

APPENDIX H

BDAR

11 November 2021

Rosebrook Sand and Gravel Pty Ltd
c/-
Julie McKimm
Town Planner
HDB Town Planning & Design
1ST Floor, 44 Church Street
MAITLAND NSW 2320

Dear Julie

Re: Biodiversity offsets strategy for Dalswinton Quarry Expansion
Project no. 35797

In support of the Biodiversity Development Assessment Report (BDAR) prepared for the Dalswinton Quarry Expansion (Biosis 2021) (the project) the following offset strategy will be applied to satisfy biodiversity offset requirements associated with the proposed works.

As described by the BDAR, residual impacts to biodiversity values as a result of the project will require biodiversity offsets to be secured in accordance with the NSW Biodiversity Offsets Scheme (BOS) established under the NSW *Biodiversity Conservation Act 2016*. The assessment and offset requirements for the project being determined in accordance with the NSW Biodiversity Assessment Method (BAM) (DPIE 2020).

Biodiversity credits to be secured as offsets for the project relate to the loss of 6.3 hectares of potential habitat for two threatened species, being:

- 315 species credits for Green and Golden Bell Frog.
- 315 species credits for Southern Myotis.

Like for like and variation biodiversity credit reports relating to these species credit species are included as Appendix 1 below.

No ecosystem credits are required for the project as the impacted vegetation is identified as Category 1 – exempt land (within the meaning of Part 5A of the *Local Land Services Act 2013* as determined under the methodology provided in the Native Vegetation Regulatory Map. Land identified as Category 1 – exempt can be excluded from the BAM and allows for the exclusion of offset requirements for areas where it is deemed to apply.

Under the BOS, Rosebrook Sand & Gravel has three main avenues for securing biodiversity offsets for the project, those being:

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- Payment to the Biodiversity Conservation Fund managed by the Biodiversity Conservation Trust.
- Purchase (transfer) and retire credits from existing credit holders.
- Establish a Biodiversity Stewardship Site to generate credits required by the project.

Rosebrook Sand & Gravel is committed to securing the required number and type biodiversity credit to offset residual impact of the project, either through retirement of like for like credits via a combination of the above listed options, or if unavailable through implementation of the variation rules.

The assessment completed as part of the development of the BDAR has concluded that there will not be significant residual impacts to Matters of National Environmental Significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and therefore biodiversity offsets are not required to meet the criteria outlined in the EPBC Act Environmental Offsets Policy (CoA 2012).

I trust that this advice is of assistance to you however please contact me if you would like to discuss any elements further.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Brooke Corrigan', with a long horizontal flourish extending to the right.

Brooke Corrigan
Consultant Restoration Ecologist
BAAS: 19061

References

Biosis 2021. *Dalswinton Quarry Expansion. Biodiversity Development Assessment Report*, Report prepared for Rosebrook Sand & Gravel. Corrigan B, Cerato S, Biosis, Newcastle, NSW. Project No. 35797.

CoA 2012. *EPBC Act Environmental Offsets Policy*, Australian Government, The Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT.

DPIE 2020. *Biodiversity Assessment Method (BAM)*, Department of Planning, Industry & Environment, <https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-method-2020>.

Appendix 1 Biodiversity Credit Report

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00027411/BAAS19061/21/00027412	Dalswinton Quarry Expansion	10/06/2021
Assessor Name	Assessor Number	BAM Data version *
Brooke Corrigan	BAAS19061	45
Proponent Names	Report Created	BAM Case Status
Colin Jackson	09/11/2021	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Major Projects	09/11/2021

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCTs With Customized Benchmarks



BAM Biodiversity Credit Report (Like for like)

PCT

No Changes

Predicted Threatened Species Not On Site

Name

Anseranas semipalmata / Magpie Goose

Botaurus poiciloptilus / Australasian Bittern

Calidris tenuirostris / Great Knot

Limicola falcinellus / Broad-billed Sandpiper

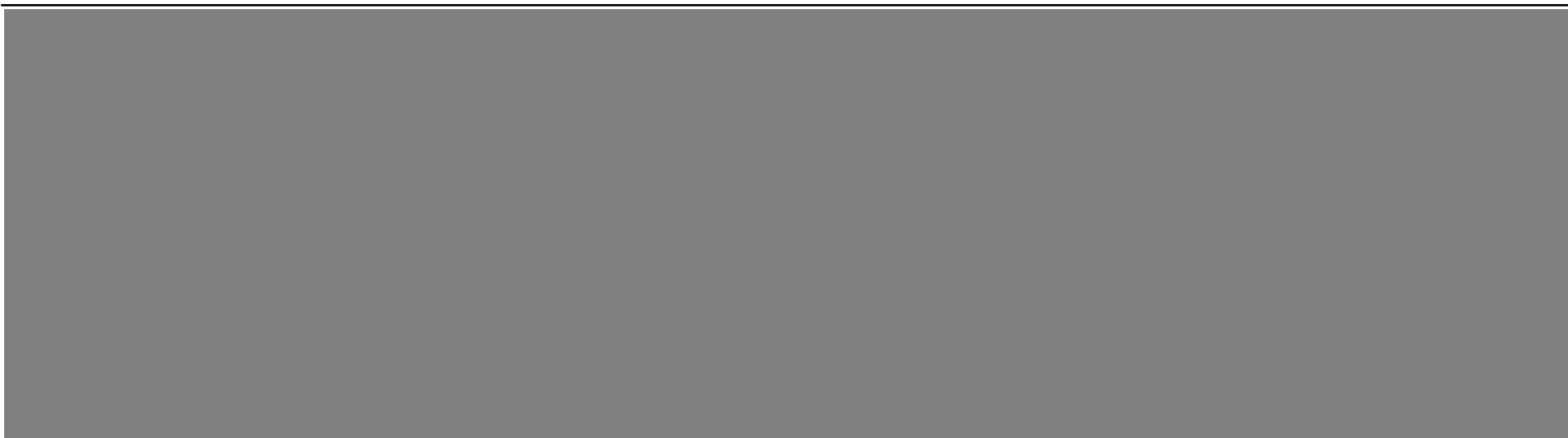
Limosa limosa / Black-tailed Godwit

Calidris ferruginea / Curlew Sandpiper

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
----- Redacted -----					

BAM Biodiversity Credit Report (Like for like)



Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Litoria aurea / Green and Golden Bell Frog	1071_moderate	6.3	315.00
Myotis macropus / Southern Myotis	1071_moderate	6.3	315.00

Credit Retirement Options

Like-for-like credit retirement options

Litoria aurea / Green and Golden Bell Frog	Spp	IBRA subregion
	Litoria aurea / Green and Golden Bell Frog	Any in NSW



BAM Biodiversity Credit Report (Like for like)

Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00027411/BAAS19061/21/00027412	Dalswinton Quarry Expansion	10/06/2021
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Brooke Corrigan	BAAS19061	45
Proponent Name(s)	Report Created	BAM Case Status
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1	Major Projects	09/11/2021

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Nil		
Species		
Nil		

Additional Information for Approval

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Variations)

Name
Anseranas semipalmata / Magpie Goose
Botaurus poiciloptilus / Australasian Bittern
Calidris tenuirostris / Great Knot
Limicola falcinellus / Broad-billed Sandpiper
Limosa limosa / Black-tailed Godwit
Calidris ferruginea / Curlew Sandpiper

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
----- Redacted -----					

BAM Biodiversity Credit Report (Variations)

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Litoria aurea / Green and Golden Bell Frog	1071_moderate	6.3	315.00
Myotis macropus / Southern Myotis	1071_moderate	6.3	315.00

Credit Retirement Options Like-for-like options

Litoria aurea / Green and Golden Bell Frog	Spp		IBRA region
	Litoria aurea /Green and Golden Bell Frog		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	Hunter, Ellerstun, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Variations)

Myotis macropus/ Southern Myotis	Spp		IBRA region
	Myotis macropus /Southern Myotis		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Hunter, Ellerston, Karuah Manning, Kerrabee, Liverpool Range, Peel, Tomalla, Upper Hunter, Wyong and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



Dalswinton Quarry Expansion Biodiversity Development Assessment Report

FINAL REPORT

Prepared for Rosebrook Sand & Gravel

9 November 2021

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Biosis project no.: 35797

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- Rosebrook Sand and Gravel: Colin Jackson
- Department of the Environment and Energy for access to the Protected Matters Search Tool of the Australian Government.
- NSW Environment, Energy and Science Group for access to the BioNet Atlas of NSW Wildlife.
- NSW Department of Primary Industries for access to indicative mapping of freshwater threatened species and populations.

Biosis staff involved in this project were:

- Luke Stone (aquatic considerations)
- Caragh Heenan (assistance in the field)
- Samantha Blades (mapping)

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Glossary

Assessment Area	All land within 1500m of the subject land
BAM	NSW Biodiversity Assessment Method
BAM-C	BAM Calculator
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	NSW <i>Biosecurity Act 2015</i>
BOS	Biodiversity Offsets Scheme
CEMP	Construction Environmental Management Plan
DA	Development Application
DCDB	Digital cadastral database
DAWE	Commonwealth Department of Agriculture, Water and Environment
Development footprint	The area of land that is directly impacted by the proposal
Development site	The broader area in which the subject land is located
DoIW	Directory of Important Wetlands
DPIE	NSW Department Planning Industry and Environment
DPI	NSW Department of Primary Industries
DTDB	Digital topographic databases
Ecosystem credit species	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development
EES	NSW Environment, Energy and Science Group
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation of Australia
LEP	Local Environmental Plan
LGA	Local Government Area
Locality	Area located within 10 kilometres radius from the subject land
LPI	NSW Land and Property Information

Matters for further consideration	Impacts that are considered to be complicated or severe that will require further consideration by the consent authority (OEH 2014). The assessment is based on thresholds detailed in Section 9 of the Framework for Biodiversity Assessment. These can also be included as part of the project SEARs.
Matters of NES	Matters of National Environmental Significance protected by a provision of Part 3 of the EPBC Act
EES	NSW Environment, Energy and Science Group
PCT	Plant Community Type
SAIL	Serious and Irreversible Impact
SALIS	NSW Soil and Land Information System
SEARs	Secretary's Environmental Assessment Requirements
SEPP	NSW State Environmental Planning Policy
SIS	Species Impact Statement
Species credits species	A class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates
SSD	State Significant Development
Subject land	The areas within or the combined areas of the development site, and any indirect and prescribed impacts, to which the BAM has been applied
TEC	Threatened Ecological Community
TBDC	Threatened Biodiversity Data Collection
WM Act	NSW <i>Water Management Act 2000</i>

Certification and Declarations

I certify that this report has been prepared on the basis of the requirements of, and information provided under, the Biodiversity Assessment Method (DPIE 2020) and s6.15 of the *Biodiversity Conservation Act 2016*.

In preparing this assessment I have acted in accordance with the Accredited BAM Assessor Code of Conduct.

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest.

A handwritten signature in black ink, appearing to read 'Brooke Corrigan', with a long horizontal flourish extending to the right.

Brooke Corrigan

Date: 09/11/2021

BAM Assessor Accreditation Number: BAAS19061

Summary

HDB Town Planning & Design proposes to undertake the Dalswinton Quarry Expansion Project at the Rosebrook Sand and Gravel Quarry, Dalswinton Road, Dalswinton, New South Wales (NSW), hereafter referred to as the development site (Figure 1). The proposed works will involve the expansion of the quarry into land previously undeveloped, in addition to reworking previously extracted areas. The current consent (DA 410/1994) allowed extraction of sand and gravel at the quarry until 13 November 2022, with the current proposal seeking to vary the footprint and continue extraction for a 25 year period.

The project is considered a State Significant Development (SSD) and will be assessed under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A SSD triggers the Biodiversity Offsets Scheme (BOS), and as such an assessment is required in accordance with the NSW Biodiversity Assessment Method (BAM) (DPIE 2020a) and the *Biodiversity Conservation Act 2016* (BC Act). This Biodiversity Development Assessment Report (BDAR) has been prepared by Brooke Corrigan, an Accredited Assessor (BAAS19061), to accompany the Development Application (DA). This BDAR describes the outcome of the development assessment case (00027411/BAAS19061/21/00027412) conducted consistent with the BAM.

This BDAR includes a Land Category Assessment to determine if Category 1 – exempt land, as determined under the methodology provided in the Native Vegetation Regulatory Map (NVRM), occurs on the development site. Land deemed to be Category 1 – exempt land under the Local Land Services Act 2013 (LLS Act) can be excluded from the BAM, and allows for the exclusion of targeted survey and offset requirements for areas where it is deemed to apply.

Applications to waive the requirement for a BDAR based on lands in the development site being Category 1 – exempt land under the LLS Act were rejected in February and July 2021 (BCD 2021a, BCD 2021b). Reasons for rejection include the need for more detailed assessment of biodiversity values, particularly in relation to potential Threatened Ecological Communities (TECs), threatened species habitat, connectivity and indirect impacts. These impacts are assessed within the BDAR framework as presented in this report.

Field investigation, undertaken in accordance with the BAM, recorded 14.4 hectares of native vegetation within the subject land, representing two threatened ecological communities. Avoidance of native vegetation, TECs and threatened species habitat have been undertaken to limit impacts to the following biodiversity values:

- Avoidance of 6.1 ha of *Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* (Critically Endangered, EPBC Act, Endangered BC ACT).
- Avoidance of 1.3 ha of *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* (Endangered, BC Act)

Further consideration has been given to avoiding and minimising impacts to biodiversity where possible during the assessment and detailed design. Mitigation and management measures will be put in place to adequately address impacts associated with the proposal, both direct, indirect and prescribed.

No candidate Serious and Irreversible Impact (SAIL) entities in accordance with Section 10.2 of the BAM occur in the subject land. As such, an SAIL assessment is not required.

The vegetation integrity (VI) scores of the vegetation to be impacted were calculated in accordance with the BAM. As such, in accordance with Section 10.3 of the BAM, offsets are to be secured for the proposed works. Upcoming seasonal survey may lead to a reduction in the number of credits required. These include:

- 315 species credits for Green and Golden Bell Frog.
- 315 species credits for Southern Myotis.

The project is not considered likely to result in a significant impact to species or communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and as such a referral to the Minister of the Environment and Energy is not required.

Stage 1 – Biodiversity assessment

1 Introduction

Biosis Pty Ltd was commissioned by HDB Town Planning & Design to undertake a biodiversity assessment of the Dalswinton Quarry Expansion Project at the Rosebrook Sand and Gravel Quarry (Lot 72/-/DP1199484), Dalswinton Road, Dalswinton, NSW.

The purpose of this assessment was to apply the NSW BAM (DPIE 2021a) to the proposed development in accordance with the BC Act, and provide HDB Town Planning & Design with a BDAR. The BDAR is to be submitted to Department of Planning, Industry and Environment (DPIE) as the approval authority for SSD as part of a DA and Environmental Impact Statement (EIS), under Part 4 of the EP&A Act, for the proposed development.

1.1 Project description

Rosebrook Sand and Gravel Pty Ltd proposes to expand the Rosebrook Sand and Gravel Quarry located at 511 Dalswinton Road, Dalswinton (Figure 1). The proposed works will involve the expansion of the quarry into land previously undeveloped, in addition to reworking previously extracted areas. The current consent (DA 410/1994) allowed extraction of sand and gravel at the quarry until 13 November 2022, with the current proposal seeking to vary the footprint and continue extraction for a 25 year period.

The project has been assessed as triggering the NSW BOS through the following:

- State Significant Development.

The NSW BC Act requires that the BAM be applied to all proposals that trigger the BOS, and mandatory for SSD, and that a BDAR therefore be required to be submitted to the approval authority in conjunction with EIS.

1.2 Purpose of this assessment

This BDAR will:

- Address the BAM (DPIE 2020a) and the BOS.
- Identify how the proponent has avoided and minimised impacts to biodiversity.
- Identify any potential impact that could be characterised as serious and irreversible.
- Describe the offset obligations required to compensate for any unavoidable biodiversity impacts resulting from the proposed development.
- Consider and assess the proposal in accordance with other relevant legislation such as the Commonwealth EPBC Act.
- Include a Land Category assessment under the methodology provided in the NVRM method statement applied within a BDAR framework.

All biodiversity assessments have been undertaken in accordance with the BAM, and this BDAR has been prepared and reviewed by Accredited Assessor Brooke Corrigan (BAAS19061). This BDAR describes the outcome of the development assessment case (00027411/BAAS19061/21/00027412) conducted consistent with the BAM.

1.3 The subject land, development footprint and assessment area

The terms subject land, development footprint and assessment area are used throughout this BDAR and are defined as follows.

- The subject land is defined as the total area of proposed disturbance, encompassing the proposed development footprint and all areas that could be disturbed, including direct, indirect and prescribed impacts (Figure 1). The BAM has been applied to this area. The subject land is approximately 176 ha in area, and comprises Lot 72/-/DP1199484, and an area of the land to the east and south of the Lot boundary that includes adjacent mapped native vegetation and watercourses. The subject land is situated within the Muswellbrook Local Government Area (LGA) and the Hunter Local Land Services (LLS) Region and is approximately 25 km south-west of the Muswellbrook central business district. Land is zoned as RU1 – Primary Production within the development site, and a small area associated with adjoining Lot 111 DP752441 within the north-east corner of the Subject Land is zoned E3 – Environmental Management under the Muswellbrook Local Environmental Plan 2009 (LEP).
- The development footprint is the area of land that could be directly impacted by the proposed works, permanent and temporary. It includes the clearing footprint, plant laydown, access roads and other associated construction works. The development footprint is approximately 100.6 ha in area.
- No upgrades to the existing haul road or Dalswinton Road access are planned under the proposal.
- The assessment area includes the subject land and the area of land within the 1,500 m buffer zone surrounding the subject land that is determined as per the BAM.

1.4 Sources of information

Sources of information used in the assessment included relevant databases, spatial data, literature and previous site reports.

In order to provide a context for the assessment area, records of flora and fauna from within 10 kilometre/s (the locality) were collated from the following databases and datasets were reviewed:

- Commonwealth Department of Agriculture, Water and Environment (DAWE) Protected Matters Search Tool for matters protected by the EPBC Act.
- NSW Environment, Energy and Science (EES) BioNet - the database for the Atlas of NSW Wildlife for species, populations and ecological communities listed under the BC Act.
- PlantNET (The Royal Botanic Gardens and Domain Trust).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2021.

Other sources of biodiversity information relevant to the assessment area were sourced from:

- The NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database (DPIE 2021a).
- Relevant vegetation mapping, including *State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894* (DPIE 2019a) and *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855* (DPIE 2019b).
- NSW BAM Calculator.
- Native Vegetation Regulatory Map (NVRM).
- BAM Important Areas maps.

The following reports were also reviewed and relied on to provide additional information:

- BDAR Waiver – RSG Dalswinton Sand and Gravel Quarry Extension (MJD 2020)
- BDAR Waiver – RSG Dalswinton Sand and Gravel Quarry Extension (MJD 2021)
- BDAR waiver decision report: Dalswinton Sand and Gravel Quarry Extension, 511 Dalswinton Rd, Dalswinton. SSD-9094. 04.02.2021 (BCD 2021a)
- BDAR waiver decision report: Dalswinton Sand and Gravel Quarry Extension, 511 Dalswinton Rd, Dalswinton. SSD-9094. 06.07.2021 (BCD 2021b)
- Dalswinton Quarry – Groundwater Impact Assessment (Hydrogeologist 2021)
- Dalswinton Quarry Expansion – Surface Water Impact Assessment – Final (Umwelt 2020)
- Dalswinton Quarry Flood Investigation and Impact Assessment (Haskoning 2020) Proposed Quarry Expansion - Rehabilitation Plan - Revised (HDB 2020a)
- Rosebrook Sand & Gravel: DA 1994-410 Notice of Determination of Amendment to Consent (MSC 2019)
- Site Rehabilitation Strategy for Lot 72 DP1199484 Dalswinton Quarry (HDB 2020b)
- State Significant Development - Revised Planning Secretary's Requirements. Dalswinton Quarry Project (SSD 9094) (DPE 2018).

Basemap data was obtained from NSW Land and property information (LPI) 1:25,000 digital topographic databases, with cadastral data obtained from LPI digital cadastral database.

The following spatial datasets were utilised during the development of this report:

- Catchment Boundaries of New South Wales dataset.
- Mitchell Landscapes Version 3.1.
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7.
- Directory of Important Wetlands (DoIW).
- NSW Soil and Land Information System (SALIS).

Mapping has been produced using a Geographic Information System (GIS). The following maps and data have been provided:

- Digital mapping with aerial photography showing 1:1000 or finer.
- Site map as described in subsection 3.1.1 of the BAM.
- Location Map as described in subsection 3.1.2 of the BAM.
- Landscape map with features including 1,500 m buffer, as described in section 3.1.3 of the BAM.

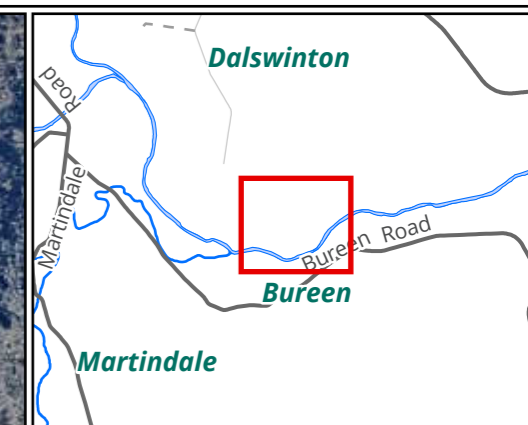
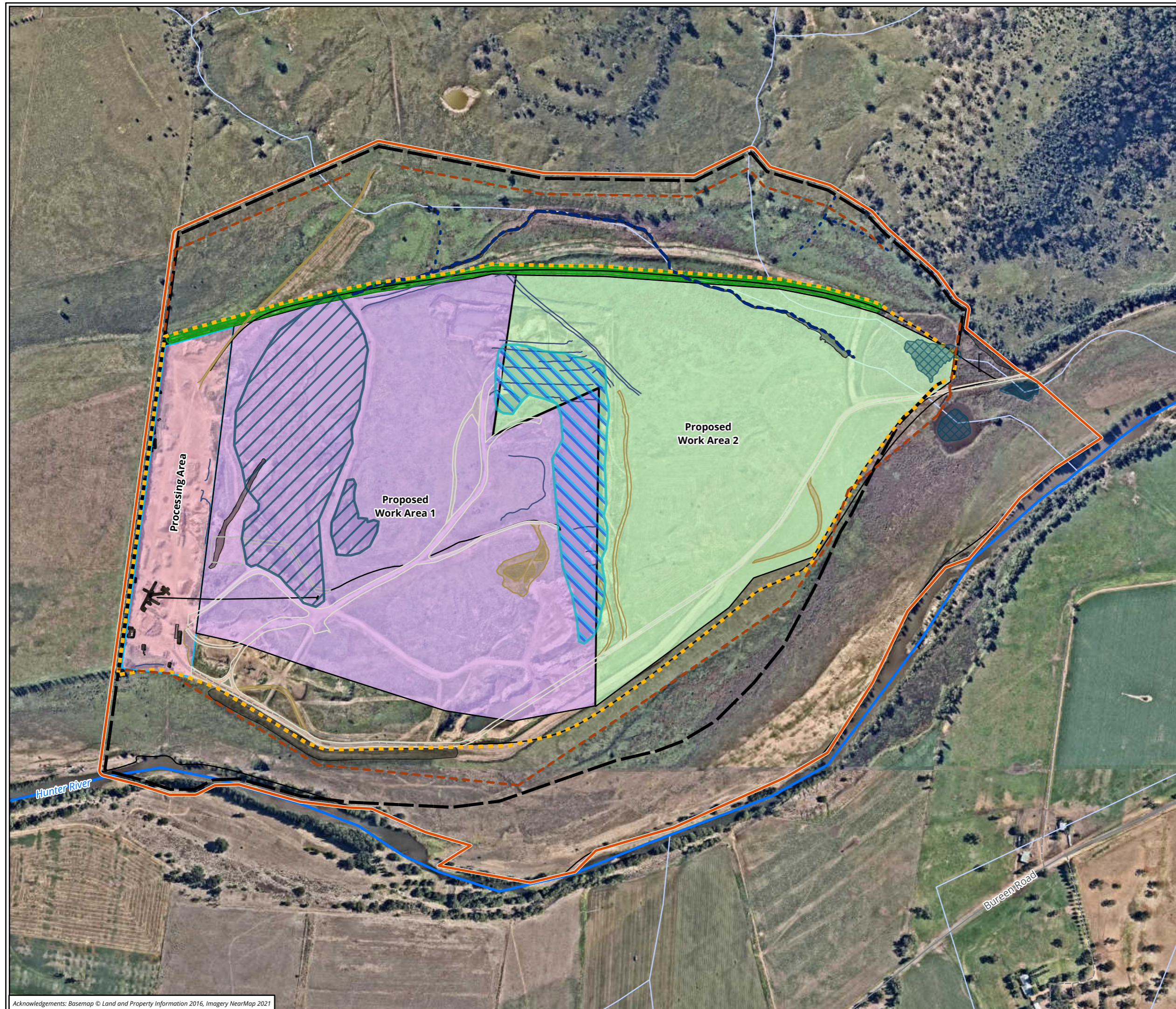
1.5 Legislative requirements

The project has considered, or has been assessed against relevant biodiversity legislation and government policy. This is provided in Table 1.

