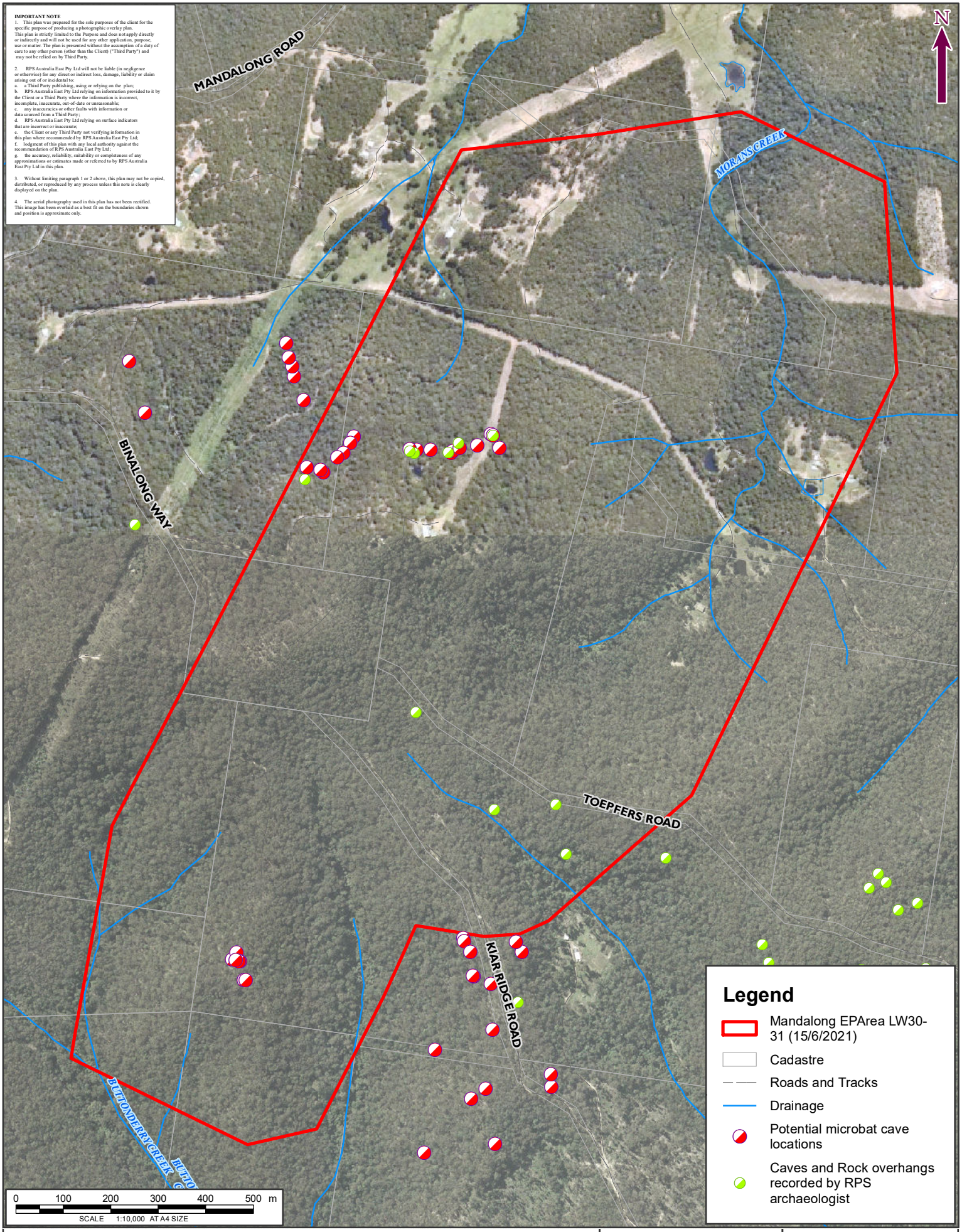
NEW_A4_Portrait 2019 Rev: B Produced:NW Reviewed: NW Date: 16/07/2019



APPENDIX 3: MICROBAT CAVE HABITAT SURVEY

LOCATION: MANDALONG LW30-31	DATUM:GDA2020 PROJECTION: GDA2020 MGA Zone 56
JOB NO.: **PR 147476** PURPOSE: BMP Technician: Robert.Suansri Date: 17/06/2021	Data Sources: RPS, Client Nearmap 2017

CLIENT: CENTENNIAL

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NEW_A4_Portrait 2019 Rev: B Produced:NW Reviewed: NW Date: 16/07/2019