Table 1 Legislation relevant to the project

Legislation / Policy	Description	Relevance to the current assessment
Commonwealth Acts		
<i>Environment Protection and Biodiversity Conservation Act 1999.</i>	<p>Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on MNES protected under the Act.</p> <p>Under the EPBC Act, the minister may agree to undertake a strategic assessment on the impacts of actions under a policy, plan or program.</p>	MNES relevant to the current project include nationally threatened species and ecological communities, migratory species, and world heritage places. Threatened species and ecological communities protected by the EPBC Act and present within the subject land are outlined in Sections 3, 4 and 10.
NSW Acts		
<i>Environmental Planning and Assessment Act 1979 (EP&A Act).</i>	Provides the overarching structure for planning in NSW and is supported by other statutory environmental planning instruments (EPIs).	Determines the approval pathway for the project, and prescribes the consideration of relevant EPIs.
<i>Biodiversity Conservation Act 2016.</i>	Key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species and communities and key threatening processes.	Mandates the application of the NSW BOS and BAM.
<i>Biosecurity Act 2015.</i>	Outlines biosecurity risks and impacts, and prescribes requirements for the management of risk to reduce the severity of impacts.	Biosecurity risks relevant to the current assessment include weeds, pest animals and pathogens that are known to occur, or potentially occur, within the subject land. Further details of biosecurity risks present within the impact area and impact assessment area are provided in Section 10.
<i>Fisheries Management Act 1994 (FM Act).</i>	Provides for the protection and conservation of aquatic species and their habitat throughout NSW.	The BAM focusses on impacts to terrestrial ecology and thus excludes items listed under the FM Act.

Legislation / Policy	Description	Relevance to the current assessment
NSW EPIs		
SEPP (Koala Habitat Protection) 2021.	This SEPP commenced on 17 March 2021 to replace and repeal the 2020 Koala SEPP. This SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas to support a permanent free-living population over their present range and reverse the current trend of Koala population decline.	<p>The Muswellbrook LGA is listed under Schedule 1 as an area to which the SEPP applies.</p> <p>Assessment of the project against the requirements of the SEPP are not required for SSD and no suitable habitat is present in the subject land. No further assessment under the SEPP is required.</p>
Muswellbrook LEP	This Plan aims to make local environmental planning provisions for land in Muswellbrook in accordance with the relevant standard environmental planning instrument under Section 3.20 of the Act.	The subject land is located within the Muswellbrook LGA. As such, the Muswellbrook LEP applies.



Legend

- Subject land
- Development site
- Development footprint
- Proposed work area 1
- Proposed work area 2
- Fence
- Tailings dam/artificial wetland
- Managed/ephemeral dam
- Tailings dam
- Dam
- Drainage channel
- Unmapped drainage line

Figure 1 Subject land

0 40 80 120 160 200

Metres

Scale: 1:6,500 @ A3

Coordinate System:

GDA 1994 MGA Zone 56



Matter: 35797, Date: 28 October 2021,
 Drawn by: SB, Checked by: SC, Last edited by: sblades
 Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx
 Layout: 35797_BDAR_F1_SubjectLand

2 Landscape Context

This chapter describes the landscape and site context of the assessment area. In accordance with the BAM, a number of features are assessed within the subject land and within the assessment area around the subject land (Figure 2). These landscape features are used to identify biodiversity values that are important for the subject land and inform the habitat suitability of the subject land for threatened species. Other features, such as rivers, streams, estuaries and wetlands, habitat connectivity, karst areas or areas of outstanding biodiversity value are considered, where appropriate.

2.1 Landscape features

2.1.1 IBRA bioregions and IBRA subregions

The subject land occurs within the Sydney Basin IBRA bioregion and the Hunter IBRA subregion. The Sydney Basin Bioregion lies on the central east coast of NSW and covers an area of approximately 3,624,008 hectares. It occupies about 4.53 per cent of NSW and is one of two bioregions contained wholly within the state. The bioregion extends from just north of Batemans Bay to Nelson Bay on the central coast, and almost as far west as Mudgee. The bioregion is bordered to the north by the North Coast and Brigalow Belt South bioregions, to the south by the South East Corner Bioregion and to the west by the South Eastern Highlands and South Western Slopes bioregions. The Sydney Basin Bioregion is one of the most species diverse in Australia. This is a result of the variety of rock types, topography and climates in the bioregion (DPIE 2016).

2.1.2 Rivers, streams, estuaries and wetlands

The subject land is located within the Hunter LLS Region and the Hunter Catchment Management Area (CMA). The closest large watercourse is the Hunter River, which is mapped as a ninth order watercourse (Strahler method) and is located within the southern portion of the subject land. The closest major waterbody is Plashett Reservoir, located approximately 15 kilometres east of the subject land.

One second order watercourse and one third order watercourse (Strahler method) are located along the north-eastern boundary of the subject land (Figure 1), both flowing in a southerly direction into the Hunter River. There are no Key Fish Habitats (KFH) as mapped by the NSW Department of Primary Industries (DPI) within the development site (DPI 2020). However, the Hunter River, located within the subject land, constitutes KFH (DPI 2020). The Hunter River is classified as habitat for the threatened Purple-spotted Gudgeon *Mogurnda adspersa* by DPI (DPI 2020).

Ramsar Wetlands are representative, rare or unique wetlands, or are important for conserving biological diversity. They are included on the List of Wetlands of International Importance developed under the Ramsar convention. Important Wetlands are identified as nationally significant and are identified in the Directory of Important Wetlands in Australia (DAWE 2004). No Ramsar Wetlands or Important Wetlands have been identified within 100 kilometres of the subject land. The closest Important Wetland to the subject land is Hexham Swamp, which is located over 100 kilometres south-east of the subject land, near Newcastle. Hexham Swamp was listed for the following reasons:

- It is a wetland which is important as the habitat for animal taxa at a vulnerable stage in their life cycles, or provides a refuge when adverse conditions such as drought prevail.
- The wetland supports native plant or animal taxa or communities which are considered endangered or vulnerable at the national level.

2.1.3 Habitat connectivity

The subject land does not form part of any recognised biodiversity corridors, flyways or significant habitat connectivity features.

The primary connectivity feature of the subject land consists of the vegetated riparian zone of the Hunter River, located along the southern boundary of the subject land. A row of planted vegetation is also present along the western boundary of the subject land, providing connectivity between the subject land and the Hunter River. These connectivity features provide marginal foraging and dispersal resources and sub-optimal breeding resources for terrestrial and arboreal mammals, flying mammals, and avifauna. Habitat fragmentation occurs across the entire subject land, however some connectivity is preserved through wetland vegetation located around the existing tailings dam within the development footprint, and the Hunter River along the southern boundary. A large area of bushland occurs along the north-eastern boundary of the subject land, joining the Hunter River to the east of the site. The subject land is isolated from the broader local area by heavy agricultural and mining practices in the local area.

Aquatic habitat corridors are limited for fish species across the subject land, however floodplain prone areas and wetland vegetation identified in the subject land may provide movement and dispersal areas for semi-terrestrial species, such as amphibians.

2.1.4 Geological features

There were no recorded karst, caves, crevices, cliffs or other areas of geological significance within the subject land or within the assessment area.

Spur Hill north-east of the subject land represents a 180 metre increase in elevation over less than 1 kilometre and contains rocky habitat features and crevices. There is some potential for small caves, however significant caves are unlikely to occur given the geology. The closest area of geological significance is the northern fringes of the Wollemi National Park, which is located approximately 3 kilometres south of the subject land.

2.1.5 Areas of outstanding biodiversity value

No areas of Outstanding Biodiversity Value (OBV) are mapped within the subject land.

2.1.6 NSW (Mitchell) Landscape

The subject land occurs within both the Central Hunter Foothills and Upper Hunter Channels and Floodplain Mitchell Landscapes (Mitchell 2002). A majority of the subject land occurs in the Central Hunter Foothills landscape, and as such this was entered into the calculator.

The Central Hunter Foothills landscape is characterised by Permian lithic sandstone, conglomerate, shale and coal on undulating lowlands and rounded to steep hills with rock outcrop on ridges. The general elevation is between 40 and 300 metres and the local relief is 30 to 120 metres.

The original community typically consisted of woodlands to open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum *Eucalyptus tereticornis*, Narrow-leaved Ironbark *Eucalyptus crebra*, Red Ironbark *Eucalyptus sideroxylon*, White Box *Eucalyptus albens*, Slaty Gum *Eucalyptus dawsonii*, Rough-barked Apple *Angophora floribunda* with Kangaroo Grass *Themeda triandra* and Wallaby Grass *Rytidosperma* sp.

2.1.7 Additional landscape features

The subject land is mapped as having Environmentally Sensitive Land (ESL). In deciding whether to grant development consent for development on land to which this clause applies, the consent authority must consider if the subject land has any of the following:

- The coastal waters of the State,
- A coastal lake,
- Land within the coastal wetlands and littoral rainforests area,
- Land reserved as an aquatic reserve under the FM Act or as a marine park under the Marine Parks Act 1997,
- Land within a wetland of international significance declared under the Ramsar Convention on Wetlands or within a World heritage area declared under the World Heritage Convention,
- Land within 100 m of land to which paragraph the above applies,
- Land identified in this or any other environmental planning instrument as being of high Aboriginal cultural significance or high biodiversity significance,
- Land reserved under the *National Parks and Wildlife Act 1974* or land acquired under Part 11 of that Act,
- Land reserved or dedicated under the *Crown Land Management Act 2016* for the preservation of flora, fauna, geological formations or for other environmental protection purposes,
- Land that is a declared area of outstanding biodiversity value under the BC Act or declared critical habitat under the FM Act.

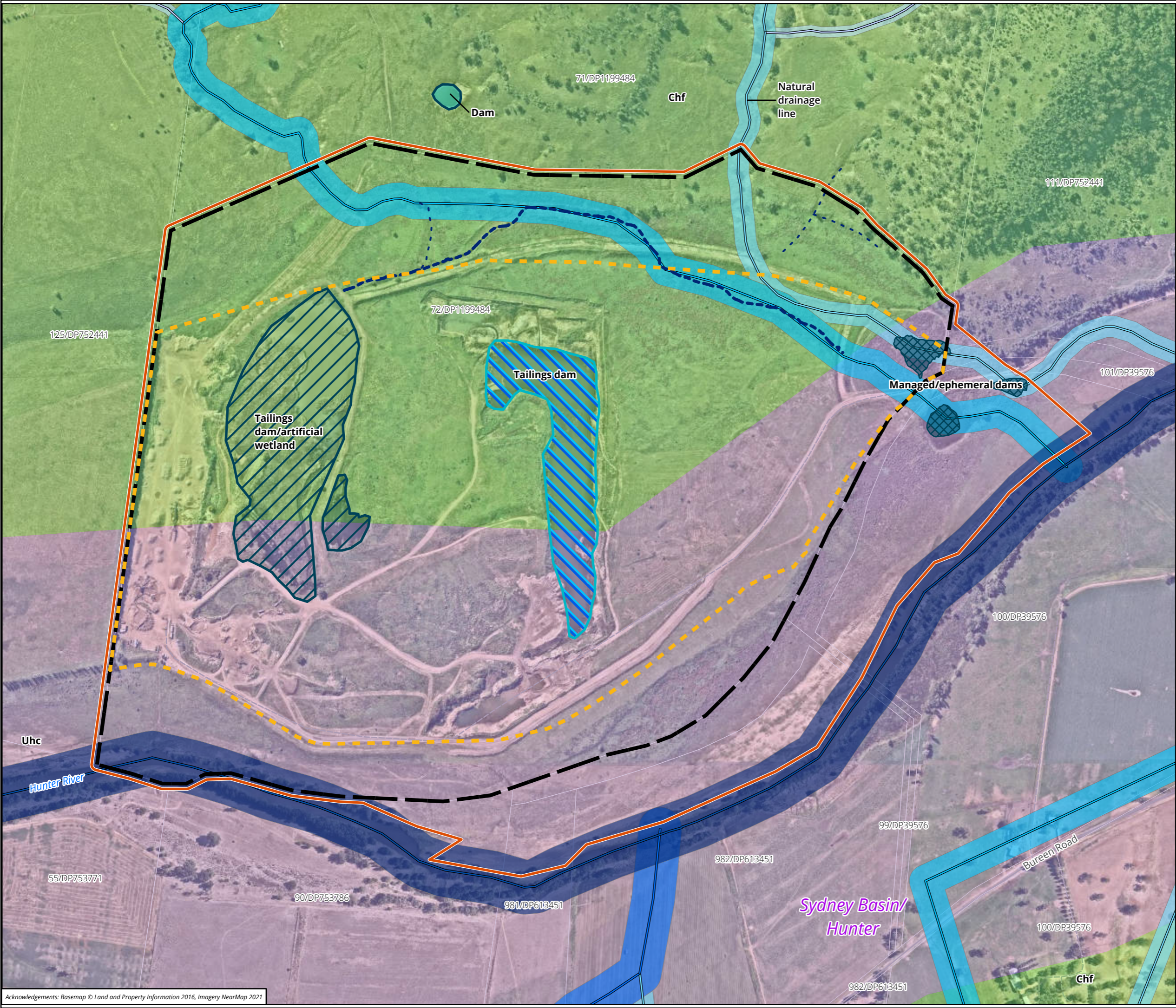
The ESL map applies as the subject land contains features identified as High Biodiversity Value on the BV Map along the Hunter River.

2.2 Native vegetation cover

In accordance with Section 3.2 of the BAM, native vegetation cover must be estimated within the assessment area to determine the landscape context of the subject land. The extent of native vegetation on the subject land and immediate surrounds was mapped using *State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894* (DPIE 2019a), with edits made to the layer to improve line-work and where obvious changes to vegetation extent had occurred.

The assessment area around the subject land is 1549 hectares, with the area of native vegetation mapped within the buffer being 639 hectares. This is a native vegetation cover of 41 % (>30-70 % class as defined in Section 3.2.3 of the BAM) and this value was entered into the BAM calculator.

Cleared areas within the assessment area include 911 hectares.



Legend

- Subject land
- Development site
- Development footprint
- IBRA Region/Sub-region

Mitchell Landscapes

- Chf, Central Hunter Foothills
- Uhc, Upper Hunter Channels and Floodplain

Hydrological features

- Tailings dam/artificial wetland
- Managed/ephemeral dam
- Tailings dam
- Dam
- Drainage channel
- Unmapped drainage line

Strahler stream order

- 1
- 2
- 3
- 4
- 9

HydroLine stream order buffers

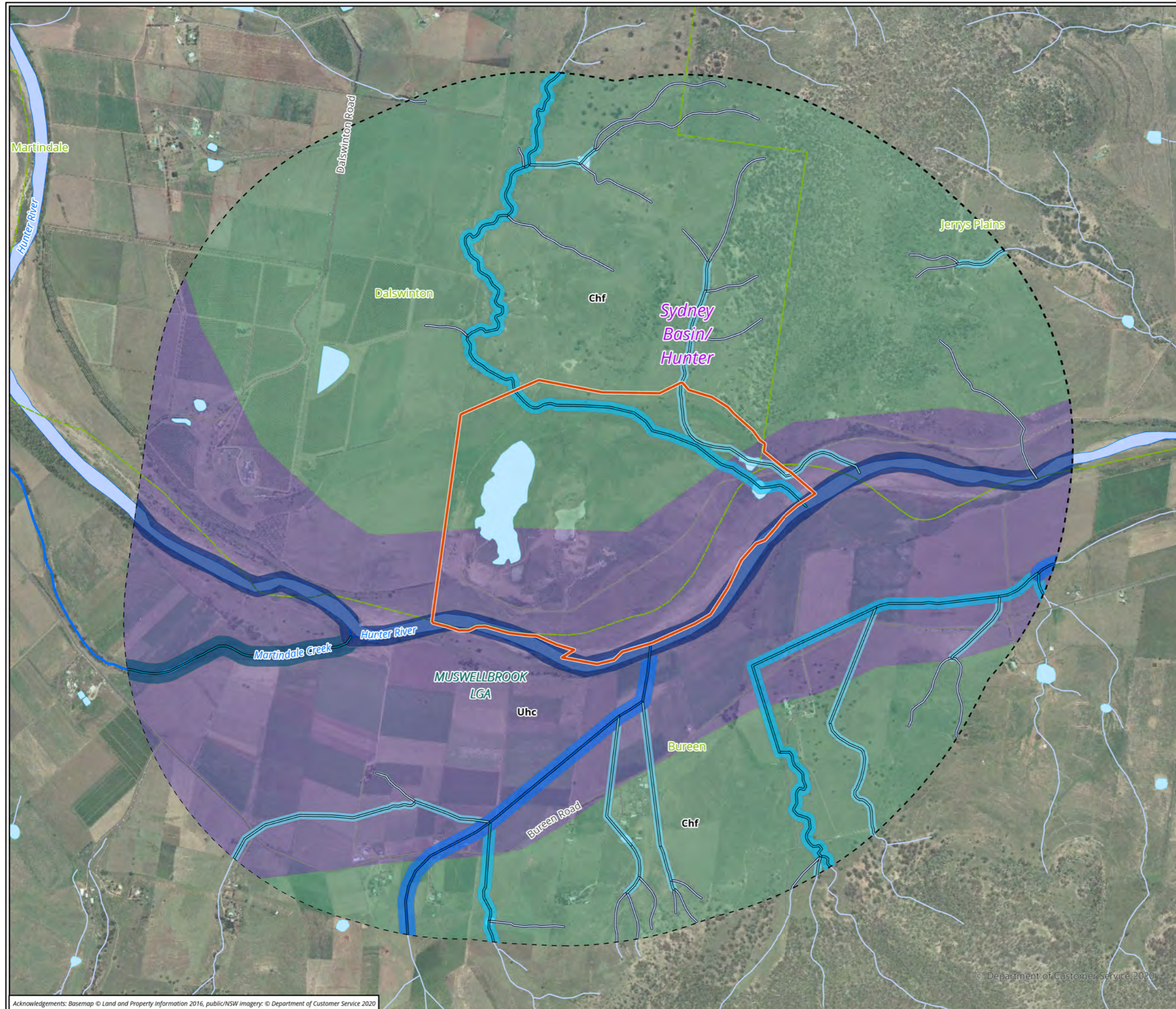
- 1
- 2
- 3
- 4
- 9

Figure 2 Site map

0 40 80 120 160 200
Metres
Scale: 1:6,500 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

biosis

Matter: 35797, Date: 28 October 2021
Drawn by: SB, Checked by: SC, Last edited by: sblades
Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.arpx.aprx
Layout: 35797_BDAR_F2_SiteMap



Legend

- Subject land
- Assessment area
- IBRA Region/Sub-region

HydroLine stream order

- 1
- 2
- 3
- 4
- 6

Strahler stream order buffers

- 1
- 2
- 3
- 4
- 6
- 9

Mitchell landscapes

- Chf, Central Hunter Foothills
- Uhc, Upper Hunter Channels and Floodplain

Figure 3 Location map

0 140 280 420 560 700

Metres

Scale: 1:17,000 @ A3

Coordinate System:

GDA 1994 MGA Zone 56



Matter: 35797, Date: 27 October 2021
 Drawn by: SB, Checked by: SC, Last edited by: sblades
 Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx
 Layout: 35797_BDAR_F3_Location

3 Native vegetation

The subject land supports 14.4 hectares of native vegetation in varying condition states. The development site supports 6.26 hectares of native vegetation as a freshwater wetland in a moderate condition state.

3.1 Native vegetation extent

The extent of native vegetation, TECs and vegetation integrity within the subject land was determined using the results of site investigations and Section 4 of the BAM (DPIE 2020a).

Figure 4, Figure 5 and Figure 6 provide maps of the native vegetation extent recorded within the subject land, development footprint and assessment area, as assessed during field investigations undertaken in August 2021. The figures include all areas of native vegetation (native ground cover and areas with canopy). Areas not shown as native vegetation cover, and which do not provide habitat for threatened species, are not included for further assessment in accordance with Section 5.1.1.5 of the BAM. Non-native vegetation considered to provide habitat for threatened species is required to be assessed.

3.1.1 Changes to mapped native vegetation extent

There were slight differences between the actual native vegetation extent and that visible on the aerial imagery. A majority of the subject land has previously been mapped as cleared land by DPIE (DPIE 2019b, DPIE 2019a). However, field investigations by Biosis found patches of wetland vegetation and derived native grassland vegetation across the subject land where it was previously unmapped.

3.1.2 Areas that are not native vegetation

Assessment of non-native vegetation or areas exempt from further assessment was undertaken in accordance with BC Act s6.8 (3) which states that any assessment relating to biodiversity is to exclude the clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the LLS Act. This excludes any impacts prescribed by the regulations under section 6.3. Additionally, in accordance with section 1.5 of the BAM, biodiversity values that do not need to be assessed include: (d) biodiversity values associated with the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A of the LLS Act), other than the additional biodiversity impacts in accordance with clause 6.1 of the BC regulation.

In the absence of a published Native Vegetation Regulatory Map (NVRM), an accredited assessor can identify lands as Category 1 – exempt land or Category 2 – regulated land by applying the definitions in the LLS Act, or advice from LLS. This is completed by approximating the method used to make the NVR map under the provisions of the BC Act and the LLS Act. This is undertaken by using the same methodology inclusive of the following:

- Historic aerial imagery at (or closest available to) 1990. Landata imagery from the Muswellbrook sheet was reviewed to inform land use in the subject land over time (1958, 1974, 1989a, 1989b).
- NSW 2017 land use dataset (Australian Land Use and Management (ALUM) Classification Version 7 revised version 1.2 (DPIE 2020b) .
- NSW Woody vegetation extent and Foliage percentage cover (FPC) 2011 (DPIE 2011)
- Sensitive regulated and vulnerable regulated lands on the Native Vegetation Regulatory Map.

To meet the Category 1-exempt land requirement, land must be:

- Legally cleared at or since 1 January 1990 (Woody vegetation only).
- Significantly disturbed or modified since 1990 (Non-woody vegetation).

Areas identified as non-native vegetation or Category 1 – exempt land and Category 2 – regulated land are shown on Figure 4

Table 2 Land category analysis.

Data sources	Category 1 – exempt land	Category 2– regulated land	Excluded land
1958 aerial imagery	Significantly cleared and modified, albeit with intact natural floodplain	Less than 2 % woody vegetation present	E3 zoned land (NE of subject land)
1974 aerial imagery	Significantly cleared and modified, livestock tracks visible.	Less than 2 % woody vegetation present	E3 zoned land (NE of subject land)
1989 aerial imagery	Clear evidence of significant groundcover modification, livestock tracks visible. Clear evidence of quarry operations	Less than 2 % woody vegetation present Woody vegetation present at 1990 in conjunction with woody vegetation extent layer	E3 zoned land (NE of subject land)
2017 Land Use Dataset	Land use identified as; <ul style="list-style-type: none"> • River - intensive use • Grazing modified pastures (excluding woody vegetation) where clear evidence of significant groundcover modification has occurred post 1990 • Reservoir / dam 	Land use identified as; <ul style="list-style-type: none"> • Rivers • Grazing native vegetation • Grazing modified pastures where evidence of significant groundcover modification is absent (precautionary principle applied) 	E3 zoned land (NE of subject land)
NSW Woody vegetation extent	Areas of woody vegetation regrowth that has occurred post 1990 following previous clearing events	Woody vegetation present as at 1990 in conjunction with historic aerial imagery	E3 zoned land (NE of subject land)
Native regulatory map Sensitive regulated land Vulnerable regulated land Excluded land	N/A	Land mapped as vulnerable regulated land by NVR <ul style="list-style-type: none"> • The Hunter River • Woody vegetation on the NE boundary Land mapped as vulnerable regulated land by Biosis <ul style="list-style-type: none"> • Native grassland on steep land susceptible to erosion • Environmentally sensitive vegetation 	E3 zoned land (NE of subject land)

3.2 Review of existing information

Existing information regarding native vegetation was reviewed to inform field investigations including:

- *State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894* (DPIE 2019a).
- *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855* (DPIE 2019b).

Based on the results of the background review and the requirements of the BAM with respect to this BDAR, appropriate surveys were designed for the subject land and development footprint.

3.3 Field investigation

A systematic biodiversity assessment was conducted on 25 August 2021 under the terms of Biosis' Scientific Licence issued by the EES under the *National Parks and Wildlife Act 1974* (SL100758, expiry date 31 March 2022). Fauna survey was conducted under approval 11/355 from the NSW Animal Care and Ethics Committee (expiry date 31 January 2022). Assessment in accordance with the BAM was carried out by the Accredited Assessor Brooke Corrigan (BAAS19061).

The subject land was surveyed in accordance with the BAM (DPIE 2020a), which involved:

- The identification and mapping of PCTs according to the structural definitions held in the BioNet Vegetation Classification database, with reference to information provided in *State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894* (DPIE 2019a).
- Undertaking floristic plots within each vegetation zone in accordance with Section 4 of the BAM (DPIE 2020a), considering varying condition states and avoidance of ecotones, areas of disturbance, and edges.
- The identification of native and exotic plant species, according to the Flora of NSW (Harden 1992, 1993, 2000, 2002) with reference to recent taxonomic changes.
- Targeted searches for plant species of conservation significance according to the NSW *Surveying threatened plants and their habitats* (DPIE 2020c).
- Incidental observations using the “random meander” method (Cropper 1993).
- Identifying and mapping fauna habitats (e.g. hollow-bearing trees, rock outcropping etc.) and assessing their condition and value to threatened fauna species.
- An assessment of the natural resilience of the vegetation of the site.
- Identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the study area.
- Observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings).
- Targeted surveys for threatened fauna species.

The conservation significance of plant species and plant communities was determined according to:

- BC Act for significance within NSW
- EPBC Act for significance within Australia.

Detailed mapping of PCTs was conducted using hand-held (uncorrected) tablet units (Samsung Galaxy Tab 3) using the ArcGIS Collector application and aerial photo interpretation. Areas of native vegetation for which a

PCT could validly be assigned were identified and delineated in the field, and their condition determined. Identification of PCTs within the study area was confirmed with reference to the community profile descriptors (and diagnostic species tests) held within NSW BioNet Vegetation Classification database (DPIE 2021a). Locations of floristic plots surveyed are shown on Figure 6.

Further details of targeted survey for threatened flora and fauna species are provided in Section 4.2 below.

3.4 Plant community types


The following PCTs were assessed as present within the subject land:

- PCT 42 *River Red Gum / River Oak riparian woodland wetland in the Hunter Valley*.
- PCT 1071 *Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion*.
- PCT 1603 *Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter*
- PCT 1691 *Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter*.

Table 3 to Table 6 provide detailed descriptions of the four PCTs recorded within the subject land. PCTs recorded within the subject land are shown on Figure 6.

Table 3 PCT 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley

PCT 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley	
Common name	River Red Gum / River Oak riparian woodland
Vegetation formation	Forested Wetlands
Vegetation class	Eastern Riverine Forests
Extent within subject land	1.3 ha, concentrated along the Hunter River. Planted vegetation consistent with the PCT occupies 0.74 ha on adjoining land
Condition	This community at the subject land was recorded in a low condition state, with a high ingress of weed species in the understorey.
Description	<p>River Red Gum / River Oak riparian woodland typically occurs as a tall forest and woodland with a grassy ground cover. The shrub layer is generally absent and the groundcover is commonly dominated by weed species. It intergrades upslope into woodlands composed of White Box <i>Eucalyptus albens</i>, Rough-barked Apple <i>Angophora floribunda</i> and Forest Red Gum <i>Eucalyptus tereticornis</i>. Before clearing this community was probably extensive along the Hunter River upstream of Maitland. River Red Gum <i>Eucalyptus camaldulensis</i> requires flooding for recruitment which is now limited in the Hunter River and the species is often absent from the PCT.</p> <p>The community present in the subject land consists of an upper stratum dominated by River Oak <i>Casuarina cunninghamiana</i> along with Willow Tree <i>Salix</i> spp. No other tree species were present. The mid story consists of; Cooba <i>Acacia salicina</i> along with exotics Green Cestrum <i>parqui</i> and African Boxthorn <i>Lycium ferocissimum</i> dominant.</p> <p>The understorey consists of; Stout Bamboo Grass <i>Austrostipa verticillata</i>, Couch <i>Cynodon dactylon</i>, Weeping Grass <i>Microlaena stipoides</i>, <i>Aristida vagans</i> Threawn Speargrass and <i>Urtica incisa</i>. Exotic groundcovers were typically dominant and included <i>Galenia pubescens</i>, <i>Prairie Grass Bromus catharticus</i>, <i>Panic Veldt Grass Ehrharta erecta</i>, <i>Tiger Pear, Opuntia aurantiaca</i>,</p>

PCT 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley	
	Blue heliotrope <i>Heliotropium amplexicaule</i> and many others described in Appendix 3 . Planted vegetation on neighbouring land immediately alongside the western fence line is broadly consistent with PCT 42 and includes River Oak and Forest Red Gum <i>Eucalyptus tereticornis</i> at high density.
Survey effort	One BAM plot/transect (Figure 6).
Justification of PCT	<p>River Red Gum / River Oak riparian woodland within the subject land meets the PCT description (DPIE 2021a) via the following:</p> <ul style="list-style-type: none"> • IBRA region and subregion – Sydney Basin IBRA bioregion and the Hunter IBRA subregion. • Soil – occurs on the Alluvial Soils landscape. • Structure – open forest with sparse mid-storey and an abundant cover of grasses. • Dominant species – River Oak. • The BioNet PCT Identification tool identified PCT 42 from the species recorded at the subject land.
TEC Status	<p>NSW BC Act: All PCT 42 within the subject land was determined to meet the criteria for <i>Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions</i> EEC. The final determination does not distinguish between condition classes</p> <p>Commonwealth EPBC Act: Not listed.</p> <p>Further information on TECS is provided in Section 3.5 below.</p>
Estimate of percent cleared value of PCT (BioNet)	95 % (DPIE 2021a).
PCT 42 – Low condition	

PCT 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley

PCT 42 – planted



Table 4 PCT 1071 *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion

PCT 1071 *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion

Common name	Freshwater Wetlands on Coastal Floodplains
Vegetation formation	Freshwater Wetlands
Vegetation class	Coastal Freshwater Lagoons
Extent within subject land	6.26 ha
Condition	This community at the subject land was recorded in a moderate condition state.
Description	<p>This community is typically associated with man-made water bodies, drainage lines and depressions across a wide variety of environments. Includes modified former wetlands such as Hexham Swamp. Occurs also in original form in wide variety of situations associated with coastal plains, valleys, lagoons and other sites of poor drainage.</p> <p>Within the subject land this community occurs in low-lying depressions and consists of a largely native species assemblage fringed by exotic vegetation. Structural habitat of trees and shrubs is provided by exotic Willow, African Boxthorn and Blackberry. The most common native species were Common Reed <i>Phragmites australis</i>, Bulrush <i>Typha</i> spp., Slender Knotweed <i>Persicaria decipiens</i> and <i>Juncus usitatus</i>, with <i>Cyperus brevifolius</i>, Couch <i>Cynodon dactylon</i> present in lower density. Native Floating Fern <i>Azolla</i> sp. occupies areas of open water.</p> <p>Other exotic species include Spiny Rush <i>Juncus acutus</i>, Castor Oil Plant <i>Ricinus communis</i> and those typical of disturbed riparian and rural areas.</p>
Survey effort	Benchmark condition was applied, BAM plots were not completed due to limited access (Figure 5)
Justification of PCT	<p>The subject land is within the Sydney Basin IBRA bioregion.</p> <p>Common Reed was recorded within vegetation in the subject land.</p> <p>The vegetation occurs as a wetland within man-made water bodies, drainage lines and</p>


PCT 1071 <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion	
	<p>depressions.</p> <p>The BioNet PCT Identification tool identified PCT 1071 from the species recorded at the subject land.</p>
TEC Status	<p>NSW BC Act: All PCT 1071 within the subject land was determined to broadly meet the criteria for <i>Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i> (EEC). The final determination does not distinguish between condition classes, however site elevation exceeds the maximum TEC occurrence in the landscape by 50 m and is not known to occur in the Muswellbrook LGA. Therefore the vegetation is not considered a TEC.</p> <p>Commonwealth EPBC Act: Not listed.</p>
Estimate of percent cleared value of PCT (BioNet)	75 % (NSW Scientific Committee 2004).
PCT 1071 – moderate condition	

Table 5 PCT 1603 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter

PCT 1603 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	
Common name	Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Extent within subject land	0.53 ha
Condition	This community at the subject land was recorded in a low condition state, with a high proportion of weed species and consistently suppressed mid and canopy layer.
Description	<p>Open forests in the Central and Lower Hunter Valley with a canopy dominated by <i>Eucalyptus crebra</i>. The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids; forbs and small ferns.</p> <p>Within the subject land this community is limited to isolated Grey Box, Narrow-leaved</p>

PCT 1603 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter


	<p>Ironbark, Rough-barked Apple, Bulloak and Cooba individuals widely spaced or in small clumps. Exotic African boxthorn provides the only perennial shrub layer. Groundcover is largely exotic, but does retain native grass and forb species which form higher condition patches of predominantly native remnant derived native grassland (DNG). These occur along the northern fenceline and near isolated woody vegetation.</p> <p>Species include Purple Wiregrass <i>Aristida ramosa</i>, Stout Bamboo Grass <i>Austrostipa ramosissima</i>, Ruby Saltbush <i>Enchylaena tomentosa</i>, Narrawa Burr <i>Solanum cinereum</i>, Creeping Speedwell <i>Veronica plebia</i>, Saltbush <i>Atriplex</i> spp. and others. Exotic species are typical of the site and locality including Galenia, Onion Weed <i>Asphodelus fistulosus</i>, Prairie Grass, Tiger Pear, Blue heliotrope, Spear Thistle <i>Cirsium vulgare</i> and many others described in Appendix 3.</p>
Survey effort	One BAM plot/transect (Figure 6)
Justification of PCT	<p>The vegetation occurs as an open woodland.</p> <p>Narrow-leaved Ironbark, Grey Box and Bulloak was recorded within the vegetation at the subject land.</p> <p>The subject land is within the Sydney Basin IBRA bioregion</p> <p>The community occurs at the Central Hunter Foothills Mitchell Landscape.</p> <p>The BioNet PCT Identification tool identified PCT 1603 from the species recorded at the subject land.</p>
TEC Status	<p>NSW BC Act: This vegetation conforms to the description of EEC Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (DPIE 2017a) which is determined to be present by this assessment.</p> <p>Commonwealth EPBC Act: The vegetation also conforms to Central Hunter Valley eucalypt forest and woodland ecological community (Threatened Species Scientific Committee 2015) listed as Critically Endangered under the EPBC Act.</p> <p>Further information on TECS is provided in Section 3.5 below.</p>
Estimate of percent cleared value of PCT (BioNet)	77 % (DPIE 2021a).
PCT 1603 – low condition	

Table 6 PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	
Common name	Narrow-leaved Ironbark - Grey Box grassy woodland
Vegetation formation	Grassy Woodlands
Vegetation class	Coastal Valley Grassy Woodlands
Extent within subject land	4.73 ha (canopy absent / derived native grassland), 0.84 ha moderate (on neighbouring land)
Condition	This community at the subject land was recorded in a low condition state, with a high proportion of weed species and consistently suppressed mid and canopy layer.
Description	<p>On adjoining lands and fence lines the canopy is comprised of Grey Box, Narrow-leaved Ironbark and Rough-barked Apple. Bulloak, and Kurrajong are also present with Cooba and Native Olive.</p> <p>The ground layer contains Tall Chloris <i>ventricosa</i>, Kidney Weed <i>Dichondra repens</i>, Purple Burr-Daisy <i>Calotis cuneifolia</i>, Wattle Mat-rush <i>Lomandra filiformis</i>, Kangaroo Grass <i>Themeda triandra</i>, Wallaby Grass <i>Rytidosperma spp.</i> Blue Flax-lilly <i>Dianella spp</i> Slender Rat's Tail Grass <i>Sporobolus creber</i> and others. Exotics include <i>Galenia pubescens</i>, Rhodes Grass <i>Chloris gayana</i>, Common Prickly Pear <i>Opuntia stricta</i> and Tiger Pear <i>Opuntia aurantiaca</i> and others described in Appendix 3.</p> <p>The species composition of the vegetation zone is similar to PCT 1603 and impacted by a history of disturbance and management. However the location in the landscape and divergent dominant species composition to vegetation on lower slopes indicate the presence of PCT 1691.</p>
Survey effort	One BAM plot/transect (Figure 6)
Justification of PCT	<p>The vegetation occurs as a grassy woodland.</p> <p>Narrow-leaved Ironbark, Grey Box, Kurrajong and Native Olive were recorded within the vegetation at the subject land.</p> <p>The subject land is within the Sydney Basing IBRA bioregion</p> <p>The community occurs at the subject land at between 70 m and 350 m above sea level on coal-bearing sedimentary geologies.</p> <p>The BioNet PCT Identification tool identified PCT 1691 from the species recorded at the subject land.</p>
TEC Status	<p>NSW BC Act: This vegetation conforms to the description of EEC Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (DPIE 2017a) which is determined to be present by this assessment.</p> <p>Commonwealth EPBC Act: The vegetation also conforms to Central Hunter Valley eucalypt forest and woodland ecological community (Threatened Species Scientific Committee 2015) listed as Critically Endangered under the EPBC Act.</p>
Estimate of percent cleared value of PCT (BioNet)	77 % (DPIE 2021a).
PCT 1691 – moderate condition	This vegetation zone occurs almost entirely upslope of the functional lot boundary indicated by the fence line, which differs from the cadastral boundary by approximately 5m – 20m

PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

(refer to Figure 1). Vegetation north of this fenceline is not under the control of RSG.



PCT 1691 – canopy absent

The upslope rise of this north-west corner contains moderate condition grassland and midstorey consistent with PCT 1691



3.5 Threatened ecological communities

Vegetation within the subject land was found to represent two TECs listed under the NSW BC Act, and one TEC listed under the Commonwealth EPBC Act, as outlined in Table 7 and Table 8 below, and illustrated on Figure 8. No TECs are present within the development footprint.

Table 7 Summary of BC Act TECs within the subject land

BC Act TEC	Listing status	Area (ha)
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	Endangered	2.04
Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions	Endangered	6.10

Table 8 Summary of EPBC Act TECs within the subject land

EPBC Act TEC	Listing status	Area (ha)
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	6.10

3.6 Vegetation integrity assessment

3.6.1 Vegetation zones

PCTs within the subject land were assessed and stratified, based on broad condition state, into vegetation zones (VZ) in accordance with Section 4.3 of the BAM. This resulted in four VZs identified within the subject land, and one within the development footprint. Table 9 describes each of the zones, and provides details on the numbers of BAM floristic plots undertaken in each zone.

Table 9 Vegetation zones within the subject land

Vegetation zone	Plant Community Type	PCT and Condition	Subject land (ha)	Development footprint (ha)	BAM plots completed
1	PCT 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley	42_low	2.04 (1.3 ha remnant)	nil	1
2	PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion.	1071_mod	6.3	6.3	Nil (assumed benchmark)
3	PCT 1603 Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter	1603_low	0.53	nil	1
4	PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	1691_low_dng	4.7 ha	nil	1

The minimum number of BAM plots per vegetation zone was determined using Table 3 of the BAM (DPIE 2020a). Zero BAM plots have been completed within the development footprint for PCT 1071, due to the difficulty in accessing and completing plots within a deep freshwater wetland, and benchmark condition has been applied to this vegetation zone in accordance with the BAM. Plots undertaken within the subject lands supported PCT identification and condition values for adjoining vegetation, details are provided in Table 9 and Table 10 and shown on Figure 6.

Table 10 BAM plots completed within the subject land

BAM plot reference	Vegetation zone	PCT and Condition
35797_01	1	42_low

BAM plot reference	Vegetation zone	PCT and Condition
35797_02	3	1603_low
35797_03	4	1691_low

3.6.2 Condition

Vegetation integrity (VI), or condition, was assessed using data obtained from undertaking BAM plots within the vegetation zones (VZ), as per Section 4.3.4 of the BAM (DPIE 2020a). Plot data was collected via:

- VZ composition, structure and function as well as presence of hollow-bearing trees for the following vegetation formations:
 - Forested wetlands
 - Grassy woodlands
- Quantitative measure of the composition and structure attributes and the functional attribute, high threat weed cover:
 - Freshwater wetlands (assumed benchmark)

Plot data was entered into the BAM calculator to determine VI score. A summary of the VI scores is provided in Table 11. A list of flora species was compiled, and records of all flora species will be submitted to EES for incorporation into the Atlas of NSW Wildlife, and is included in Appendix 3.

Table 11 Vegetation zone integrity scores

Vegetation zone	Composition score	Structure score	Function score	Vegetation integrity score*	IBRA subregion
42_low	16.7	56.7	42.3	34.2	Hunter
1071_moderate*	100	100	-	100	Hunter
1603_low	22.4	18.5	61.9	29.5	Hunter
1691_low	16	42.2	15.2	21.7	Hunter

*Benchmark (pristine) condition vegetation would receive a VI score of 100.

As outlined in Section 9.2.1 of the BAM, an offset is required for impacts on native vegetation where the VI score is:

- ≥ 15 where the PCT is representative of an endangered or critically endangered ecological community.
- ≥ 17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community.
- ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

3.6.3 Assessment of patch size

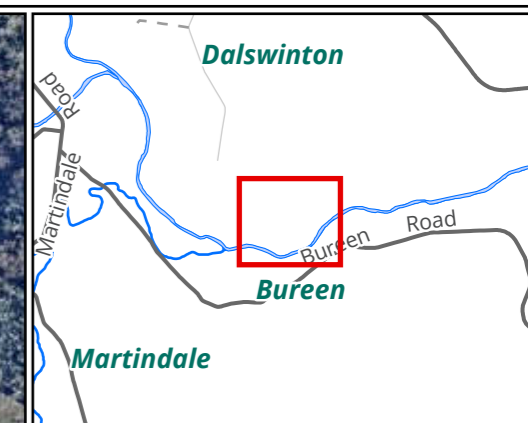
Patch size classes for each vegetation zone present within the subject land were assessed as per Section 4.3.2 of the BAM (DPIE 2020a) using a select process in ArcGIS. All native vegetation with a gap of less than 100 metres from the next area of native vegetation (or ≤ 30 metres for non-woody ecosystems), is considered a single patch, with a patch able to extend onto adjoining land.

Native woody vegetation within the subject land was mapped and was found to form part of a relatively large patch of connecting vegetation with an area of approximately 400 hectares. The patch size was found to be larger than 101 hectares and this value was entered into the calculator. Non-woody wetland vegetation was found to be isolated from this larger patch by non-native vegetation and cleared areas with a patch size of approximately 9 hectares and this value was entered into the calculator.

3.6.4 Survey effort

The subject land was surveyed in accordance with Section 4.3.4 of the BAM (DPIE 2020a), which involved:

- The identification and mapping of PCTs according to the structural definitions of *State Vegetation Type Map: Upper Hunter v1.0. VIS_ID 4894* (DPIE 2019a) and *Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855* (DPIE 2019b).
- Undertaking vegetation integrity survey plots (either the minimum number required or more) within each vegetation zone, considering varying condition states and avoidance of ecotones.
- Identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the study area including; composition, structure, function and ground cover.
- Identifying fauna habitats (e.g. hollow-bearing trees), assessing their condition and assessing their value to threatened fauna species.
- The identification of native and exotic plant species, according to the Flora of NSW (Harden 1992, 1993, 2000, 2002) with reference to recent taxonomic changes.
- Targeted searches for plant species of conservation significance according to the *NSW Surveying threatened plants and their habitats* (DPIE 2020c).
- Incidental observations using the “random meander” method (Cropper 1993).
- Observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings).
- An assessment of the natural resilience of the vegetation of the site.



Legend

- Subject land
- Development site
- Development footprint
- Fence

Land category

- Cat 1 - Exempt Land
- Cat 2 - Regulated Land
- Excluded Land

Figure 4 Land categories

0 40 80 120 160 200

Metres

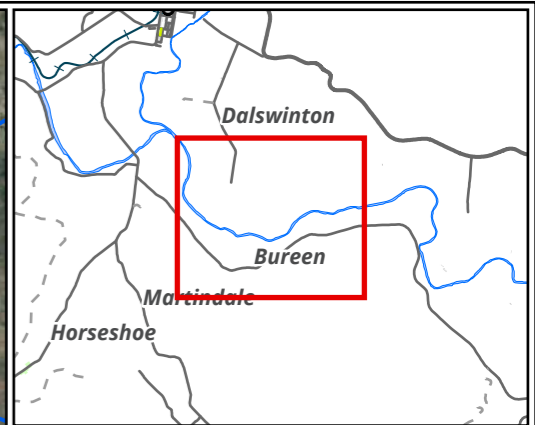
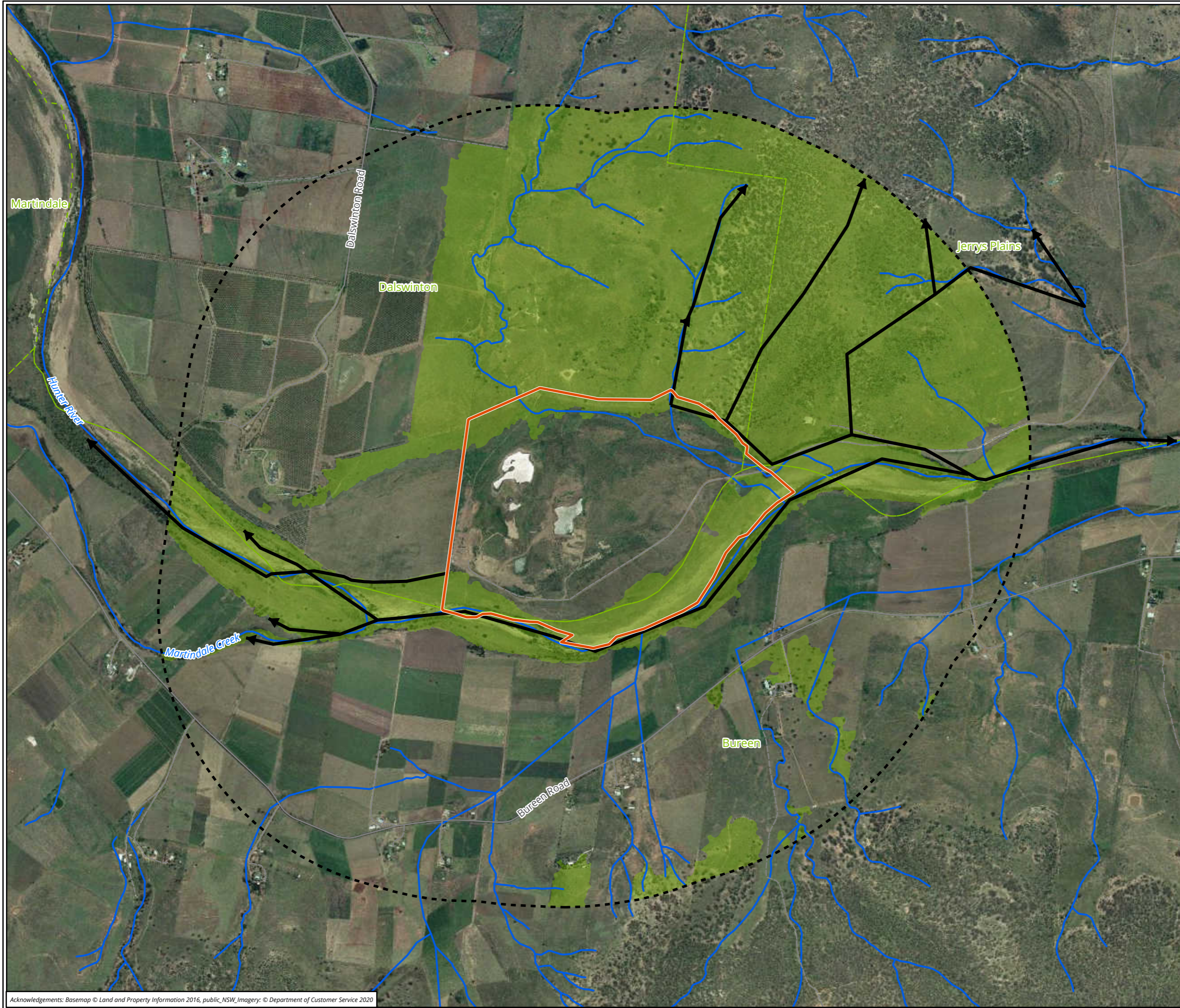
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Coordinate System:

GDA 1994 MGA Zone 56

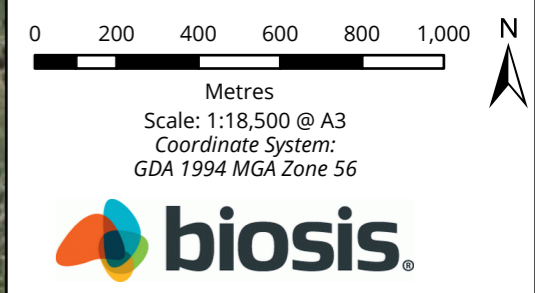


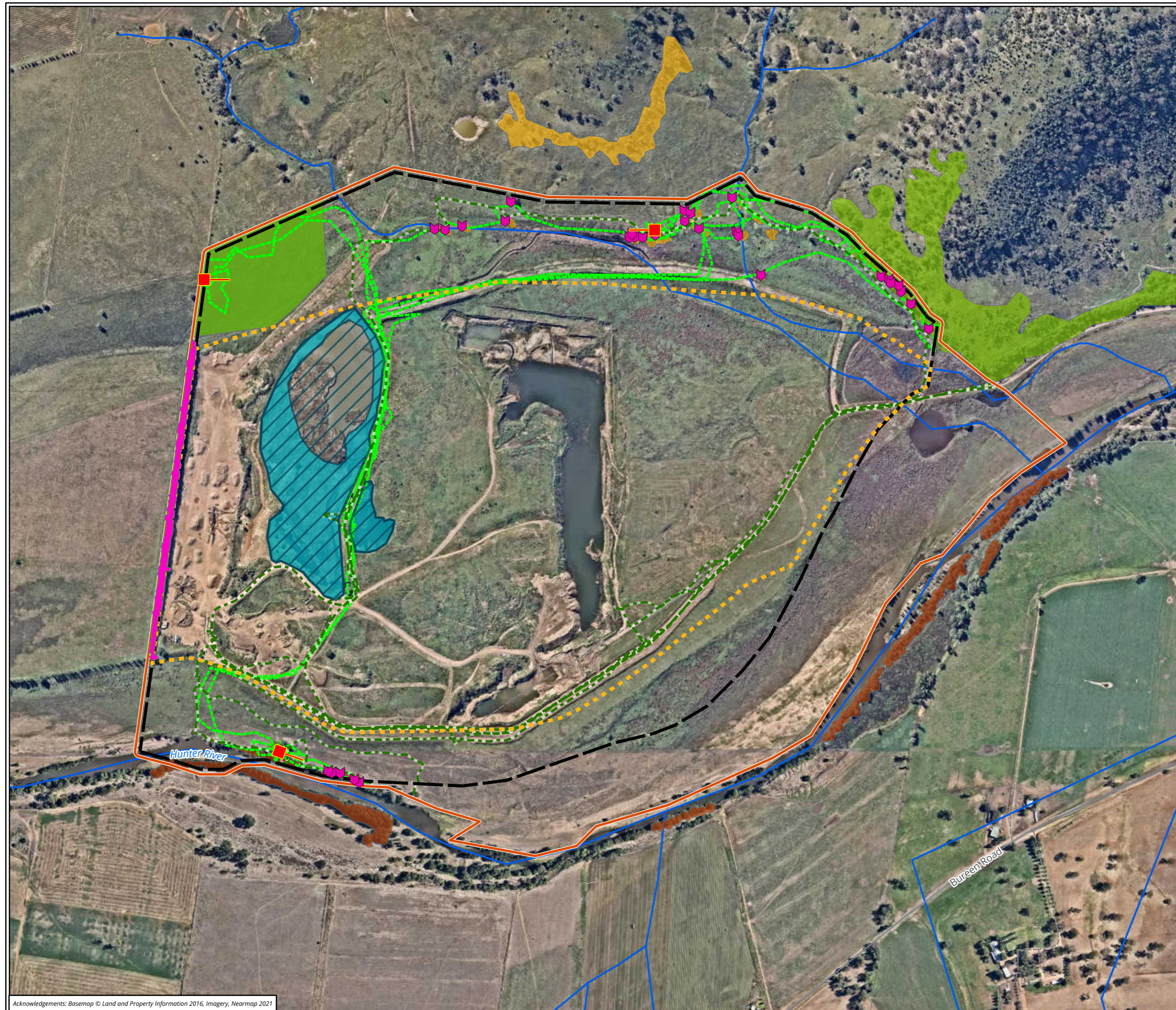
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- Legend**
- Subject land
 - Assessment area
 - Native vegetation
 - Habitat connectivity
 - Drainage line

Figure 5 Native vegetation extent





Legend

- Subject land
- Development site
- Development footprint
- Tailings dam/artificial wetland
- Hollow-bearing Trees
- Drainage line
- BAM plot

Habitat and species survey tracks

- 25 August 2021
- 9 Sept 2021

Plant community type

- 42 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley
- 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter
- 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
- 1071 - Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
- 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (canopy absent)
- 42 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley (planted)

Figure 6 Vegetation within the subject land

0 40 80 120 160 200

Metres

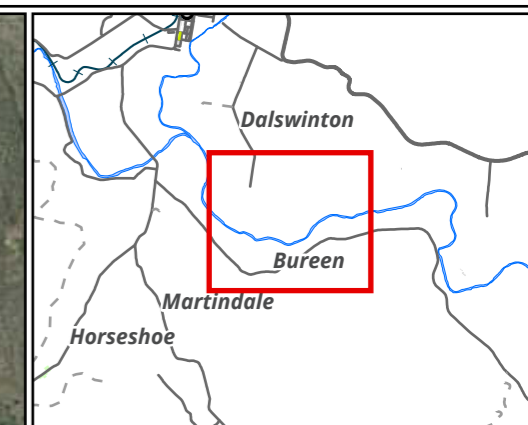
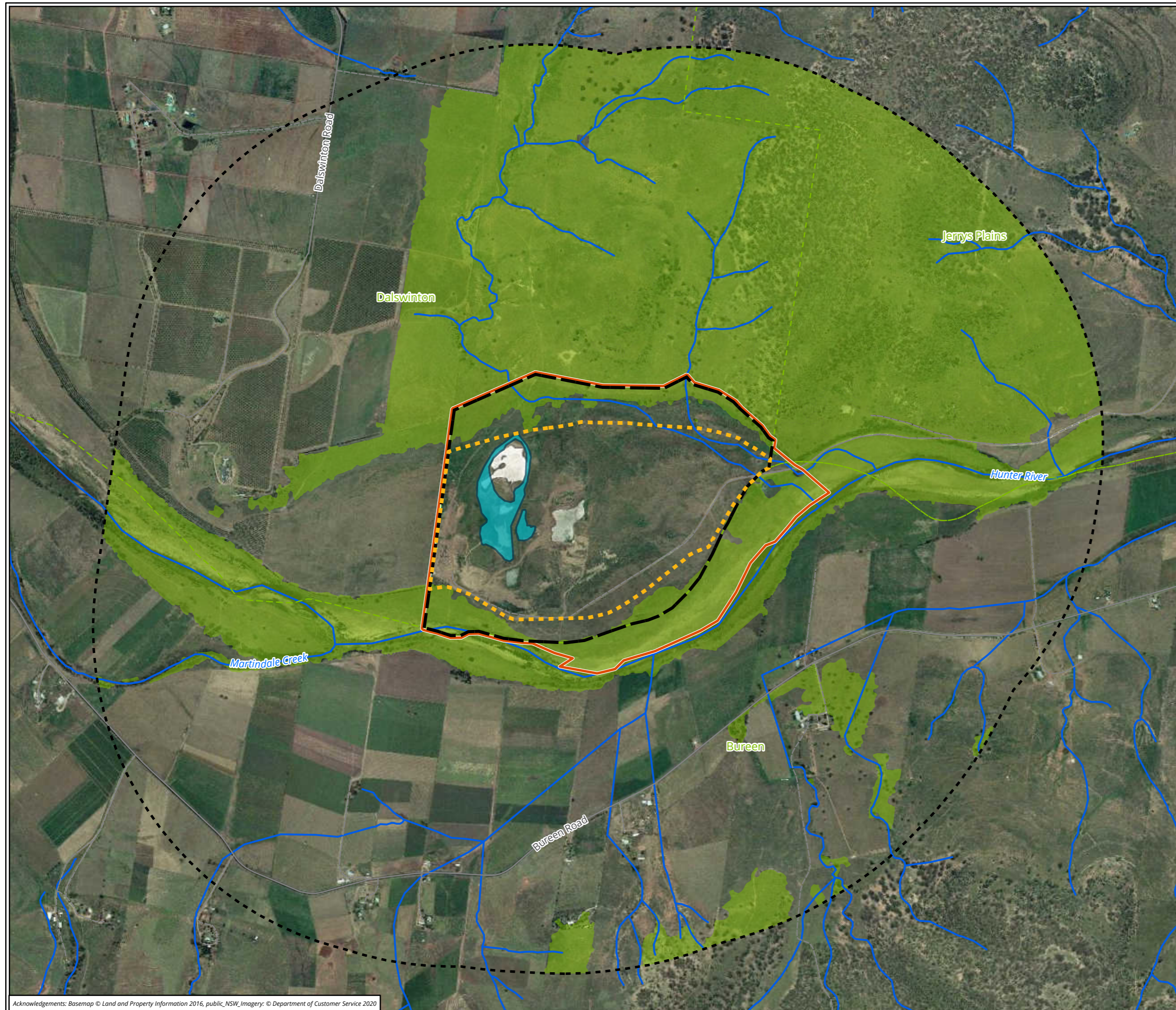
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Coordinate System:

GDA 1994 MGA Zone 56



Matter: 35797, Date: 08 November 2021 Drawn by: SB, Checked by: SC, Last edited by: sbldes
Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx
Layout: 35797_BDAR_F6_VegSubjectLand



- Legend**
- Subject land
 - Assessment area
 - Development site
 - Development footprint
- Patch size**
- 5-<25 ha
 - ≥ 100 ha

Figure 7 Patch size locations

0 100 200 300 400 500
Metres
Scale: 1:16,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56



Matter: 35797, Date: 28 October 2021 Drawn by: SB, Checked by: SC, Last edited by: sblades Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx Layout: 35797_BDAR_F7_PatchSize

4 Threatened species

4.1 Ecosystem credit species

A list of predicted species (ecosystem credit species) expected to occur within the subject land was generated as per Section 5 of the BAM. Impacts to these species require assessment, however targeted survey is not required as these species are assumed to occur, based on the occurrence of the PCTs, habitat constraints, native vegetation cover in the landscape and calculated patch sizes. Table 12 lists the ecosystem credit species that could not be discounted, based on geographical restrictions or a lack of suitable habitat, from utilising the subject land. Note that only ecosystem species associated with PCT 1071 are required by the calculator, some species associated with adjoining woodland PCTs have been retained where appropriate.

These species were considered when prescribing management and mitigation measures for the project.

Table 12 Ecosystem credit species (predicted species) with potential to occur

Common name	Species name
Regent Honeyeater	<i>Anthochaera phrygia</i>
Dusky Woodswallow	<i>Artamus cyanopterus</i>
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>
Speckled Warbler	<i>Chthonicola sagittata</i>
Spotted Harrier	<i>Circus assimilis</i>
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>
Varied Sittella	<i>Daphoenositta chrysoptera</i>
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>
White-fronted Chat	<i>Epthianura albifrons</i>
Black Falcon	<i>Falco subniger</i>
Little Lorikeet	<i>Glossopsitta pusilla</i>
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>
Little Eagle	<i>Hieraetus morphnoides</i>
White-throated Needletail	<i>Hirundapus caudacutus</i>
Comb-crested Jacana	<i>Irediparra gallinacea</i>
Black Bittern	<i>Ixobrychus flavicollis</i>
Swift Parrot	<i>Lathamus discolor</i>
Square-tailed Kite	<i>Lophoictinia isura</i>
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata</i>
Eastern Coastal Free-tailed Bat	<i>Micronomus norfolkensis</i>

Little Bent-winged Bat	<i>Miniopterus australis</i>
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>
Turquoise Parrot	<i>Neophema pulchella</i>
Barking Owl	<i>Ninox connivens</i>
Powerful Owl	<i>Ninox strenua</i>
Blue-billed Duck	<i>Oxyura australis</i>
Eastern Osprey	<i>Pandion cristatus</i>
Scarlet Robin	<i>Petroica boodang</i>
Flame Robin	<i>Petroica phoenicea</i>
Koala	<i>Phascolarctos cinereus</i>
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis</i>
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>
Australian Painted Snipe	<i>Rostratula australis</i>
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>
Diamond Firetail	<i>Diamond Firetail</i>
Freckled Duck	<i>Stictonetta naevosa</i>
Masked Owl	<i>Tyto novaehollandiae</i>

Blue-billed ducks were potentially sighted on the freshwater wetland in 25 August 2021. Three birds matching the species description were observed at in open water within 20 m of a reed bed. However, no identifying photos could be captured of the group. The birds were not present during survey on 9 September 2021. The species is known to occasion the region but is irregularly recorded, with the most recent sighting near Singleton in 2014 (DPIE 2021b).

Two ecosystem credit species were discounted from occurring within the subject land as the geographic limitation of 'East of Cessnock' was not met:

- Magpie Goose *Anseranas semipalmata*.
- Australasian Bittern *Botaurus poiciloptilus*.

One ecosystem credit species was discounted from occurring within the subject land as the habitat constraints of 'Mistletoes present at a density of greater than five mistletoes per hectare' was not present within the subject land:

- Painted Honeyeater *Grantiella picta*.

Several ecosystem credit species were discounted from occurring within the subject land as the subject land is not mapped on the 'BAM - Important Areas' map for migratory shorebirds:

- Curlew Sandpiper *Calidris ferruginea*.
- Great Knot *Calidris tenuirostris*.
- Broad-billed Sandpiper *Limicola falcinellus*.
- Black-tailed Godwit *Limosa*.

4.2 Species credit species

Species credit species are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence, or components of their habitat. These candidate species are identified as species credit species in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the subject land, or alternatively the species can be assumed to be present (DPIE 2020a).

A list of species credit species predicted to occur within the subject land was generated based on the presence of PCT 42, PCT 1071, PCT 1603 and PCT 1691 within a patch size of 101 hectare, and a percentage native vegetation cover score of 41 %. The potential for a species to occur within the subject land was assessed in accordance with Section 5.2 of the BAM and species with geographical restrictions, or habitat constraints not present, were not required to be assessed. While final considerations relate to direct impacts to PCT 1071 with a patch size of 5 to ≤ 25 hectares and 41% native vegetation cover score, specific considerations relating to threatened species and adjoining woody habitat types have been retained where appropriate.

A detailed assessment of potential for occurrence, and potential for impact, for all species credit species predicted to occur within the subject land, and those excluded from further assessment, is provided in Appendix 2. Sixteen predicted species credit species have been excluded from occurring within the subject land based on the substantial degradation of existing potential habitat within the subject land. Species credit species considered to potentially occur within the subject land, and thus considered 'candidate species credit species' have been either assumed present or have been targeted through threatened species surveys. The candidate species credit species considered as part of this assessment, and their associated method of assessment, are listed in Table 13 (flora species) and Table 14 (fauna species).

Threatened flora

Habitats for threatened flora species within the subject land are largely considered degraded due to the high degree of management, previous quarry activity, grazing and history of pasture improvement. Woodland and grassland habitat suitable for threatened species typical of the Central Hunter are restricted to the periphery of the subject land in PCT 42, PCT 1603 and PCT 1691 and are too degraded to support populations of most cryptic flora such as orchids, small shrubs and species dependant on shelter from overstorey vegetation. These areas are also outside the development footprint, however species with potential to occur were included in targeted survey. Threatened flora associated with impact PCT 1071 such as Tall Knotweed *Persicaria elatior*, *Maundia triglochoides* and *Zannichellia palustris* habitat is absent or the site lies outside the species range and so targeted survey was not required.

Table 13 provides a list of candidate flora species credit species considered in this assessment, each species' required survey period and the relevant method of assessment. Further detail of the targeted surveys undertaken are provided below. For species excluded as flora candidate species credit species refer to Appendix 2 for rationale.

Table 13 Candidate flora species credit species

Species name	Common name	Survey period	Method of assessment
<i>Acacia pendula</i> - endangered population	<i>Acacia pendula</i> population in the Hunter catchment	All year	Targeted survey
<i>Cymbidium canaliculatum</i> - endangered population	<i>Cymbidium canaliculatum</i> population in the Hunter Catchment	All year	Targeted survey

Species name	Common name	Survey period	Method of assessment
<i>Eucalyptus camaldulensis</i> - endangered population	Eucalyptus camaldulensis population in the Hunter catchment	All year	Targeted survey
<i>Eucalyptus glaucina</i>	Slaty Red Gum	All year	Targeted survey

Threatened fauna

Fauna habitat assessment was undertaken to determine whether the vegetation to be impacted by the proposed development contained microhabitats suitable to support the candidate fauna species credit species, as outlined in Appendix 2.

Four broad habitat types occur in the subject land and wider locality:

- Artificial freshwater wetland and riparian
- Open woodland on low slopes
- Forested steep rocky slopes
- Cleared / exotic agricultural lands

Of these, two occur within the development footprint, being artificial freshwater wetland and cleared / exotic agricultural lands. While a number of species may utilise the site as part of a wider foraging range or the edge of suitable habitat, breeding habitat or other constraints preclude most species credit species. Refer to Appendix 2 for detailed rationale for species identified by the BAM calculator as relevant to the site.

Table 14 provides a list of candidate fauna species credit species considered in this assessment, each species' required survey period and the relevant method of assessment. Further detail of the targeted surveys undertaken are provided below.

Table 14 Candidate fauna species credit species

Species name	Common name	Survey period	Method of assessment
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	July – December	Targeted survey
<i>Hieraaetus morphnoides</i>	Little Eagle	August – October	Targeted survey
<i>Litoria aurea</i>	Green and Golden Bell Frog	November – March	Assumed present
<i>Lophoictinia isura</i>	Square-tailed Kite	September – January	Targeted survey
<i>Myotis macropus</i>	Southern Myotis	October – March	Assumed present

4.2.1 Threatened species survey details

Targeted threatened species surveys of the subject land were undertaken 25 August 2021 and 9 September 2021 for flora and fauna. Weather observations for each survey date are shown in Table 15.

Table 15 Weather observations during targeted flora and fauna surveys (Merriwa, NSW)

Survey undertaken	Survey date	Temperature (°C)		Rain (mm)
		Min.	Max.	
BAM Plot, Targeted flora and fauna survey	25/8/2021	3.2	15.3	4.4

Survey undertaken	Survey date	Temperature (°C)		Rain (mm)
		Min.	Max.	
BAM Plot, Targeted flora and fauna survey	9/9/2021	3.0	24.0	0.0

Information from the Australia Government Bureau of Meteorology website.

Details of surveys undertaken as part of the current assessment are provided below.

Threatened flora

Survey guidelines followed included:

- Section 5 of the BAM to determine the potential for threatened species identified under the BAM as 'ecosystem credit species' and 'species credit species' to occur (DPIE 2020a).
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004).
- *Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020c).

Survey method and effort

Survey methods included:

- 15 m separated transect searches of areas of potential habitat in August and September 2021.

Targeted flora surveys were undertaken by the Biosis ecologists outlined in Table 16.

Table 16 Targeted flora survey personnel and relevant experience

Staff member	Role	Relevant experience
Brooke Corrigan	Consultant Restoration Ecologist	Over 15 years' experience undertaking targeted flora surveys in the Hunter Valley.

Results

Table 17 provides a summary of the results of the targeted flora surveys completed.

Table 17 Summary of targeted flora survey method and results

Species name	Common name	Survey method	Survey results	Species Polygon (ha) or count
<i>Acacia pendula</i>	Weeping Myall, Boree	15m separated transect searches of areas of potential habitat in August and September 2021.	Not recorded during surveys	N/A
<i>Cymbidium canaliculatum</i>	Tiger Orchid	15m separated transect searches of areas of potential habitat in August and September 2021.	Not recorded during surveys	N/A
<i>Eucalyptus camaldulensis</i>	River Red Gum	15m separated transect searches of areas of potential habitat in August and September 2021.	Not recorded during surveys	N/A

Species name	Common name	Survey method	Survey results	Species Polygon (ha) or count
<i>Eucalyptus glaucina</i>	Slaty Red Gum	15m separated transect searches of areas of potential habitat in August and September 2021.	Not recorded during surveys	N/A

Fauna habitat assessments

Fauna habitat assessment was undertaken to determine the presence of microhabitats and other critical habitat components (habitat constraints) suitable for all fauna species outlined in Table 14 and Appendix 2. Habitat assessments focussed on the presence of the following features within the subject land:

- Habitat trees including large and/or hollow-bearing trees, stick nests, availability of flowering shrubs and canopy/understorey feed tree species.
- Soil type and presence of cliffs, overhangs and other rocky areas.
- Condition and type of native vegetation and the presence of exotic species.
- Presence and condition of pools and waterways.
- Quantity of ground litter and woody debris.
- Searches for indirect evidence of fauna (i.e. feathers, tracks and scats).
- General degradation of the site as a result of past and current disturbances such as vegetation clearing and industrial land management practices.
- Topography and landscape morphology.
- Presence of Flying-fox camps.

Several habitat features with potential to support threatened species credit species were identified during these habitat assessments. These features have been summarised in Table 18.

Table 18 Habitat features with potential to support threatened species credit species

Habitat feature	Presence within the development footprint
Hollow-bearing trees	Habitat trees supporting hollows of a variety of size classes from small (<50 mm diameter) through to extra-large (> 400 mm diameter) were present across the subject land. These trees have the potential to provide breeding resources for a range of native fauna species including threatened cockatoos (Glossy Black-Cockatoo and Gang-gang Cockatoo), owls (Barking Owl, Masked Owl, and Powerful Owl), and microbats.
Feed tree species	Trees and shrubs providing food resources for smaller mammals were recorded but exist in a degraded landscape and in low abundance throughout the development footprint and impact assessment area and are therefore unlikely to provide foraging habitat for threatened mammals.
Caves and rocky overhangs	Rocky overhangs were identified to the north-east of the subject land, outside of the boundary. These environments provide potential breeding habitat for threatened microbats including Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat, and Southern Myotis, as well as Sooty Owls and potentially Masked Owls.

Habitat feature	Presence within the development footprint
Rocky outcrops and sandstone crevices	Rock outcrops were identified to the north-east of the subject land, outside of the boundary. These features provide potential habitat for reptiles including the threatened Pink-tailed Legless Lizard and Striped Legless Lizard.
Major and minor watercourses and waterbodies (i.e. dams)	There are several minor watercourses in the subject land. The banks of these waterways and the supporting vegetation along these systems may provide potential habitat for amphibians. Artificial waterbodies (i.e. farm dams) were also identified as potential habitat for threatened amphibians.
Woody debris and leaf litter	There is limited woody debris and leaf litter in the remnant vegetation patches across the subject land.

Field capture of detailed fauna habitat information allowed for confirmation of presence/absence of habitat features and microhabitats for a range of candidate threatened species across surveyed portions of the development footprint and impact assessment area. Fauna habitat assessments were captured using ArcGIS polygons attributed with specific habitat criteria that allowed for planning of further targeted survey for select species, or the exclusion of the potential for occurrence of various candidate species from the subject land.

Amphibians

Survey for Green and Golden Bell Frog was undertaken by MJD in October 2020 over one night, which does not conform to the BAM minimum survey requirement or optimal survey period. During survey it was determined that the presence of Mosquito Fish *Gambusia holbrooki* in high densities precluded the presence of Green and Golden Bell Frog and no further survey was required (MJD 2020). Guidance from the BCD (2021a) advises the presence of Mosquito fish is not adequate justification to exclude the species from targeted survey on the basis of degraded habitat. Therefore, in accordance with the BAM, Green and Golden Bell Frog has been assumed present in the subject land, as time constraints did not permit complying survey within the prescribed and optimal survey period.

Further survey is planned for the upcoming 2021/22 period to assess species presence within the site.

Diurnal birds (Raptors – breeding habitat)

Targeted diurnal bird surveys were undertaken for breeding habitat and behaviours for:

- White-bellied Sea Eagle *Haliaeetus leucogaster*.
- Little Eagle *Hieraaetus morphnoides*.
- Square-tailed Kite *Lophoictinia isura*.

Survey method and effort

Survey guidelines followed included:

- *Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010a).
- *Threatened Biodiversity Survey and Assessment - Guidelines for Developments and Activities* (DEC 2004).

Timing of survey

Survey was conducted in relation to requirements in the TBDC survey guides.

Survey personnel and relevant experience

Diurnal bird surveys were undertaken by the Biosis ecologists outlined in Table 19.

Table 19 Targeted diurnal bird survey personnel and relevant experience

Staff member	Role	Relevant experience
Brooke Corrigan	Consultant Restoration Ecologist	Over 15 years' experience undertaking fauna surveys in NSW.
Caragh Heenan	Project Zoologist	Over one years' experience undertaking fauna surveys in NSW.

Results

Table 20 provides a summary of the results of the diurnal bird surveys completed.

Table 20 Summary of diurnal bird survey method and results

Species Name	Common name	Survey method	Survey results	Species Polygon (ha) or count
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	<ul style="list-style-type: none"> One hectare 20 minute area search per 50 ha Searching for large stick nests. 25/8 and 9/9 2021 	Not recorded during surveys.	N/A
<i>Hieraaetus morphnoides</i>	Little Eagle	<ul style="list-style-type: none"> One hectare 20 minute area search per 50 ha Searching for large stick nests. 25/8 and 9/9 2021 	Not recorded during surveys.	N/A
<i>Lophoictinia isura</i>	Square-tailed Kite	<ul style="list-style-type: none"> One hectare 20 minute area search per 50 ha Searching for large stick nests. 25/8 and 9/9 2021 	Not recorded during surveys.	N/A

Microchiropteran bats

Targeted microbat surveys were undertaken for:

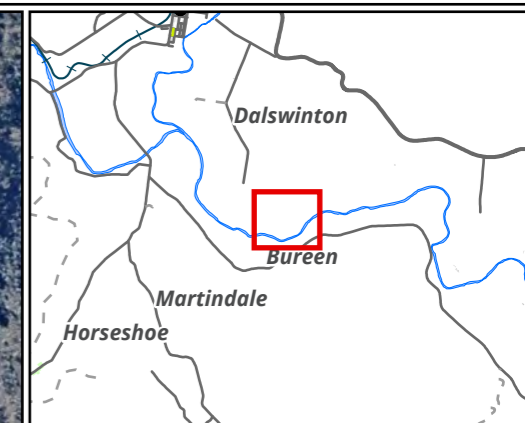
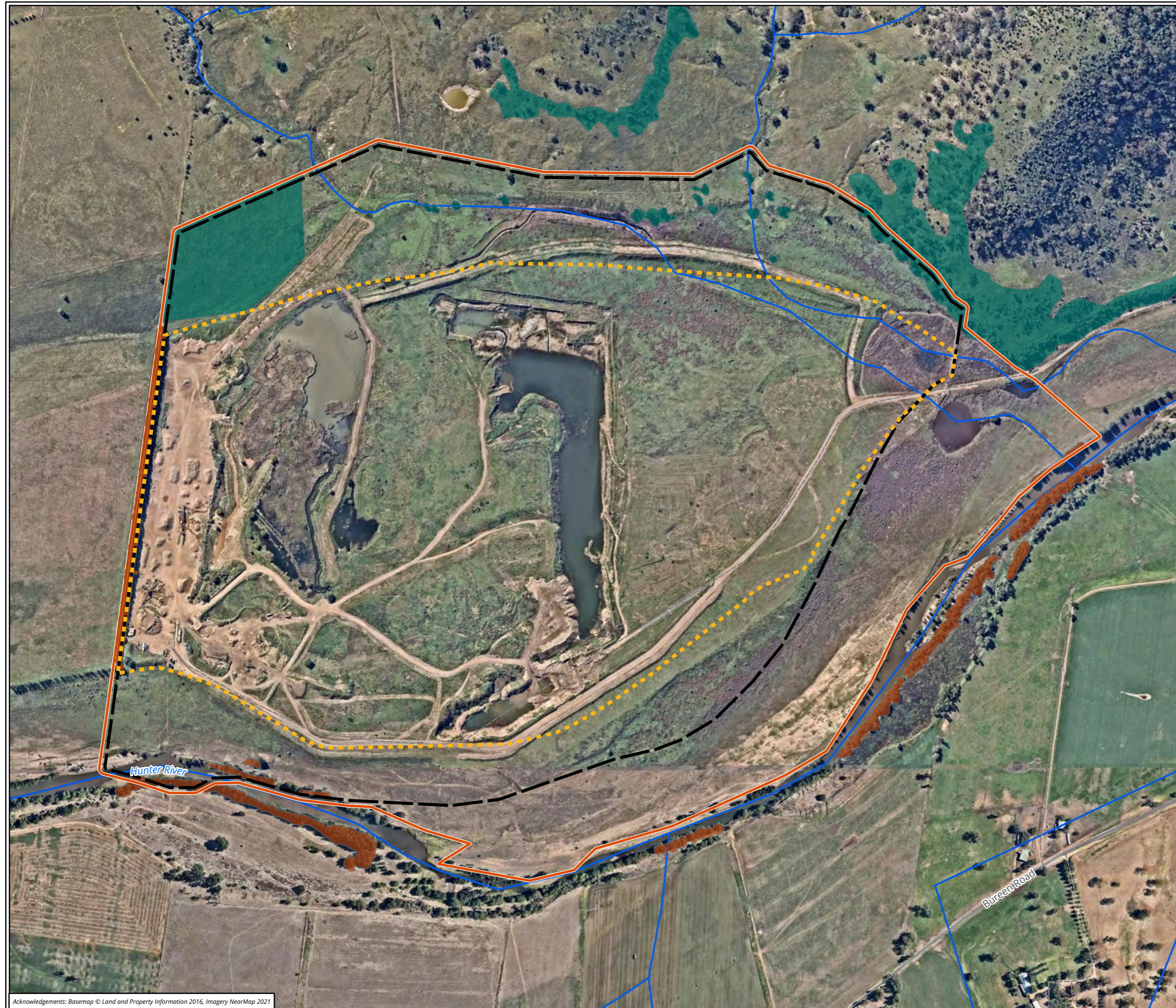
- Southern Myotis *macropus*.

Survey for Southern Myotis was undertaken by MJD in October 2020 but does not conform to the BAM minimum survey requirement or optimal survey period. Therefore, in accordance with the BAM, Southern

Myotis has been assumed present in the subject land, as time constraints did not permit complying survey within the prescribed and optimal survey period.

4.2.2 Incidental flora and fauna surveys

With exception the Blue Billed Ducks mentioned in Section 4.1, no other threatened species were recorded during incidental surveys undertaken as part of the current assessment.



Legend

- Subject land
- Development site
- Development footprint

Threatened ecological community

- Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions – Endangered (BC Act)
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions – Endangered (BC Act)

Figure 8 Threatened ecological communities within the subject land

0 40 80 120 160 200

Metres

Scale: 1:6,500 @ A3

Coordinate System:

GDA 1994 MGA Zone 56



Matter: 35797, Date: 28 October 2021 Drawn by: SB, Checked by: SC, Last edited by: sblades Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.arpx.aprx Layout: 35797_BDAR_F8_ThrEcoComms

4.2.3 Local data

Local data has not been used for threatened species assessment.

4.2.4 Expert reports

Sections 5.2 and 5.3 of the BAM outlines that an expert report may be obtained instead of undertaking a species survey for a project, where the expert report is prepared by a person who, in the opinion of the Environment Agency Head, possesses specialised knowledge based on training, study or experience to provide an expert opinion in relation to the biodiversity values to which an expert report relates (DPIE 2020a).

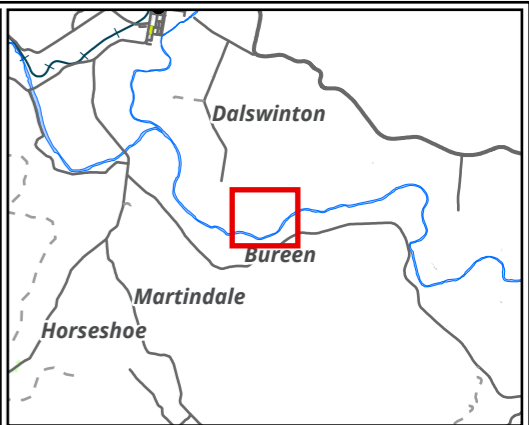
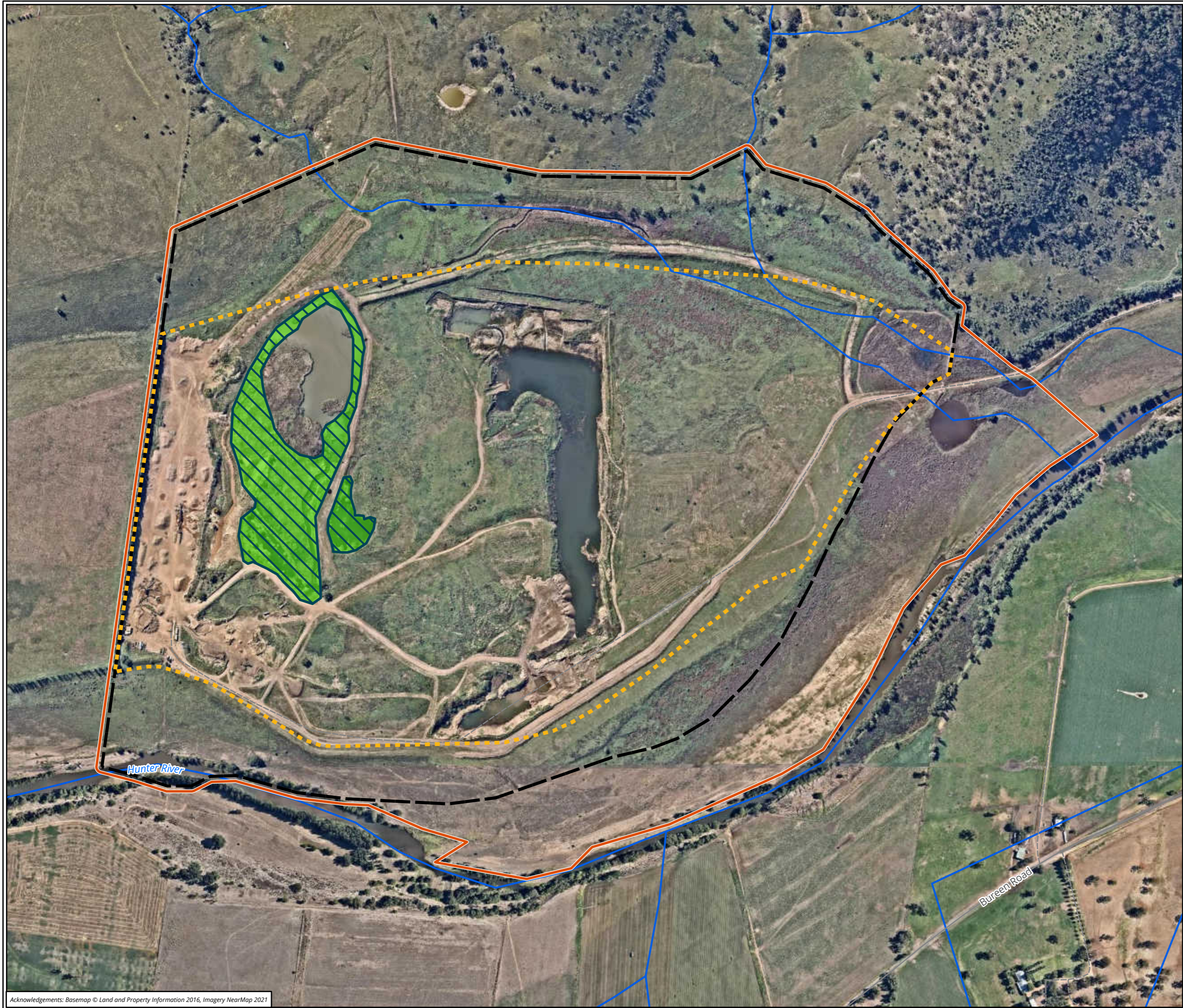
No expert reports were utilised for the current assessment.

4.2.5 Threatened species summary and polygons

Table 21 provides details of threatened species impacted by the project and outlines the attributes that comprise the threatened species polygons. The presence of threatened species impacted by the project is illustrated on Figure 9.

Table 21 Threatened species polygons within the development footprint and impact assessment area

Threatened species	Impact (ha / No. indiv.)	Unit of measure	Biodiversity risk weighting	Polygon attributes
Fauna				
Green and Golden Bell Frog <i>Litoria aurea</i>	6.3 ha	Area	2	PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion, and a buffer, incorporating the PCTs with which the species is associated, of 200 metres radius from the top of bank. The polygon should include minimum 50 metre wide corridors of native and non-native vegetated areas linking the available waterbodies, where relevant.
Southern Myotis <i>Myotis macropus</i>	6.3 ha	Area	2	PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion, within 200 m of waterbodies, with 3 m or wider stretches, suitable for species' foraging activities.



Legend

- Subject land
- Development site
- Development footprint
- Threatened species habitat**
 - Green and Golden Bell Frog
 - Southern Myotis

Figure 9 Threatened species polygons

0 40 80 120 160 200
Metres
Scale: 1:6,500 @ A3
Coordinate System:
GDA 1994 MGA Zone 56



Matter: 35797, Date: 28 October 2021 Drawn by: SB, Checked by: SC, Last edited by: sblades Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx Layout: 35797_BDAR_F9_ThrSpPoly

Stage 2 – Impact assessment (biodiversity values)

5 Avoid and minimise impacts

This section demonstrates the efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with BAM, including an analysis of alternatives:

- Modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology.
- Routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route.
- Alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location.
- Alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.
- Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design.
- Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal.

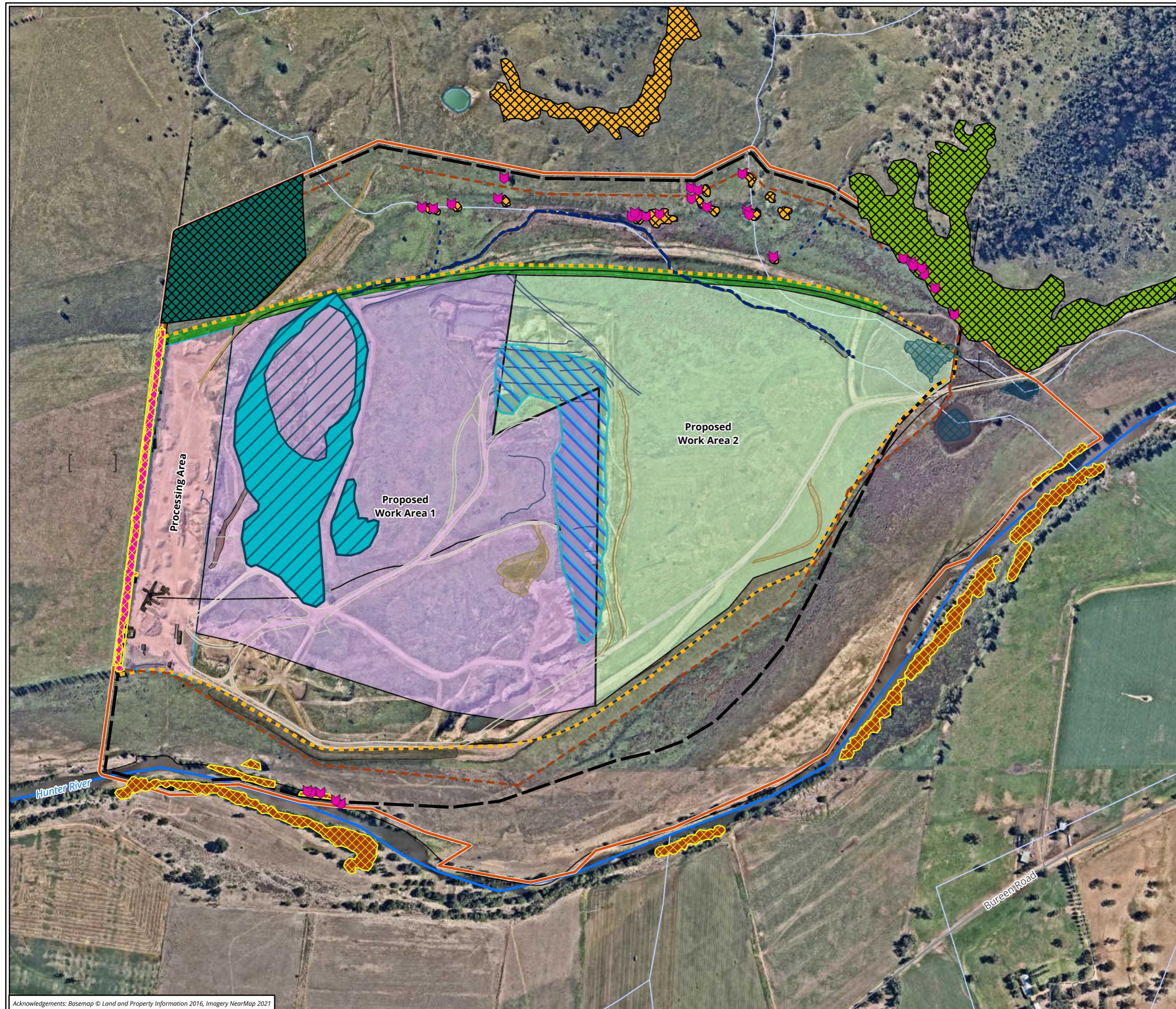
5.1 Actions to avoid/minimise project impacts

The principle means to reduce impacts on biodiversity values within the development site is to avoid and/or minimise the removal of native vegetation and fauna habitat. Additional recommendations include measures to mitigate residual impacts after all measures to avoid and minimise impacts have been considered in Table 22. The final development footprint (including construction and operation) is shown in Figure 10, with efforts to avoid or minimise impacts on biodiversity values are illustrated on Figure 11, indirect impact areas are shown on Figure 12.

Table 22 Avoidance and minimisation of impact

Avoidance and minimisation components	Action	Outcome	Timing	Responsibility
Modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology.	Proposal includes the upgrade of quarry processing and water management systems to increase efficiencies and minimize impacts from operations.	Reduced water and energy requirements for quarry operations for comparative extraction rate.	From approval.	RSG
Routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route.	Routes will not exceed the current operations footprint.	No increase from proposal.	From inception	RSG

Avoidance and minimisation components	Action	Outcome	Timing	Responsibility
Alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	The development footprint lies wholly within the existing cleared lands and does not impact adjacent remnant vegetation	High value and remnant vegetation is not impacted	From inception	RSG
Alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.	The development footprint lies wholly within the existing cleared lands and does not impact adjacent remnant vegetation	High value and remnant vegetation is not impacted	From inception	RSG
Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design.	The proposal will increase the recourse efficiency of the quarry, including water requirements for the washery. Disturbance to the tailings dam artificial wetland will be undertaken in stages to mitigate impacts to resident fauna	Water resources are more efficiently used during operations and fauna habitat disturbance is mitigated	From approval	RSG
Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal.	The design includes reworking existing quarry areas to more effectively extract materials and reduce the overall disturbance footprint or need for new quarry locations in the locality	Minimised disturbance area for extractive operations	From inception	RSG



Legend

- Subject land
- Development site
- Development footprint
- Fence
- ★ Hollow-bearing Trees

Hydro features

- Tailings dam/artificial wetland
- Managed/ephemeral dam
- Tailings dam
- Dam
- Drainage channel
- Unmapped drainage line

Threatened ecological community

- Central Hunter Grey Box-Ironbark
- Woodland in the NSW North Coast and Sydney Basin Bioregions – Endangered (BC Act)
- Hunter Floodplain Red Gum
- Woodland in the NSW North Coast and Sydney Basin Bioregions – Endangered (BC Act)

Plant community type

- 42 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley
- 1603 - Narrow-leaved Ironbark - Bull
- Oak - Grey Box shrub - grass open forest of the central and lower Hunter
- 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter
- 1071 - Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion
- 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (canopy absent)
- 42 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley (planted)

Figure 10 Final development footprint

0 40 80 120 160 200

Metres

Scale: 1:6,500 @ A3

Coordinate System:
GDA 1994 MGA Zone 56



Matter: 35797, Date: 28 October 2021,
Drawn by: SB, Checked by: SC, Last edited by: sblades
Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx
Layout: 35797_BDAR_F10_FinalDevFootprint

6 Impacts that are unable to be avoided

Assessment of direct and indirect impacts unable to be avoided has been undertaken in accordance with the BAM (DPIE 2020b). The following direct and indirect impacts are unable to be avoided in progressing the proposed development.

6.1 Direct impacts

Direct impacts include vegetation clearing calculated from the area of proposed lot boundaries, roads and easements for service infrastructure.

Direct impacts arising from the project include:

- Removal of 6.3 ha of *PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion*.
- Removal of 6.3 ha of Green and Golden Bell Frog assumed habitat.
- Removal of 6.3 ha of Southern Myotis assumed habitat

These impacts will be semi-permanent and will occur during the relocation and overall reduction of the tailings dam artificial wetland. Mitigation measures outlined in Section 5.1 above will help to minimise the potential impacts to biodiversity values that remain present within the subject land.

A summary of PCTs/zones directly impacted is demonstrated in Table 23.

Table 23 Summary of direct impacts to vegetation

Zone	PCT	TEC	Area within subject land (ha)	Area impacted (ha)	VI Score
Zone 1	<i>PCT 1071 Phragmites australis and Typha orientalis coastal freshwater wetlands</i>	Not a TEC	6.3 ha	6.3 ha	100 (assumed)

Table 24 Summary of direct impacts species credit habitat or individuals

Species	Sensitivity	Area (ha) or count
Green and Golden Bell Frog	High Sensitivity to Potential Gain	6.3 ha (assumed)
Southern Myotis	High Sensitivity to Potential Gain	6.3 ha (assumed)

6.1.1 Loss of hollow bearing trees

No hollow bearing trees will be lost as a result of the proposed development.

6.1.2 Loss of scattered paddock trees

No scattered paddock trees will be lost as a result of the proposed development.

6.2 Indirect impacts

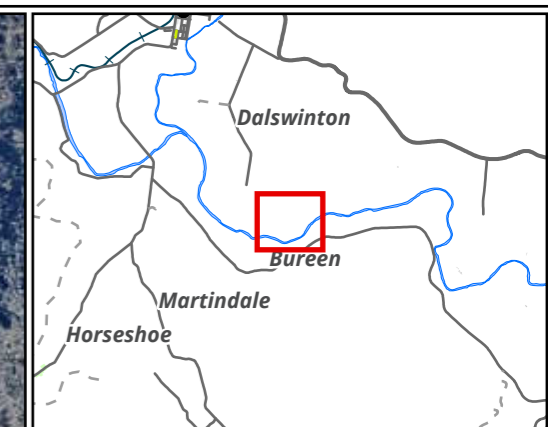
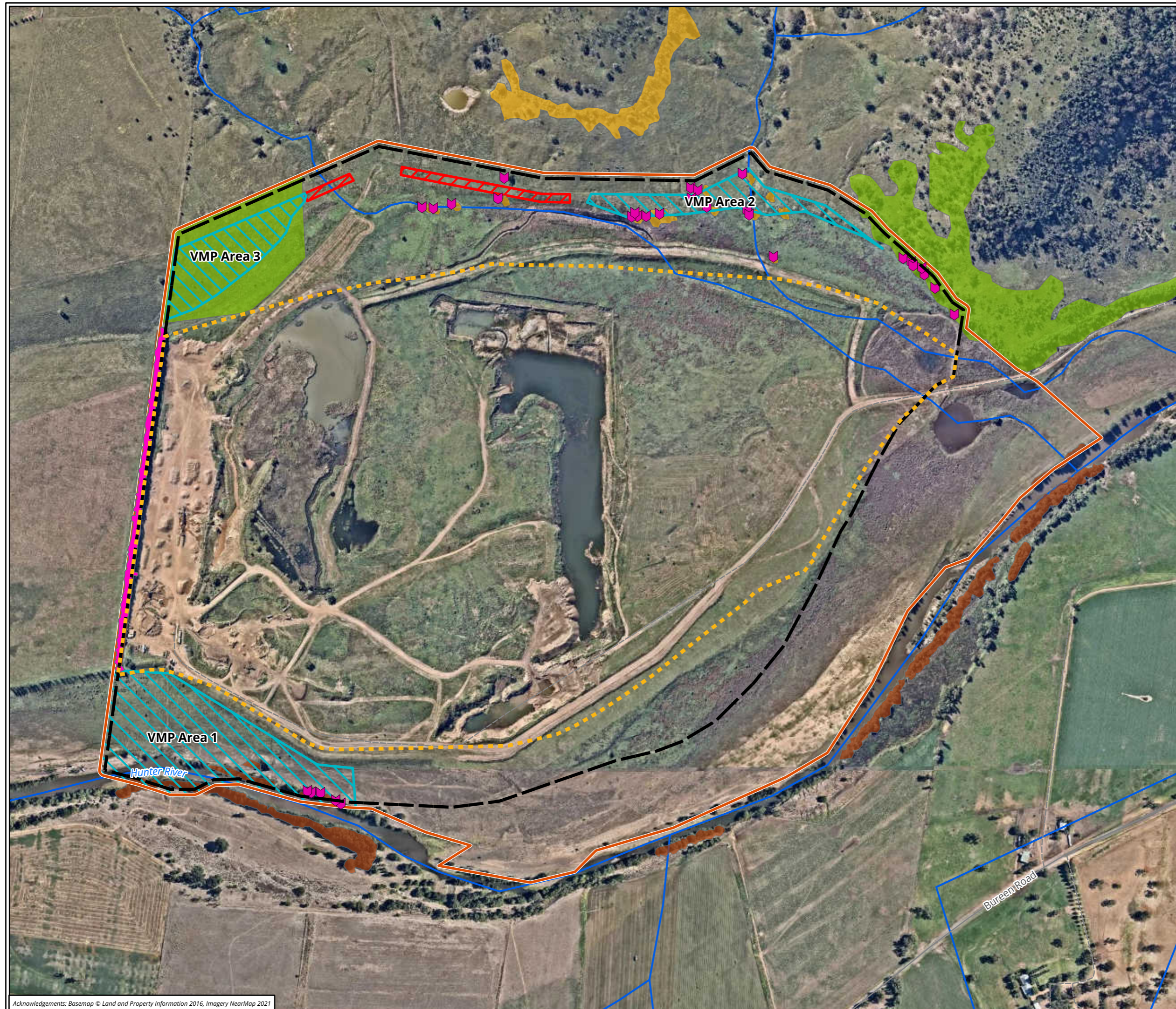
Potential indirect impacts arising from the project are outlined and addressed in Table 25.

Table 25 Avoidance and minimisation of impact

Indirect impact	Assessment / likelihood of occurrence
Inadvertent impacts on adjacent habitat or vegetation	Impacts to adjacent vegetation during construction and operational phase will be prevented or minimised through appropriate exclusion fencing, implementation of a VMP and a CEMP detailing best practice environmental protection measures, strict water quality practices and stormwater controls, and by ensuring any lighting is directed towards the quarry area, rather than towards the adjacent retained habitats.
Reduced viability of adjacent habitat due to edge effects	Adjacent habitats are currently subject to a high degree of edge effects due to prior clearing and surrounding existing agricultural land use. Since edge vegetation will not be removed from the subject land, and edge vegetation will be maintained and improved, therefore an increase to edge effects is not expected to occur to the remnant vegetation and habitat elements surrounding the subject land, as a result of the proposal.
Reduced viability of adjacent habitat due to noise, dust or light spill	It is predicted that the adjacent habitat may result in minor indirect impacts such as noise, dust and light spill, during construction and operation of the revised quarry operation without mitigation. However, this will be managed via best practices outlined in a CEMP and reduced via increasing buffer vegetation which will reduce the impacts on adjacent habitat once established. The subject land also already contains an operational quarry, and noise and dust spill is unlikely to increase to a significant degree as a result of the proposal.
Transport of weeds and pathogens from the site to adjacent vegetation	Weeds occurring within the subject land are consistent with those occurring in the locality, with the exception of Tree Cholla <i>Cylindropuntia imbricata</i> located near the Hunter River. If this species is encountered within disturbance areas vehicle hygiene will be required to prevent spread by equipment within and outside the quarry operation. Biosecurity measures managed under a CEMP will mitigate the risk of increased transport of pathogens and weeds.
Increased risk of starvation, exposure and loss of shade or shelter	The artificial wetland habitat present within the tailings dam in the subject land provides habitat for a range of more common disturbance tolerant waterbirds. The proposal will disturb, relocate and ultimately reduce the area of this habitat in the subject land and immediate locality slightly. This will result in a minor increase risk of starvation, exposure and loss of shade or shelter to native species, which will be mitigated by the staged relocation of the pond southward to its final footprint. This will encourage dispersal of the largely mobile species which are associated with population responses to ephemeral habitat i.e water bodies which are seasonally variable in nature. The Hunter River also provides habitat for these species and will remain unchanged as a result of the proposal.
Loss of breeding habitats	The subject land including the artificial freshwater wetland is not known to provide specialist breeding habitat for threatened species, but does provide potential breeding habitat for a range of more common disturbance

Indirect impact	Assessment / likelihood of occurrence
	tolerant water birds. This habitat will be disturbed and ultimately reduced by the proposal. The Hunter River also provides habitat for these species and will remain unchanged as a result of the proposal. Woodland breeding habitat is largely absent from the site and will not be impacted.
Trampling of threatened flora species	No threatened flora species were found, or are considered likely to occur, within the subject land, and thus trampling of threatened flora species is unlikely.
Inhibition of nitrogen fixation and increased soil salinity	Any future excavations or soil disturbance resulting from the future development of the subject land would be largely restricted to areas having undergone significant previous disturbance through cattle grazing and quarrying activities. As such it is not considered likely that the future development of the subject land would result in substantial changes to the level of nitrogen fixation or soil salinity in the locality.
Fertiliser drift	The subject land has a long grazing history over the entirety of the area and will continue as appropriate to operations in the future. Improved pasture and leafy forage are the dominant component of operations area lands not currently subject to active quarry activities and are supported by intermittent fertilizer application. The proposal will not result in an increase in fertilizer application and will not contribute to increased superphosphate loads on adjoining ecosystems above that already present in a productive agricultural landscape.
Rubbish dumping	The development site is not open to the public and does not require intensive external contractor involvement to achieve the proposed expansion and modification of the quarry. Therefore, there is no avenue to facilitate increased risk of rubbish dumping on or adjacent to the site, or as a result of the proposal.
Wood collection	The quarry is not open to the public and wood collection is not part of operations, nor is much present within the heavily, and historical cleared subject lands. Fallen or standing dead wood will largely fall within VMP areas and not interfere with grazing areas which may have been maintained for access in the past. Therefore, the proposal will not lead to increased wood collection and is likely to lead to increased wood retention in the landscape.
Removal and disturbance of rocks, including bush rock	The development footprint does not contain surface bush rock in a manner which provides fauna habitat. Rocky habitat, where present is restricted to the margins of the subject land, will not be disturbed and will be protected within the VMP.
Increase in predators	The subject land already occurs within a fragmented productive rural landscape and high densities of Fox <i>Vulpes vulpes</i> and Black Rat <i>Rattus rattus</i> occur within the locality, which in this context predate heavily on small arthropod, mammal, bird and eggs. Dogs have also been observed. Numerous native predator bird species also occupy the site including Nankeen Kestrel <i>Falco cenchroides</i> , Swamp Harrier <i>Circus approximans</i> and Eastern Barn Owl <i>Tyto javanica</i> . Given the proposal is an extension and reconfiguration of existing operations it is unlikely to increase predatory

Indirect impact	Assessment / likelihood of occurrence
Increase in pest animal populations	<p>species populations already active in the subject land.</p> <p>The subject land already occurs within a fragmented productive rural landscape with pest animals such as Foxes, Black Rat, Rabbit <i>Oryctolagus cuniculus</i>, Carp <i>Cyprinus carpio</i> and Eastern Gambusia <i>holbrooki</i> are also widely spread within the Hunter region and are likely to occur across the locality. The proposal will not result in an increase in available habitat for these species and is unlikely to lead to an increase in pest animal populations.</p> <p>Additionally, the proposed works are likely to remove individuals and habitat and to lower the population in the short term.</p>
Changed fire regimes	<p>The proposal occurs in a rural area engaged in active production. Appropriate asset protection zones and fire mitigation systems will be reconfigured and implemented for the future development layout and the proposal will not result in an increased risk of fire.</p>
Disturbance to specialist breeding and foraging habitat, e.g. Beach nesting for shorebirds	<p>Specialist breeding habitat for migratory Rainbow Bee-eater occurs within riparian and steep sandy slopes in the subject land. While the species is not a listed threatened species, disruption of breeding birds during spring and summer should be avoided. The habitat will not be removed by reconfiguration and expansion of existing quarry operations, however significant movement of material within the site will occur and may impact existing burrow sites.</p> <p>Freshwater wetland habitat provides breeding and foraging habitat for a range of water birds, many of which were observed to successfully raise young at the site. However, the site or locality are not known to be important areas for specific threatened water birds and is not a mapped important area for migratory wader birds. It is unlikely that the Blue-billed Duck potentially present during survey breed within the wetland and would use site on transient basis. This is due to the species preferring secluded, densely vegetated areas to construct nest beds within aged Cumbungi or Typha or other dense aquatic vegetation generally over water, and although present, is more patchy and sporadic, therefore is consistent with sub-optimal habitat on their easterly breeding distribution limit.</p>
Fragmentation of movement corridors	<p>Movement corridors supported by woody vegetation are currently restricted in width and availability through the locality. The project will not remove woody native vegetation that fringes the subject land to the north, south and west, and will increase the condition and connectivity of these areas under a VMP. The removal of non-native vegetation within the operations land may fragment movement corridors on the eastern boundary where the distance between northern rocky remnant vegetation and the Hunter River is narrowest. However, the existing vegetation would not provide cover for cryptic or small fauna at high risk of predation, and its disturbance is unlikely to impact the movement of larger mobile fauna between the two habitats. Connectivity along the northern boundary with planted corridors on the western boundary and the Hunter River will be improved under a VMP as shown on Figure 11.</p>



Legend

- Subject land
- Development site
- Development footprint
- Tree planting buffer
- Vegetation management plan area (VMP)
- ◆ Hollow-bearing Trees

Plant community type

- 42 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley
- 1603 - Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter
- 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter (canopy absent)
- 42 - River Red Gum / River Oak riparian woodland wetland in the Hunter Valley (planted)

Figure 11 Avoidance and mitigation

0 40 80 120 160 200

Metres

Scale: 1:6,500 @ A3

Coordinate System:

GDA 1994 MGA Zone 56



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6.3 Prescribed impacts

Assessment of prescribed biodiversity impacts are outlined and addressed in Table 26 below and shown in Figure 7.

Table 26 Assessment of prescribed impacts

Prescribed impact	Assessment / likelihood of occurrence
Karst, caves, crevices, cliffs, rocks and other geological features of significance	Surface rocks and small crevices are found on the north-east boundary. Crevices, small caves, rocks and other geological features are not present within the subject land however, are associated with habitat more broadly and associated with nearby Spur Hill. Elevation rises from 100 m RSL at the Hunter River to 280 m over approximately 1 km
Occurrences of human-made structures and non-native vegetation	Human-made structures are present in the subject land and include the quarry washery, machine storage areas and sheds. Concrete pipes and culverts are present throughout the quarry drainage management infrastructure. Non-native vegetation covers all remaining area not otherwise mapped as native vegetation or infrastructure. A large tailings dam supports and artificial freshwater wetland. Specific considerations are outlined in Section 6.3.1 below.
Corridors or other areas of connectivity linking habitat for threatened entities	No known flight paths or connectivity important to known threatened entities will be severed by the proposal. Specific considerations are outlined in Section 6.3.2 below.
Water bodies or any hydrological processes that sustain threatened entities	Hydrological processes which sustain PCT 42 and the Hunter River will not be significantly impacted upon by the proposal, as per Section 5 and 10 of the groundwater assessment report (Hydrogeologist 2021).
Protected animals that may use the proposed wind farm development site as a flyway or migration route	The proposed development is not a wind farm.
Where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community	Traffic speed or frequency along existing access roads is not substantially altered by the proposed development, and so an increase in risk from vehicle strike is considered negligible.

6.3.1 Human-made structures and non-native vegetation

Human-made structures are present in the subject land and include the quarry washery, machine storage areas and sheds. Concrete pipes and culverts are present throughout the quarry drainage management infrastructure. Non-native vegetation covers all remaining area not otherwise mapped as native vegetation or infrastructure.

A large tailings dam and artificial freshwater wetland which supports derived native rushland PCT 1071 coastal freshwater wetland is present. The wetland provides habitat for a range of water bird species, a comprehensive list of which is included with Appendix 4 and includes Blue-billed Duck listed as vulnerable under the BC Act. The wetland also provides foraging habitat for Southern Myotis which collect small fish and invertebrates from the surface of waterbodies. Habitat is also suitable for Green and Golden Bell Frog, should they occur in the area.

6.3.2 Habitat connectivity

There are no known flight paths of protected animals over the subject land. Rainbow Bee-eater observed at the site displayed breeding behavior and burrow occupation along the Hunter River and northern drainage channel. The migratory and insectivorous bird is reliant on deep sandy soils near waterways, breeding in the Hunter Valley during spring and summer. Blue-billed Duck potentially utilise the site when deep water is available, with three birds identified to a probable degree of confidence on the wetland during August 2021. However the species is an irregular visitor to the region and are unlikely to breed within or rely on the subject land for resources.

Connectivity for mobile fauna capable of traversing an open landscape is provided by a non-native ground layer within the subject land. This will be largely retained under the proposal which will continue to operate in a manner consistent with current rates of extraction and patch disturbance.

Habitat connectivity in the locality is constrained by a lack of woody vegetation in an overcleared landscape. To address this higher value native vegetation on the northern boundary and south-west corner will be fenced and managed under a VMP (see section 5.1). This will support movement and dispersal of less mobile fauna and support species such as pollinators, and increase habitat complexity in the interface between river flat and low slope landscape types as shown in Figure 11.

Threatened birds that move up and down the Hunter Valley such as Gang-gang Cockatoo, Regent Honeyeater and Swift Parrot are more likely to do so along the more heavily wooded sides of the valley (BCD 2021b). There is no proposed infrastructure for this project likely to interfere with local flight paths, and so any impacts, if they occur, would be small.

6.3.3 Water bodies, water quality and hydrological processes

A groundwater impact assessment concluded that no impacts on aquifers, watercourses, riparian land, water-related infrastructure, and other water users is expected to occur as a result of the proposal (Hydrogeologist 2021).

6.3.4 Wind farm developments

The proposed development is not a wind farm, and needs no further consideration relative to this development type.

6.3.5 Vehicle strikes

Vehicle traffic during construction and operation may slightly increase the risk of vehicle strike on species occurring in or near the development site due to increased traffic movements, however this still considered negligible. The development site only has one access road and any impacts associated with vehicle strike would more likely occur to common species such as Kangaroos and avifauna such as Galah. Site management to enforce and reduce site speed limits to the development site, as well as indirect impacts such as dust, would minimise impacts of vehicle strikes. Therefore, impacts resulting from access roads is not substantially altered by the proposed development, and so an increase in risk from vehicle strike is considered negligible.

6.4 Impacts considered uncertain

The regional significance of the permanent freshwater wetland habitat provided by the tailings dam for waterbirds within an over cleared and water regulated landscape is difficult to quantify. Therefore, the impact of disturbance and relocation of this artificial habitat feature is uncertain.

6.5 Impacts to Groundwater Dependent Ecosystems (GDE)

Assessment of the potential for the subject land to support groundwater dependant ecosystems (GDEs) was undertaken and the results provided in the Report on Groundwater Impact Assessment: Dalswinton Quarry from Hydrogeologist (2021). The nearest high-priority groundwater dependent ecosystem (GDE) is the Wappinguy Spring, located near Merriwa, however, as this site is located approximately 40 km to the north-west, the proposal poses no risks of impact to any known high-priority GDEs.

Within the subject land and surrounding locality the Hunter River is identified as a known aquatic GDE with areas of High Potential GDE overlaid relating to riparian vegetation identified as PCT 42 on the southern boundary. Remnant woodland within the subject lands north west boundary and on rocky slopes to the north are identified as low potential GDE (Hydrogeologist 2021).

The groundwater impact assessment Section 10 concludes the proposal poses no risk of significant impact to any GDE site (Hydrogeologist 2021, pp. 41).

6.6 Aquatic habitat impacts relating *Fisheries Management Act 1991* matters

There are no Key Fish Habitats (KFH) as mapped by the NSW Department of Primary Industries (DPI) within the development site (DPI 2020). However, the Hunter River, located within the subject land, constitutes KFH (DPI 2020). The Hunter River is classified as habitat for the threatened Purple-spotted Gudgeon *Mogurnda adspersa* by DPI. Threatened fish recorded within 10 km of the subject land include Purple-spotted Gudgeon and Darling River Hardyhead *Craterocephalus amniculus* within the Hunter River and nearby Goulburn River (DPI 2020).

A groundwater impact assessment concluded that no impacts on aquifers, watercourses, riparian land, water-related infrastructure, and other water users is expected to occur as a result of the proposal (Hydrogeologist 2021). As such, no significant impact is likely to occur relating to *Fisheries Management Act 1991* (FM Act) matters.

Indirect impacts on aquatic habitats from the proposal and ongoing operation of the expanded quarry may occur. These include increased capture of catchment runoff within the quarry water management system and higher operational demands leading to increased demand and retention of water within the quarry which may reduce water movement downstream, release of sediment laden water downstream, and alterations to the local catchment flood regime (Umwelt 2020). These potential impacts to biodiversity and water quality will be mitigated as outlined in Section 5.1.

6.7 Impacts to Matters of National Environmental Significance (MNES)

An assessment of the impacts of the proposed development on Matters of National Environmental Significance (MNES), against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the proposed development to the Commonwealth Minister for the Environment is required. MNES relevant to the proposed development are summarised in Table 27.

Table 27 Assessment of the proposed development against the EPBC Act

Matter of NES	Project specifics	Potential for significant impact
Threatened species	No EPBC listed threatened species occur on the subject land. Green and Golden Bell Frog, listed as vulnerable under the EPBC Act are assumed to be present as per BAM requirements regarding survey	No significant impact likely

Matter of NES	Project specifics	Potential for significant impact
	adequacy, but are not considered likely to occupy the site.	
Threatened ecological communities	Central Hunter Valley eucalypt forest and woodland, listed as Critically Endangered under the EPBC Act occurs along the northern boundary outside of the development footprint. The patch, while heavily degraded within the subject land, is contiguous with a significant remnant of the community which would meet Class A. High Quality condition category as per the conservation advice (Threatened Species Scientific Committee 2015). Therefore it is of value as a buffer to the wider patch and transitional edge between disturbance and habitat types.	Low, vegetation outside of the development footprint will be retained and managed under a VMP to protect and improve the habitat, and provide a buffer for higher condition remnants of the CEEC on adjoining lands.
Migratory species	Rainbow Bee-eater and Fork-tailed Swift <i>Apus pacificus</i> were recorded in the development site during survey. Both species were foraging for insects along riparian areas and over the artificial wetland. Rainbow Bee-eater were observed accessing burrows along the drainage channel in the development footprint.	Foraging habitat will be retained for the species in the development lands, albeit in an altered state. Breeding habitat will continue to be available for Rainbow Bee-eater within the quarry and Hunter River. Mitigation measures implemented will ensure avoidance and minimising of impacts as far as practicable in regards to disturbing birds and their breeding burrows during the spring and summer breeding period.
National Heritage Places	The subject land does not contain any National Heritage Places.	No significant impact likely
Wetlands of international importance (Ramsar sites)	The subject land does not contain any wetlands of international or national importance.	No significant impact likely

7 Mitigation and management of impacts

Identification of measures to mitigate or manage impacts has been undertaken in accordance with the BAM (DPIE 2020a), including considerations such as:

- Techniques, timing, frequency and responsibility.
- Identification of measures for which there is risk of failure.
- Evaluation of the risk and consequence of any residual impacts.
- Documentation of any adaptive management strategy proposed.

Identification of measures for mitigating impacts related to:

- Displacement of resident fauna.
- Indirect impacts on native vegetation and habitat.
- Mitigating prescribed biodiversity impacts.
- Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain.

Table 28 Measures to mitigate and manage impacts

Measures to mitigate and manage impacts	Action	Outcome	Timing	Responsibility
<i>Displacement of resident fauna</i>	Tailings dam vegetation is to be inspected immediately prior to removal or infill by a qualified ecologist to confirm the absence of, or relocate resident fauna.	Minimal direct impact to resident fauna during habitat removal.	Immediately prior to removal or infill of vegetation.	Supervising ecologist and RSG
	Staged relocation of tailings dam artificial wetland southwards to the final (reduced) footprint.	Mitigation of habitat loss to resident and transient fauna Encouraged dispersal of water birds to the wider landscape.	Ongoing during construction / reconfiguration.	Supervising ecologist and RSG
<i>Indirect impacts on native vegetation and habitat</i>	Prepare a VMP for areas shown in Figure 11 to fence, control weeds, install canopy and otherwise manage vegetation.	Improved habitat connectivity and structure to support fauna mobility in the locality.	Prior to clearing and construction works.	Supervising ecologist and RSG
	Construction Environmental Management Plan (CEMP) will include measures to avoid noise and light	Minimal indirect impacts by avoiding night works and Directing light spill from vegetation, and	Prior to clearing and construction works.	RSG

Measures to mitigate and manage impacts	Action	Outcome	Timing	Responsibility
	encroachment on adjacent habitats such as avoiding night works as much as possible.	reduction and monitored speed limits on access roads.		
	Implement appropriate storm water and erosion controls in CEMP during transitional periods where existing quarry infrastructure may not apply.	Mitigate risk of impact to environmental controls during construction.	Ongoing during construction / reconfiguration.	RSG
<i>Mitigating prescribed biodiversity impacts</i>	Implement groundwater monitoring program	Changes to water quality as a result of the proposal are identified and rectified	Ongoing from approval	RSG and groundwater specialist
<i>Adaptive management strategies proposed to monitor and respond to impacts on biodiversity values that are uncertain</i>	Monitor water bird population for signs of extended stress in individuals or resistance to dispersal which would indicate a reliance on the habitat and lack of alternative habitat in the regional context	Fauna is not lost to starvation or habitat loss if dispersal unviable	Ongoing during construction / reconfiguration	Project ecologist and RSG

7.1 Adaptive management strategy

Construction and operational management plans will all contain an adaptive management component. Adaptive management strategies will be receptive to any new and relevant data that may arise through ongoing assessment and monitoring and are key to the successful implementation of crucial objectives yet also allow flexibility to changing dynamics and ongoing feedback and results. This includes measures to monitor predicted and uncertain impacts which will trigger adaptive management actions and allow for effective and quick responses.

8 Impact summary

8.1 TECs and threatened species

This section outlines the impact summary for the project which has identified and assessed impacts on TECs and threatened species that are at risk of a SAI including:

- Addressing all criteria for each TEC listed as at risk of an SAI present on the subject land.
- Addressing all criteria for each threatened species at risk of an SAI present on the subject land.
- Documenting assumptions made and/or limitations to information.
- Documenting all sources of data, information, references used or consulted.
- Clearly justifying why any criteria could not be addressed.
- Identification of impacts requiring offset.
- Identification of impacts not requiring offset.
- Identification of areas not requiring offset.

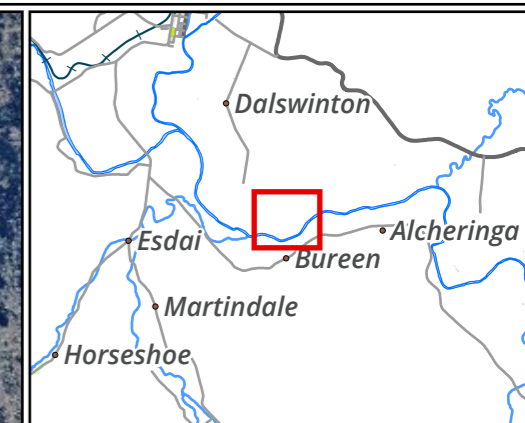
Figure 12 shows the location of impacts requiring offset, impacts not requiring offset and areas not requiring assessment.

8.2 Serious and irreversible impacts

In accordance with Clause 6.7 of the BC Regulation an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

- a) Principle 1: It will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.*
- b) Principle 2: It will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size.*
- c) Principle 3: It is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.*
- d) Principle 4: The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.*

No species or entities considered to meet the above principles and may be impacted by the proposal are present in the subject land. Detailed SAI assessment is not required.



Legend

- Subject land
- Development site
- Development footprint

Impact area

- Indirect impact area

Figure 12 Indirect impacts

0 40 80 120 160 200



Metres

Scale: 1:6,500 @ A3
Coordinate System:
GDA 1994 MGA Zone 56



Matter: 35797, Date: 01 November 2021
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Layout: 35797_BDAR_F12_IndirectImpacts

8.3 Identification of impacts requiring offset

8.3.1 Impacts to native vegetation (ecosystem credits)

As outlined in Section 9.2.1 of the BAM, the assessor must determine an offset for all impacts of proposals on PCTs that are associated with a vegetation zone that has a vegetation integrity score of:

- a) ≥ 15 , where the PCT is representative of an EEC or a CEEC.
- b) ≥ 17 , where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community.
- c) ≥ 20 , where the PCT does not represent a TEC and is not associated with threatened species habitat.

Although vegetation zone 2 has a vegetation integrity score greater than 17, this zone occurs on Category 1 Exempt land, and therefore in accordance with section 1.5 of the BAM (d) biodiversity values associated with the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land other than the additional biodiversity impacts in accordance with clause 6.1 of the BC regulation, are not required. However this zone was entered into the BAM calculator in order to be able to provide offset requirements for species credits.

The offset requirement for the proposal was calculated using the BAM Calculator. Table 29 provides a summary of the ecosystem credit offsets required for impacts from proposed development at the subject land.

Table 29 Offsets required (ecosystem credits)

Vegetation zone	Area (ha)	Impact	VI score	Offset required	TEC	HBTs	Credit requirement
PCT 1071_moderate	6.30	Clearance	100	No	No	No	N/A – Cat 1 Exempt Land

BAM vegetation assessment methodology was applied to freshwater wetland habitat within Category – 1 lands to quantify and assess threatened species habitat values provided by the artificial structure within. However, as the BAM does not apply to vegetation within Category – 1 lands, offset of ecosystem credits within the BOS are not required.

8.3.2 Impacts to threatened species and their habitat

As outlined in Section 9.2.2 of the BAM an offset is also required for the impacts of the proposals on the habitat of threatened species assessed for ecosystem credits and associated with a PCT in a vegetation zone with a vegetation integrity score of ≥ 17 .

The offset requirement for the proposal was calculated using the BAM Calculator. Table 30 provides a summary of the species credit offsets required for impacts from proposed development at the subject land.

Table 30 Offsets required (species credits)

Vegetation zone	Species	Habitat condition (vegetation integrity score) loss	Area (ha)	Biodiversity risk weighting	Credit requirement
VZ2	Green and Golden Bell Frog	100	6.30	2	350
	Southern Myotis	100	6.30	2	350

Species polygons for the above two assumed species credit species impacted by the project are illustrated in Figure 14 below.

8.4 Identification of impacts not requiring offset

Following assessment the following impacts do not require offsetting in accordance with BAM:

- Impact to 94.3 ha of Category 1 exempt land including
 - Impact to 84.7 ha of non-native vegetation and cleared land.
 - Impact to 6.3 ha of PCT1071.
- Removal / relocation of 9.6 ha of the waterbody associated with the tailings dam artificial wetland.

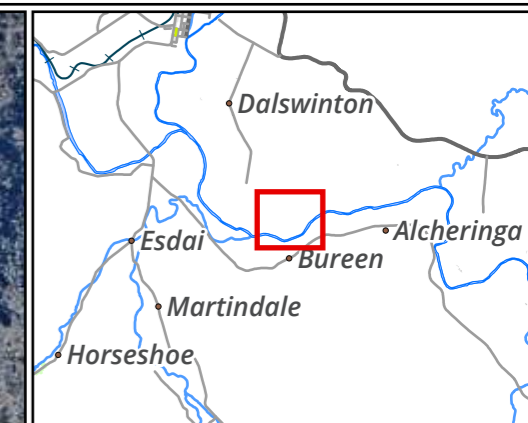
Areas not requiring offset are shown in Figure 15.

8.5 Identification of areas not requiring assessment

Following assessment the following areas do not require assessment in accordance with BAM:

- Areas identified as Category – 1 exempt under the LLS Act.

Areas not requiring offset are shown in Figure 13.



Legend

- Subject land
- Development site
- Development footprint
- Human made structures and non-native vegetation

Waterbodies

- Tailings dam/artificial wetland
- Managed/ephemeral dam
- Tailings dam
- Dam

Figure 13 Prescribed impacts

0 40 80 120 160 200

Metres

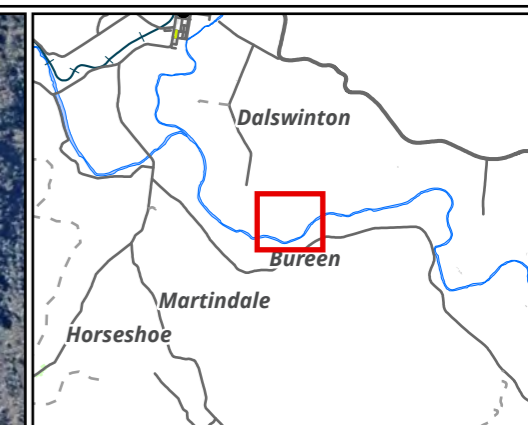
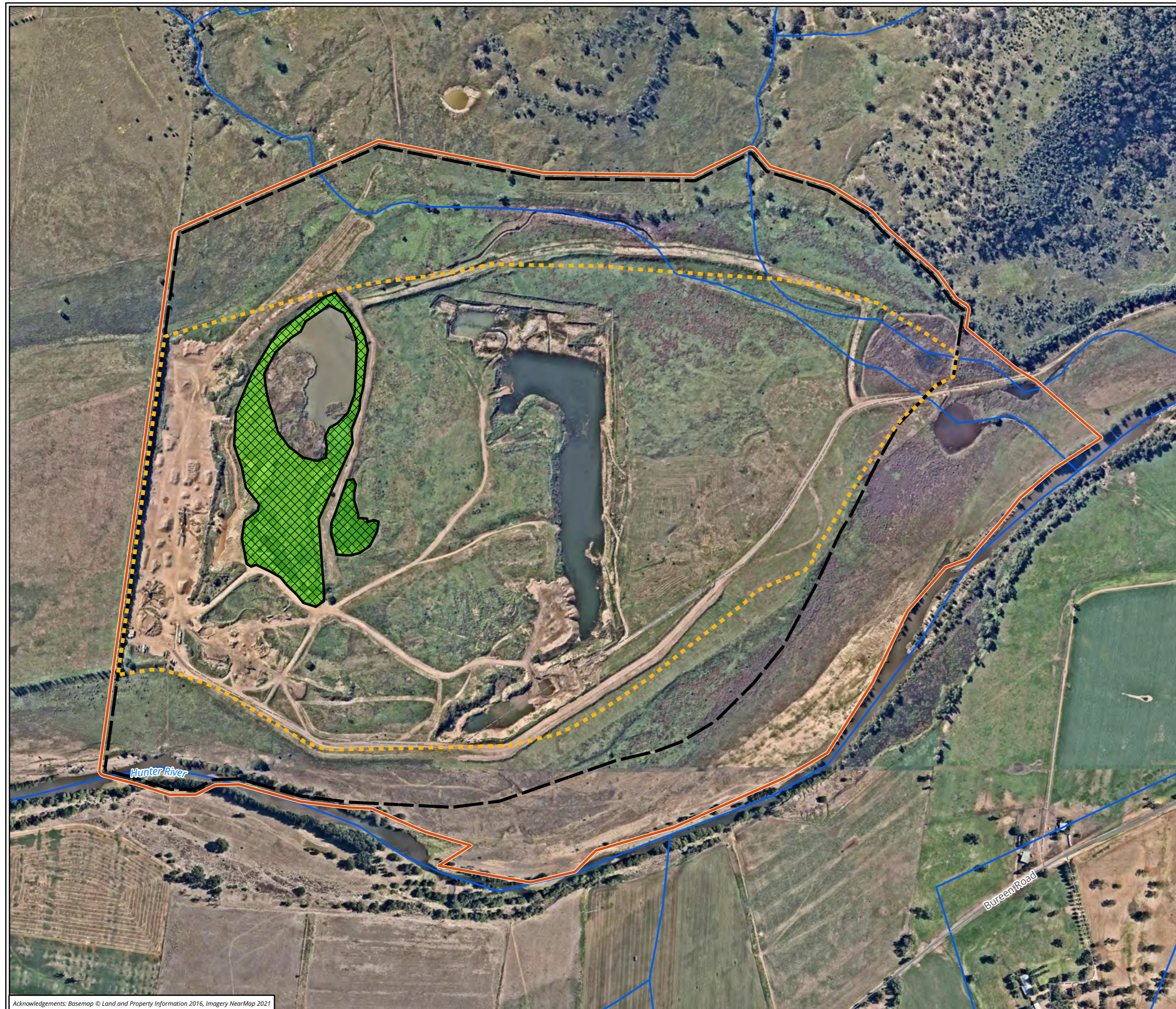
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Coordinate System:

GDA 1994 MGA Zone 56



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Legend

- Subject land
- Development site
- Development footprint

Impact requirements

- Impacts requiring offsets

Threatened species habitat

- Green and Golden Bell Frog and Southern Myotis habitat

Figure 14 Impacts requiring offsets

0 40 80 120 160 200

Metres

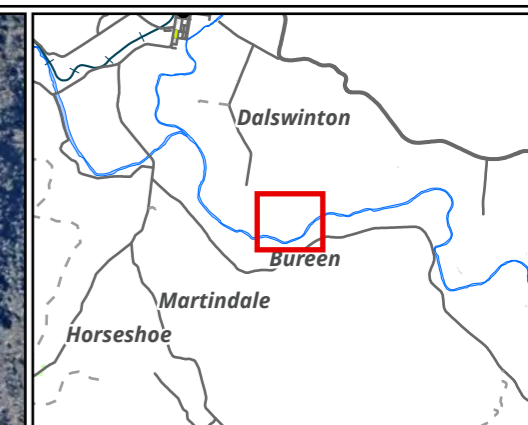
Scale: 1:6,500 @ A3

Coordinate System:

GDA 1994 MGA Zone 56



Matter: 35797, Date: 29 October 2021 Drawn by: SB, Checked by: SC, Last edited by: sblades Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.aprx.aprx Layout: 35797_BDAR_F14_ImpactsOffsets



Legend

- Subject land
- Development site
- Development footprint
- Tailings dam/artificial wetland

Offset requirements

- Impacts not requiring offset

Plant community type

- 1071 - *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basic Bioregion

Figure 15 Impacts not requiring offset

0 40 80 120 160 200

Metres

Scale: 1:6,500 @ A3

Coordinate System:
GDA 1994 MGA Zone 56



Matter: 35797, Date: 29 October 2021 Drawn by: SB, Checked by: SC, Last edited by: sblades Location: P:\35700s\35797\Mapping\35797_Dalswinton_BDAR.arpx.aprx Layout: 35797_BDAR_F15_ImpactsNoOffsets

9 Biodiversity credit report

Offsetting through the transfer and retirement of biodiversity credits, or paying into the BCT Offset Fund, is required for the current assessment for impacts to one vegetation zone at the subject land. A biodiversity credit report is provided on the following pages.

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00027411/BAAS19061/21/00027412	Dalswinton Quarry Expansion	10/06/2021
Assessor Name	Report Created	BAM Data version *
Brooke Corrigan	09/11/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS19061	Finalised	09/11/2021
Assessment Revision	Assessment Type	
1	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

----- *Redacted* -----

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Species credits
<i>Litoria aurea / Green and Golden Bell Frog (Fauna)</i>								
1071_moderate	100.0	100.0	6.3	Endangered	Vulnerable	2	False	315
							Subtotal	315
<i>Myotis macropus / Southern Myotis (Fauna)</i>								
1071_moderate	100.0	100.0	6.3	Vulnerable	Not Listed	2	False	315
							Subtotal	315

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Appendices

Appendix 1 Survey methods

Appendix 1.1 Nomenclature

The flora taxonomy (classification) used in this report follows the most recent Flora of NSW (Harden 1992, Harden 1993, Harden 2002). All doubtful species names were verified with the on-line Australian Plant Name Index (Australian National Botanic Gardens 2007). Flora species, including threatened species and introduced flora species, are referred to by both their common and then scientific names when first mentioned. Subsequent references to flora species cite the common names only, unless there is no common name, for which scientific name will be used. Common names, where available, have been included in threatened species tables and the complete flora list in Appendix 3.

Names of vertebrates follow the Census of Australian Vertebrates (CAVs) maintained by the DEE (Commonwealth of Australia 2009). In the body of this report vertebrates are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only.

Appendix 1.2 Permits and licences

The flora and fauna assessment was conducted under the terms of Biosis' Scientific Licence issued by EES (SL100758, expiry date 31 March 2022). The BAM Assessment and quality review of the BDAR was carried out by Accredited Assessors Brooke Corrigan (BAAS19061) and Mitchell Palmer (BAAS17051).

Appendix 1.3 Limitations

Field surveys were undertaken in accordance with the BAM. Ecological surveys provide a sampling of flora and fauna at a given time and season. Factors influencing detectability of species during survey include species dormancy, seasonal conditions, ephemeral status of waterbodies, and migration and breeding behaviours of some fauna. In many cases, these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The field survey was conducted in late winter and early spring during fine, clear weather, which is not a suitable time to determine the presence of most threatened species.

Surveys undertaken, combined with habitat assessments and desktop analysis are considered sufficient to reach the conclusions herein in regards to this and all other species' likelihood of occurrence within the subject land.

Database searches, and associated conclusions on the likelihood of species to occur within the assessment area, are reliant upon external data sources and information managed by third parties.

Appendix 2 BAM Candidate species assessment

Table A. 1 Threatened flora species assessment

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/ complete	Potential for impact	Candidate species rationale
	EP BC	BC							
<i>Acacia pendula</i> - endangered population <i>Acacia pendula</i> population in the Hunter catchment	-	E2	No, associated with PCT 1691	This population is known to occur naturally from Warkworth to the west of Muswellbrook at Wybong. Only recorded to date at 6 locations: Jerrys Plains, Edderton, Wybong, Apple-tree Creek, Warkworth and Apple-tree Flat. Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	Medium	Yes	Yes – targeted survey in Sept 2021	No	<p>This species has been previously recorded on 20 occasions within 10 km of the subject land, with closest record 900 m of the subject land.</p> <p>Potential habitat in the subject land is restricted to PCT 1691 along the eastern boundary. Targeted surveys were undertaken (Sept 2021) for this species and none have been recorded.</p> <p>Based on the absence of this species within the development footprint, the species does not require any further consideration</p>
<i>Asperula asthenes</i> Trailing Woodruff	V	V	Yes, associated with PCT 1603 and 1071	This low, trailing perennial herb occurs in damp sites, often along river banks. Endemic to NSW It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens / Wallis Lakes area /	Low	No	Not required, habitat searches in Aug – Sept 2021	No	There are no previous records of this species within 10 km of the subject land which occurs outside the species known area of occurrence, which is typically coastal. Additionally, potential habitat for the species is absent

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				Forster (including Myall Lakes NP, New England NP, Wallingat NP and Darawank NR).					from the immediate surrounds of the artificial wetland impact PCT 1071 due to disturbance. Potential habitat associated with forested PCTs is heavily degraded within the subject land, but will be retained under the proposal.
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	V	V	No, associated with PCT 42	Recorded from Gibraltar Range National Park south into Victoria. Does not appear to have well defined habitat preferences and is known from a range of communities. The larger populations typically occur in woodland dominated by Scribbly Gum, Silvertop Ash, Red Bloodwood and Black Sheoak. It appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid.	Low	No	Not required	No	There are no previous records of this species within 10 km of the subject land. Potential habitat within the riparian corridor is severely degraded from disturbance, grazing and high weed loads and unlikely to support a population of Leafless Tongue Orchid. Additionally this area will not be directly impacted by the proposal, which will be managed under a VMP. Species is not associated with impact PCT 1071.
<i>Cymbidium canaliculatum</i> - endangered population <i>Cymbidium canaliculatum</i> population in the Hunter Catchment	-	E2	No, associated with PCT 1603 and 1691	The Hunter population is known to occur naturally from Weston and Pokolbin in the Lower Hunter, which represents its south-eastern geographic limit, but appears to be more centred in the Upper Hunter, predominantly north of Singleton.	Low	Yes	Yes – in Aug – Sep 2021	No	Marginal habitat for the species is present within trees outside the development footprint. Species was not detected during survey and does not occur on the subject land. <i>Cymbidium canaliculatum</i> is not associated

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/ complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				Typically grows in the hollows, fissures, trunks and forks of trees in dry sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. It usually occurs singly or as a single clump, which can form large colonies on trees, between two and six metres from the ground.					with the impact PCT 1071.
<i>Cynanchum elegans</i> White-flowered Wax Plant	E	E	No, associated with PCT 42 and 1603	Restricted to eastern NSW where it is distributed from Brunswick Heads to Gerroa. Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest, coastal scrub, Forest Red Gum aligned open forest and woodland, Spotted Gum aligned open forest and woodland and Bracelet Honey myrtle scrub to open scrub	Low	No	Not required, searches in Aug – Sep 2021	No	There is only one historic record of this species within 10 km of the subject land, recorded in 1997. Potential habitat within the subject land is highly degraded and unlikely to support White-flowered Wax Plant. Additionally, all potential habitat will be retained by the proposal. Species not associated with impact PCT 1071.
<i>Diuris tricolor</i> Pine Donkey Orchid	-	V	No, associated with PCT 1603 and 1691	Sporadically distributed on the western slopes of NSW, extending from Narrandera to the north of NSW. Species is usually recorded from disturbed habitats. It grows in sclerophyll forest among grass, often with native Cypress Pine. It is found in sandy soils, either on flats or small rises. Also recorded from a	Low	No	Not required	No	There is only one record of this species 9.1 km from the subject land. Potential habitat within grassy woodland is too degraded via disturbance and weed infestation and unlikely to support the species. Additionally, remnant woodland vegetation will not be impacted

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/ complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				red earth soil in a Bimble Box community in western NSW.					on by the proposal. Species is not associated with impact PCT 1071
<i>Eucalyptus camaldulensis</i> - endangered population <i>Eucalyptus camaldulensis</i> population in the Hunter catchment	-	E2	No, associated with PCT 42	The Hunter population occurs from the west at Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River, in the Port Stephens LGA. Only 19 stands are known, occupying at most 100 ha, the largest remnant being 15 – 20 ha in extent. May occur with Forest Red Gum, Yellow Box, Forest Oak and Rough-barked Apple.	Low	Yes	Not required, searches in Aug – Sep 2021	No	Habitat for the species occurs on the Hunter River, however no individuals occur within the subject land or immediate locality. Potential habitat for the species will be retained by the proposal and managed under a VMP. River Red-gum is not associated with the impact PCT 1071.
<i>Eucalyptus glaucina</i> Slaty Red Gum	V	V	No, associated with PCT 1603 and 1691	Found only on the north coast of NSW. Commonly found in Casino, and from Taree to Broke. Grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	Low	Yes	Not required, searches in Aug – Sep 2021	No	Potential habitat for the species occurs in grassy woodland PCTs, however no individuals are present in the subject land or immediate locality. No potential habitat will be impacted on by the proposal.
<i>Maundia triglochinos</i>	-	V	Yes, associated with PCT 1071	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong. Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients	Low	No	No	No	Species is restricted to coastal habitats with the closest record near Raymond Terrace approximately 80 km south east of the subject site.

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
<i>Melaleuca biconvexa</i> Biconvex Paperbark	V	V	Yes, associated with PCT 1071	The species is only found in NSW, with scattered populations found in the Jervis Bay area and Gosford-Wyong area. It generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Low	No	No	No	There are no previous records of this species within 10 km of the subject land. The subject land is outside the species known range, which is restricted to coastal lowlands. The closest record being approximately 82km south east on the Central Coast.
<i>Persicaria elatior</i> Tall Knotweed	V	V	Yes, associated with PCTs 42 and 1071	Tall Knotweed has been recorded in south-eastern NSW, Moruya State Forest, the Upper Avon River catchment, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace and the Grafton area. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low	No	No	No	The subject land lies outside the species known range which is largely restricted to coastal lowlands. The closest record being approximately 80 km to the south east in Raymond Terrace.
<i>Prasophyllum petilum</i> Tarengo Leek Orchid	E	E	No, associated with PCTs 42 and 1603	Natural populations are known from Boorowa, Queanbeyan area, Ilford, Delegate and a newly recognised population west of Muswellbrook. This species has also been recorded at Bowring Cemetery where it was experimentally introduced, though it is not known whether this population has persisted.	Low	No	Not required	No	There are no previous records of this species within 10 km of the subject land. Additionally potential habitat within remnant woodland PCTS is highly degraded and unlikely to support the species. Grassy woodland remnant vegetation will be retained by the proposal.

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/ complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				Grows in open sites within Natural Temperate Grassland at the Boorowa and Delegate sites. Also grows in grassy woodland in association with River Tussock, Black Gum and Tea-trees.					Species is not associated with impact PCT 1071.
<i>Prasophyllum sp. Wybong</i>	CE	-	No, associated with PCTs 42 and 1603	Endemic to NSW, it is known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. A perennial orchid, appearing as a single leaf over winter and spring. Known to occur in open eucalypt woodland and grassland.	Low	No	Not required	No	There are no previous records of this species within 10 km of the subject land. Potential habitat within the subject land is highly degraded and unlikely to support the species, and will not be impacted on by the proposal. Species is not associated with impact PCT 1071.
<i>Pterostylis chaetophora</i>	-	V	No, associated with PCTs 1603 and 1691	In NSW it is currently known from 18 scattered locations between Taree and Kurri Kurri, extending south towards Tea Gardens and west into the Upper Hunter, with additional records near Denman and Wingen. The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. The most common habitat is grassy open forests or derived native grasslands of Cabbage Gum and Grey Box on gentle flats, or that are dominated by Spotted Gum.	Low	No	Not required	No	The Denman records for this species are not readily available within BioNet or other sources. However, while potential habitat occurs within PCTs 1603 and 1691 it is highly degraded and unlikely to support the species, particularly given the absence of shrub understorey. Additionally, all potential habitat is retained by the proposal and the species is not associated with impact PCT 1071.

Species	Status*		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM Candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
<i>Thesium australe</i> Austral Toadflax	V	V	No, associated with PCTs 42 and 1603	Scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass, in which it parasitises.	Low	No	Not required	No	There are no previous records of this species within 10 km of the subject land. Microhabitat within the subject land is too degraded via disturbance and weed infestation to support the species. Grassy woodland remnant vegetation will not be impacted on by the proposal.
<i>Zannichellia palustris</i>	-	E	Yes, associated with PCT 1071	A submerged aquatic plant. Leaves 2-7 cm long by less than 1 mm wide. In NSW, known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. NSW populations behave as annuals, dying back completely every summer.	Low	No	Not required	No	The subject site lies outside the known species range which is typically restricted to coastal lowlands. The closest record being approximately 67km south east near Cessnock, and the majority of local records near Newcastle, 85 km south east.

*CE = Critically Endangered, E = Endangered, E2 = Endangered Population, V = Vulnerable

Table A. 2 Threatened fauna species assessment

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/ complete	Potential for impact	Candidate species rationale
	EP BC	BC							
<i>Anthochaera Phrygia</i> Regent Honeyeater	CE	CE	No, associated with PCTs 42, 1603 and 1691	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Usually nest in tall mature eucalypts and Sheoaks.	Low	No	Not required, habitat assessment	Breeding – No Foraging – No	Not within a mapped important area and the subject land does not contain suitable resources for the species to any notable degree. Species is not associated with impacted PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Aprasia parapulchella</i> Pink-tailed Legless Lizard	V	V	No, associated with PCTs 42, 1603 and 1691	The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. The species inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. The species is commonly found beneath small, partially-embedded rocks	Medium	No	Not required, habitat assessment	No	Habitat includes rocky areas, or habitat within 50 m of rocky areas. Some rocky habitat is present within 50 m of the subject land, located outside of the subject land to the north-east. There are no sightings within 10 km of the subject land. Potential species microhabitat is not found within the development footprint.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				and appear to spend considerable time in ant or termite burrows below these rocks.					Species is not associated with the impact PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Burhinus grallarius</i> Bush Stone-curlew	-	E	Yes, associated with PCTs 42, 1071, 1603 and 1691	The Bush Stone-curlew is found throughout Australia except for the central southern coast, inland, the far south-eastern corner and Tasmania. In the South-east it is considered rare or extinct throughout its former range. It inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber where it feeds on insects, frogs, lizards and snakes. The species is largely nocturnal and is highly active on moonlit nights. Bush Stone-curlew breeds in Spring to early Summer where it builds a nest on the ground in a scrape or bare patch, usually laying two eggs in a clutch.	Low	No	Yes, habitat assessment	No	Habitat for the species is absent from the site. Furthermore the high density of fox and other predators in the landscape preclude it's presence within the subject land.
<i>Calidris ferruginea</i> Curlew Sandpiper	CE	E	Yes, associated with PCT 1071	The Curlew Sandpiper is a small (18-23 cm), highly-gregarious, migratory shorebird with a medium-length, down-curved bill and longish black legs. The Curlew Sandpiper is distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in	Low	No	Not required	No	Subject land is not located within 5 km of coast or tidal influenced water bodies. Nor is it within a mapped important area for migratory shorebird. Therefore no further consideration is required.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.					
<i>Calidris tenuirostris</i> Great Knot	CE	V	Yes, associated with PCT 1071	A medium-sized bulky wader with a straight, dark-brown bill and yellowish-brown legs. In NSW, the species has been recorded at scattered sites along the coast down to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons.	Low	No	Not required	No	The subject land is not located within proximity to the coast and does not constitute coastal wetland habitat as required by the species. Nor is it within a mapped important area for migratory shorebird. Therefore no further consideration is required.
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (breeding)	-	V	No, associated with PCTs 42, 1603 and 1691	Gang-gang Cockatoo is distributed from southern Victoria to central eastern NSW. In Spring and Summer, this species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests, in winter often move to lower altitudes in drier more open eucalypt forests. In Autumn and Winter, the species moves to lower altitudes,	Low	No	Not required, potential habitat assessment	Breeding habitat (direct impacts) – No Breeding habitat (indirect impacts) –	Old growth forests and woodland habitats preferred by the species are not present in the subject land which has been largely cleared, grazed and quarried. There are some trees with suitably sized hollows available in the subject land, however most are 2-3 m above the

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				inhabiting dry sclerophyll forests and woodlands. Gang-gang Cockatoo favours old growth forest and woodland for breeding where it nests in hollows over 10 cm in diameter and above 9 m from the ground.				No Foraging habitat – No	ground and not located in suitable breeding habitat. There are records within 10 km of the subject land. Species is not associated with impacted PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (breeding)	-	V	No, associated with PCTs 42, 1603 and 1691	Glossy Black-Cockatoo has a distribution spanning from central Queensland to East Gippsland Victoria with a small population in the Riverina region and on Kangaroo Island in South Australia. This species inhabits open forests and woodlands which contain Black Sheoak <i>Allocasuarina littoralis</i> and Forest Sheoak <i>Allocasuarina torulosa</i> . Breeding habitat consists of living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground. Glossy Black-Cockatoo forages exclusively on <i>Casuarina</i> and <i>Allocasuarina</i> species.	Medium	No	Not required, potential habitat assessment	Breeding habitat (direct impacts) – No Breeding habitat (indirect impacts) – No Foraging habitat – Low level impacts	Suitably sized hollows occur in the subject land, however the reclusive species is unlikely to breed in exposed and isolated trees near human activity. Foraging habitat in the form of <i>Allocasuarina</i> and <i>Casuarina</i> spp. are present and will be retained by the proposal. Species is not associated with impacted PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	V	V	No, associated with PCTs 42, 1603	Large-eared Pied Bat is distributed from Rockhampton in Queensland to Bungonia in the Southern Highlands of NSW with sporadic records from New England	Low	No	Not required	Breeding habitat (direct impacts) –	There are rocky areas containing overhangs within 2 km of the subject land, therefore it is considered to

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
			and 1691	Tablelands and the North West Slopes. Large-eared Pied Bat is found in areas with extensive cliffs and caves near intact forests containing gullies. The species roosts in the day in caves, old mines and disused Fairy Martin nests and will hibernate between Autumn and Spring. Large-eared Pied Bat breeds in maternity roosts formed from large domed caves from November to January.				No Breeding habitat (indirect impacts) – No Foraging habitat – Low level impacts	contain breeding habitat for the species. They forage in well-timbered areas containing gullies, under the forest canopy, therefore there is unlikely to be any suitable foraging habitat in the subject land. There are no sightings within 10 km of the subject land. Species is not associated with impacted PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Crinia tinnula</i> Wallum Froglet	-	V	Yes, associated with PCT 1071	Wallum Froglets are found along the coastal margin from Litabella National Park in south-east QLD to Kurnell in Sydney. The species is found in a wide range of habitats, usually associated with acidic swamps on coastal sand plains. They typically occur in sedgelands and wet heathlands. They can also be found along drainage lines within other vegetation communities and disturbed areas, and occasionally in swamp sclerophyll forests. The species breeds in swamps with permanent water as well as shallow ephemeral pools and drainage ditches. Wallum Froglets shelter under	Low	No	Not required	No	Potentially suitable habitat in the form of a first order creek line and freshwater wetland are present in the subject land. However the species is associated with coastal lowlands, the closest record being approximately 67km south east near Cessnock, and the majority of local records near Hexham, 80 km south east.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/ complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				leaf litter, vegetation, other debris or in burrows of other species. Shelter sites are wet or very damp and often located near the water's edge.					
<i>Delma impar</i> Striped Legless Lizard	V	V	No, associated with PCTs 42, 1603 and 1691	Striped Legless Lizard occurs in the Southern Tablelands, the South West Slopes, and the Upper Hunter and possibly on the Riverina. Also occurs in the ACT, Victoria and south-eastern South Australia. The species is found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component and in open Box-Gum Woodland.	Medium	No	Not required – Habitat assessment in Aug – Sep 2021	No	Sub optimal habitat in the form of temperate modified tussock-forming grassland is present in the subject land. Higher condition rocky and tussock habitat located outside of the subject land to the north-east could potentially support population of the species. However, the proposal will not impact these areas. The species is not associated with impacted PCT 1071.
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (breeding)	-	V	Yes, associated with PCTs 42, 1071 and 1691	White-bellied Sea-Eagle has a distribution which spans the Australian coastline, including Tasmania, and ranges inland along major rivers and waterways. This species occurs in the vicinity of the sea, near bays and inlets, beaches, reefs, lagoons, estuaries in addition to freshwater swamps, lakes, reservoirs, billabongs and waterways. Terrestrial habitat consists of coastal dunes, tidal	Medium	Yes	Yes – stick nest searches and diurnal bird survey	Breeding – No Foraging - Negligible	Breeding habitat is live large old trees within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines and the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				flats, grassland, heathland, woodland and forest. White-bellied Sea-Eagle is highly selective in choice of breeding habitat and maintains high site fidelity. Preferred Breeding habitat is live large old trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines. Breeding individuals will build a large stick nest within tree canopy which is built up over successive years. This species forages within proximity to waterways where it preys upon fish and freshwater turtles, occasionally supplementing their diet with waterbirds, reptiles, mammals and carrion.					Breeding habitat for the species is not present in the subject land. While the artificial freshwater wetland and nearby Hunter River may provide suitable foraging habitat. No nests or evidence of breeding were observed during the field investigations and there are no sightings within 10 km of the subject land.
<i>Hieraaetus morphnoides</i> Little Eagle (breeding)	-	V	Yes, associated with PCTs 42, 1071, 1603 and 1691	Little Eagle is distributed throughout the Australian mainland except for densely forested sections of the Great Dividing Range. Little Eagle occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. This species breeds in spring in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Medium	Yes	Yes – stick nest searches and diurnal bird survey	Breeding – No Foraging - Negligible	Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. Vegetation within the subject land is degraded and unlikely to be considered suitable breeding habitat by the species. No nests or evidence of breeding were

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
									observed during field survey.
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	-	V	No, associated with PCTs 42, 1603 and 1691	The species is found in north-east Queensland to the north-eastern quarter of NSW. In NSW it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains. Most records appear to be from sites of relatively lower elevation. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour riparian areas.	Low	No	Not required, habitat assessment	Low	Habitat for the species does not occur within the development footprint and is marginal within the subject land. Additionally, hollow bearing trees and woodland habitat will be retained and managed under a VMP by the proposal. There are no sightings within 10 km of the subject land. Species is not associated with impact PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Lathamus discolor</i> Swift Parrot	CE	E	No, associated with PCTs 42, 1603 and 1691	Swift Parrot migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Forest Red Gum, Mugga Ironbark, and White Box. This species	Low	No	No	Negligible	The subject land is not within a mapped important area, nor does the land support suitable foraging habitat to any notable degree. Species is not associated with impact PCT 1071 and is therefore not predicted by the BAM calculator.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				breeds in Tasmania between September to January and returns to the mainland during the winter months.					
<i>Limicola falcinellus</i> Broad-billed Sandpiper	-	V	Yes, associated with PCT 1071	The Broad-billed Sandpiper is an uncommon, small, stint-like sandpiper reaching 18 cm in length. Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary.	Low	No	Not required	Nil	The subject land is not located within proximity to the coast and does not constitute coastal wetland habitat as required by the species. Nor is it within a mapped important area for migratory shorebird. Therefore no further consideration is required.
<i>Limosa limosa</i> Black-tailed Godwit	-	V	Yes, associated with PCT 1071	A large sandpiper reaching 44 cm long, with a wingspan of 63 - 75 cm. It has a distinctive long, straight bill that is pink with a black tip. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large lakes in the western areas during summer, when the muddy shores are exposed.	Low	No	Not required	Negligible	The subject land does not constitute coastal wetland habitat as required by the species. Nor is it within a mapped important area for migratory shorebird. Therefore no further consideration is required.
<i>Litoria aurea</i> Green and Golden Bell	V	E	Yes, associated	Green and Golden Bell Frog occurs in 50 known populations within NSW, the	Low	Yes	No – Assumed	Low	The artificial freshwater wetland and associated PCT 1071 is

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
Frog			with PCTs 42, 1071, 1603 and 1691	majority of which are small coastal or near coastal populations. Green and Golden Bell Frog predominantly inhabits marshes, dams and streamsides containing <i>Typha</i> and <i>Eleocharis</i> spp. and is known to inhabit disturbed sites around Sydney. This species prefers habitats which are open to sunlight, free of predatory fish and close to grassy areas. Green and Golden Bell Frog breeds in summer and is diurnal. Tadpoles forage on algae whereas adults forage on invertebrates and other frogs.			presence		considered potential habitat for the species. Refer to Section 4.2 for impact assessment.
<i>Litoria brevipalmata</i> Green-thighed Frog	-	V	Yes, associated with PCTs 42, 1071 and 1603	Green-thighed Frog occurs in isolated localities along the coast and ranges from just north of Wollongong to south-east QLD. The species occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in the north. Breeding occurs following heavy rainfall, with larger temporary pools and flooded areas preferred. Frogs are thought to forage in leaf litter.	Low	Yes	No	No	While there is some potential habitat in the subject land along first order creeklines and the freshwater wetland, associated woodland and forest vegetation is lacking in condition and proximity. Vegetation and leaf litter within the riparian zone being a critical component of habitat (Lemckert & Slatyer 2002). There are no sightings within 10 km of the subject land and Green-thighed Frog has not been recorded west of Cessnock in the Hunter.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
<i>Lophoictinia isura</i> Square-tailed Kite (breeding)	-	V	Yes, associated with PCTs 1071, 1603 and 1691	Square-tailed Kite is distributed along coastal and subcoastal areas from south-western to northern Australia and in NSW, has a scattered distribution throughout the state. Square-tailed Kite is found in a variety of timbered habitats including dry woodlands and open forests. This species shows a particular preference for timbered watercourses and forages on passerines and invertebrates. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	Medium	Yes	Yes – surveys for stick nests and habitat assessment undertaken to detect suitable breeding trees.	Breeding – No Foraging - Negligible	Breeding habitat is live large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. No stick nests are present in the subject lands.
<i>Miniopterus australis</i> Little Bent-winged Bat (breeding)	-	V	Yes, associated with PCTs 42 and 1071	Little Bent-winged Bat is distributed along the east coast from Cape York in Queensland to Wollongong in NSW. Eastern Coastal Free-tailed Bat inhabits wet, dry and moist sclerophyll forest, Melaleuca swamps, coastal forests and Banksia scrub. This species is insectivorous and roosts caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and buildings. Little Bent-winged Bat breeds in spring where they form large maternity colonies centred on five known nursery sites in Australia.	Low	Yes	No	Low	No breeding maternity habitat onsite or in broader locality, no suitable man-made structures present and HBTs not impacted in the low likelihood of chance of roosting or overwintering. Minimal foraging and transient use only.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (breeding)	-	V	Yes, associated with PCTs 42, 1071, 1603 and 1691	Large Bent-winged Bat spans the east and north-west coasts of Australia. The species hunts in vegetated/forested areas, preying on invertebrates above the canopy. Caves are the primary roosting and breeding habitat for this species; however, it is also known to roost in derelict mines, storm-water tunnels, culverts and man-made structures. Populations are usually centred on a maternity cave which is used during the breeding season between spring and summer. Outside of breeding season, this species usually disperses within 300 km of maternity caves.	Low	Yes	No	Low	No breeding maternity habitat onsite or in broader locality, no suitable man-made structures present and HBTs not impacted in the low likelihood of chance of roosting or overwintering. Minimal foraging and transient use only.
<i>Myotis macropus</i> Southern Myotis	-	V	Yes, associated with PCTs 42, 1071, 1603 and 1691	Southern Myotis is distributed along a coastal band from the north-west of Australia, across the top end and south to western Victoria and is rarely found inland. Southern Myotis is known to roost in groups of 10 to 15 within close proximity to water in caves, mine shafts, houses, hollow-bearing trees, stormwater channels, bridges. The species has a unique foraging strategy to other microbat species as it forages on aquatic macroinvertebrates and larval fish. The species is highly dependent on waterbodies for foraging,	High	Yes	No - assumed present	Foraging habitat – Potential impacts	Breeding and foraging habitat was considered to be present within the subject land due to the presence of hollow-bearing trees within 200 m of the waterways.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				roosting and breeding.					
<i>Ninox connivens</i> Barking Owl (breeding)	-	V	No, associated with PCTs 42, 1603 and 1691	Barking Owl is found throughout Australia except for the central arid regions and has a wide but sparsely distributed population in NSW, predominantly on the western slopes and plains as well as the northeast coastal and escarpment forests. It preferred habitat ranges from woodland to open sclerophyll forest including fragmented remnants and partially cleared farmland. Barking Owl breeding habitat is defined as patches of vegetation (including riparian forests) which contains large living or dead trees (80-240 DBH) with hollows greater than 20cm diameter and more than 4 m above ground. Breeding trees are usually situated in an area containing dense mid-storey vegetation.	Medium	No	Not required, potential habitat mapped.	Breeding habitat (direct impacts) – No Breeding habitat (indirect impacts) – Potential	Breeding habitat requires suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. The proposal will not disturb hollow bearing trees, furthermore no owl species successfully occupied hollows within the site, with a barn owl lost to predation while utilising an undesirably low hollow. There are no sightings within 10 km of the subject land, however the species is known to inhabit Wollemi National Park. Species is not associated with the impact PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Ninox strenua</i> Powerful Owl (breeding)	-	V	No, associated with PCTs 1603 and	Powerful Owl is endemic to eastern and south-eastern Australia; east of the Great Dividing Range from Mackay to south-western Victoria. Powerful Owl preferred	Medium	No	Not required, potential habitat	Breeding habitat (direct impacts) –	Breeding habitat requires suitable habitat AND (a) presence of male and female OR (b) calling to each other

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
			1691	habitat ranges from woodland, open sclerophyll forest, wet sclerophyll forest and rainforest. Powerful Owl breeding habitat is defined as patches of vegetation which contains large living or dead trees (80-240 DBH) with hollow greater than 20cm diameter and 50 cm depth. Breeding trees are usually situated in an area containing dense mid-storey vegetation.			mapped	No Breeding habitat (indirect impacts) – Potential	(duetting) OR (c) find nest. Note that this species does not respond as well to call-play-back and could require stagwatching and other evidence of nesting. There is one record within 10 km of the subject land. The proposal will not disturb hollow bearing trees, furthermore no owl species successfully occupied hollows within the site, with a barn owl lost to predation while utilising an undesirably low hollow. Species is not associated with impact PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Pandion cristatus</i> Eastern Osprey (breeding)	-	V	Yes, associated with PCT 1071	Eastern Osprey is a large water dependant raptor with dark brown plumage above, white underparts and distinctly bowed wings when in flight. This species has a global distribution and in Australia, ranges along the coastline with the exception of Victoria and Tasmania. Eastern Osprey preferred habitat consist of the mouths of large rivers, lagoons and lakes where it forages for fish over clear, open water. This species breeds from July	Low	Yes	Yes – assess habitat, stick nest survey, diurnal bird survey	No	Breeding habitat for this species consists of dead trees or artificial structures that are located within 100 m of a floodplain, with a preference for coastline. No nests or evidence of breeding were found during the field investigations. There are no sightings within 10 km of the subject land, however there are records west of Singleton.

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				to September, building stick nests high up in dead crowns of live trees within 1 km of the sea.					Habitat constraint not met - Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting.
<i>Tyto novaehollandiae</i> Masked Owl (breeding)	-	V	No, associated with PCTs 1603 and 1691	Masked Owl is distributed from the coast to the western plains where it inhabits dry sclerophyll forests and woodlands from sea level to 1100 m in elevation. Masked Owl is known to occasionally utilise forest margins and roadsides. Pairs have a home range of 500 to 1000 ha and will roost and breed in moist gullies utilising large tree hollows or caves for nesting.	Low	No	Not required, potential habitat mapped	Breeding habitat (direct impacts) – No Breeding habitat (indirect impacts) – No Foraging habitat – No	This species breeds in moist eucalypt forests and woodlands, and the species relies on medium sized hollows with close proximity to open habitat. There are some suitable hollow-bearing trees present in the subject land. There are no sightings within 10 km of the subject land. Species is not associated with impact PCT 1071 and is therefore not predicted by the BAM calculator.
<i>Uperoleia mahonyi</i> Mahony's Toadlet	-	E	Yes, associated with PCT 1071	Mahony's Toadlet is endemic to the mid-north coast of NSW and has been found between Kangy Angy and Seal Rocks. The species inhabits ephemeral and semi-permanent swamps and swales on the coastal fringe of its range. Known records occur in heath or wallum habitats almost exclusively associated with leached (highly	Low	No	Not required	No	The subject land does not contain the soil type consistent with the habitat needs of the species. Nor does the artificial wetland provide habitat consistent with acidic or nutrient impoverished swamps. Additionally there are no

Species	Status		BAM predicted SCS	Habitat description	Potential occurrence in subject land	BAM candidate species	Survey required/complete	Potential for impact	Candidate species rationale
	EP BC	BC							
				nutrient impoverished) white sand. Commonly associated with acid paperbark swamps, Mahony's Toadlet also is known to occur in wallum heath, swamp mahogany-paperbark swamp forest, heath shrubland and Sydney red gum woodland. Recent studies suggest intact vegetation adjacent to and within water bodies is an important habitat feature for this species.					sightings within 80 km of the subject land, the closest being Raymond Terrace on the coastal lowlands to the east.

Appendix 3 Flora

Appendix 3.1 BAM plot field data

Plot ID	D.01_1603	D.02_1691	D.03_42
PCT	1603	1691	42
Area	0	0	0
Patch size	101	101	101
Condition class	Low	DNG	Low
Zone	56	56	56
Easting	286007	285114	285253
Northing	6407659	6407558	6406617
Bearing	361	95	100
Composition tree	2	0	2
Composition shrub	4	0	0
Composition grass	4	4	3
Composition forbs	2	5	2
Composition ferns	0	0	0
Composition other	0	0	0
Structure tree	6	0	20.2
Structure shrub	1.3	0	0
Structure grass	25.2	61.1	21
Structure forbs	0.2	2.2	1
Structure ferns	0	0	0
Structure other	0	0	0
Number of large trees	1	0	1
Number of hollow bearing trees	2	0	0
Litter cover	95	95	42
Length of fallen logs (m)	2	1	4
Stem class – 5 to 10 cm	0	0	0
Stem class – 10 to 20 cm	0	0	0
Stem class – 20 to 30 cm	0	0	1
Stem class – 30 to 50 cm	0	0	1
Stem class – 50 to 80 cm	0	0	0
Tree regen	1	0	1
High Threat Exotic cover	26	25.1	15.2

Appendix 3.2 BAM plot data sheets

Table A. 3 Flora species recorded in the subject land from BAM plots

Plot ID	Growth form	Species name	Establishment means	High Threat Weed	Cover	Abundance
D.01_1603	Forb (FG)	Oxalis spp.	Alive in NSW, Native		0.1	20
D.01_1603	Forb (FG)	Rumex spp. - Dock	Alive in NSW, Native		0.1	5
D.01_1603	Grass & grasslike (GG)	Aristida ramosa - Purple Wiregrass	Alive in NSW, Native		20	
D.01_1603	Grass & grasslike (GG)	Austrostipa ramosissima - Stout Bamboo Grass	Alive in NSW, Native		5	
D.01_1603	Grass & grasslike (GG)	Cyperus spp.	Alive in NSW, Native		0.1	5
D.01_1603	Grass & grasslike (GG)	Juncus spp. - A Rush	Alive in NSW, Native		0.1	10
D.01_1603	Shrub (SG)	Atriplex spp. - A Saltbush	Alive in NSW, Native		0.1	1
D.01_1603	Shrub (SG)	Enchylaena tomentosa - Ruby Saltbush	Alive in NSW, Native		1	30
D.01_1603	Shrub (SG)	Solanum cinereum - Narrawa Burr	Alive in NSW, Native		0.1	1
D.01_1603	Shrub (SG)	Veronica plebia	Alive in NSW, Native		0.1	1
D.01_1603	Tree (TG)	Acacia salicina - Cooba	Alive in NSW, Native		5	3
D.01_1603	Tree (TG)	Angophora floribunda - Rough-barked Apple	Alive in NSW, Native		1	1
D.01_1603	--	Asphodelus fistulosus - Onion Weed	Introduced		0.1	20
D.01_1603	--	Brassica spp. - Brassica	Introduced		0.5	20
D.01_1603	--	Bromus catharticus - Praire Grass	Introduced		5	

Plot ID	Growth form	Species name	Establishment means	High Threat Weed	Cover	Abundance
D.01_1603	--	Cirsium vulgare - Spear Thistle	Introduced		0.5	20
D.01_1603	--	Conyza bonariensis - Flaxleaf Fleabane	Introduced		0.1	5
D.01_1603	--	Emex australis - Spiny Emex	Introduced		0.1	2
D.01_1603	--	Galenia pubescens - Galenia	Introduced	Y	25	
D.01_1603	--	Lycium ferocissimum - African Boxthorn	Introduced	Y	1	6
D.01_1603	--	Medicago spp. - A Medic	Introduced		0.1	5
D.01_1603	--	Sonchus oleraceus - Common Sowthistle	Introduced		0.1	5
D.01_1603	--	Verbena bonariensis - Purpletop	Introduced		0.2	40
D.02_1691	Forb (FG)	Calotis cuneifolia - Purple Burr-Daisy	Alive in NSW, Native		0.1	10
D.02_1691	Forb (FG)	Dichondra repens - Kidney Weed	Alive in NSW, Native		0.5	200
D.02_1691	Forb (FG)	Oxalis spp.	Alive in NSW, Native		1	200
D.02_1691	Forb (FG)	Sonchus spp. - Sowthistle	Alive in NSW, Native		0.1	20
D.02_1691	Forb (FG)	Vittadinia spp. - Fuzzweed	Alive in NSW, Native		0.5	200
D.02_1691	Grass & grasslike (GG)	Austrostipa ramosissima - Stout Bamboo Grass	Alive in NSW, Native		10	
D.02_1691	Grass & grasslike (GG)	Chloris ventricosa - Tall Chloris	Alive in NSW, Native		50	
D.02_1691	Grass & grasslike (GG)	Lomandra spp. - Mat-rush	Alive in NSW, Native		0.1	30
D.02_1691	Grass & grasslike (GG)	Poa spp.	Alive in NSW, Native		1	50

Plot ID	Growth form	Species name	Establishment means	High Threat Weed	Cover	Abundance
D.02_1691	--	Asphodelus fistulosus - Onion Weed	Introduced		0.2	200
D.02_1691	--	Brassica spp. - Brassica	Introduced		1	50
D.02_1691	--	Cirsium vulgare - Spear Thistle	Introduced		0.5	20
D.02_1691	--	Cyperus brevifolius	Introduced		0.1	20
D.02_1691	--	Galenia pubescens - Galenia	Introduced	Y	5	
D.02_1691	--	Heliotropium amplexicaule - Blue Heliotrope	Introduced	Y	0.1	50
D.02_1691	--	Hyparrhenia hirta - Coolatai Grass	Introduced	Y	20	
D.02_1691	--	Lysimachia arvensis - Scarlet Pimpernel	Introduced		0.1	10
D.02_1691	--	Medicago polymorpha - Burr Medic	Introduced		0.1	30
D.02_1691	--	Plantago lanceolata - Lamb's Tongues	Introduced		1	100
D.02_1691	--	Verbena bonariensis - Purpletop	Introduced		0.1	20
D.02_1691	--	Vulpia spp. - Rat's-tail Fescue	Introduced		5	
D.03_42	Forb (FG)	Oxalis perennans	Alive in NSW, Native		0.5	200
D.03_42	Forb (FG)	Sonchus spp. - Sowthistle	Alive in NSW, Native		0.5	1000
D.03_42	Grass & grasslike (GG)	Aristida vagans - Threeawn Speargrass	Alive in NSW, Native		1	100
D.03_42	Grass & grasslike (GG)	Austrostipa ramosissima - Stout Bamboo Grass	Alive in NSW, Native		10	
D.03_42	Grass & grasslike (GG)	Cynodon dactylon - Common Couch	Alive in NSW, Native		10	

Plot ID	Growth form	Species name	Establishment means	High Threat Weed	Cover	Abundance
D.03_42	Tree (TG)	Acacia salicina - Cooba	Alive in NSW, Native		0.2	1
D.03_42	Tree (TG)	Casuarina cunninghamiana subsp. cunninghamiana - River Oak	Alive in NSW, Native		20	
D.03_42	--	Asphodelus fistulosus - Onion Weed	Introduced		0.1	50
D.03_42	--	Bromus catharticus - Praire Grass	Introduced		20	
D.03_42	--	Bromus molliformis - Soft Brome	Introduced		0.5	100
D.03_42	--	Conyza spp. - A Fleabane	Introduced		1	1000
D.03_42	--	Ehrharta erecta - Panic Veldtgrass	Introduced	Y	5	
D.03_42	--	Emex australis - Spiny Emex	Introduced		0.1	3
D.03_42	--	Fumaria spp. - Fumitory	Introduced		0.5	200
D.03_42	--	Galenia pubescens - Galenia	Introduced	Y	5	
D.03_42	--	Heliotropium amplexicaule - Blue Heliotrope	Introduced	Y	5	
D.03_42	--	Lolium spp. - A Ryegrass	Introduced		20	
D.03_42	--	Medicago polymorpha - Burr Medic	Introduced		1	500
D.03_42	--	Opuntia aurantiaca - Tiger Pear	Introduced		0.1	5
D.03_42	--	Phyllanthus tenellus - Hen and Chicken	Introduced		1	1000
D.03_42	--	Rumex crispus - Curled Dock	Introduced		0.5	1000
D.03_42	--	Salix spp.	Introduced	Y	0.2	1

Plot ID	Growth form	Species name	Establishment means	High Threat Weed	Cover	Abundance
D.03_42	--	Senecio madagascariensis - Fireweed	Introduced		0.1	20
D.03_42	--	Sida rhombifolia - Paddy's Lucerne	Introduced		0.1	5
D.03_42	--	Sisymbrium spp.	Introduced		15	
D.03_42	--	Vicia sativa - Common vetch	Introduced		2	100
D.03_42	--	Vulpia spp. - Rat's-tail Fescue	Introduced		20	

Appendix 4 Fauna

Table A. 4 Fauna species recorded at the subject land

Common name	Scientific name
Mammals	
<i>Bos taurus</i>	European Cattle
<i>Canis lupus familiaris</i>	Dog
Macropod sp.	Kangaroo/Wallaroo/Wallaby
<i>Macropus giganteus</i>	Eastern Grey Kangaroo
<i>Macropus robustus</i>	Common Wallaroo
<i>Macropus rufogriseus</i>	Red-necked Wallaby
<i>Oryctolagus cuniculus</i>	Rabbit
Rabbit sp.	Brown Hare/Rabbit
<i>Rattus</i>	Black Rat
<i>Vulpes</i>	Fox
Birds	
<i>Acrocephalus australis</i>	Australian Reed-Warbler
<i>Anas gracilis</i>	Grey Teal
<i>Anas rhynchotis</i>	Australasian Shoveler
<i>Anas superciliosa</i>	Pacific Black Duck
<i>Anthus novaeseelandiae</i>	Australian Pipit
<i>Apus pacificus</i>	Fork-tailed Swift
<i>Ardea intermedia</i>	Intermediate Egret
<i>Aythya australis</i>	Hardhead
<i>Chenonetta jubata</i>	Australian Wood Duck
<i>Cinclosoma punctatum</i>	Spotted Quail-thrush
<i>Circus approximans</i>	Swamp Harrier
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike
<i>Corcorax melanorhamphos</i>	White-winged Chough
<i>Corvus coronoides</i>	Australian Raven
<i>Corvus</i> sp.	-
<i>Coturnix ypsilophora</i>	Brown Quail
<i>Cracticus tibicen</i>	Australian Magpie

Common name	Scientific name
<i>Cygnus atratus</i>	Black Swan
<i>Egretta novaehollandiae</i>	White-faced Heron
<i>Elseya melanops</i>	Black-fronted Dotterel
<i>Eolophus roseicapillus</i>	Galah
<i>Falco cenchroides</i>	Nankeen Kestrel
<i>Fulica atra</i>	Eurasian Coot
<i>Geopelia humeralis</i>	Bar-shouldered Dove
<i>Himantopus</i>	Black-winged Stilt
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck
<i>Malurus cyaneus</i>	Superb Fairy-wren
<i>Manorina melanocephala</i>	Noisy Miner
<i>Merops ornatus</i>	Rainbow Bee-eater
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
<i>Microeca fascians</i>	Jacky Winter
<i>Ocyphaps lophotes</i>	Crested Pigeon
<i>Oxyura australis</i>	Blue-billed Duck
<i>Pelecanus conspicillatus</i>	Australian Pelican
<i>Petrochelidon ariel</i>	Fairy Martin
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
<i>Platycercus eximius</i>	Eastern Rosella
<i>Poliocephalus</i>	Hoary-headed Grebe
<i>Porphyrio</i>	Purple Swampphen
<i>Rhipidura leucophrys</i>	Willie Wagtail
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
<i>Threskiornis spinicollis</i>	Straw-necked Ibis
<i>Tyto javanica</i>	Eastern Barn Owl
<i>Vanellus miles</i>	Masked Lapwing
<i>Zosterops lateralis</i>	Silvereye
Frogs	
<i>Crinia signifera</i>	Common Eastern Froglet
Fish	
<i>Cyprinus carpio</i>	Carp
<i>Gambusia sp.</i>	Gambusia

Appendix 5 Significant Impact Criteria assessments

The following section provides for Significant Impact Criteria assessments as outlined in the *Matters of National Environmental Significance: Significant impact guidelines 1.1* (CoA 2013) for all biota listed under the EPBC Act that have likelihood of impact or occurrence rated as medium or greater.

Green and Golden Bell Frog *Litoria aurea*

Green and Golden Bell Frog is listed as Vulnerable under the EPBC Act. As such a Significant Impact Criteria Assessment is required and is provided below.

Table A. 5 Green and Golden Bell Frog *Litoria aurea* - assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to the long-term decrease in the size of an important population of a species	Unlikely	No Green and Golden Bell Frog are known to occupy the subject land, however 6.3 ha of potential habitat within PCT 1071 Coastal Freshwater Wetlands. The closest local record is located approximately 4.8 km east at the Mt Owen Mine in 1995 (DPIE 2021b). The subject site falls within the bounds of the Upper Hunter Green and Golden Bell Frog Key Population which is centred around the townships of Singleton and Muswellbrook in the upper parts of the Hunter River catchment and incorporates the Upper Hunter River and its tributaries within the Singleton and Muswellbrook LGAs (DECC 2007). The subject site lies approximately 25 km west of the core population area. The proposal will not permanently reduce the area of occupancy and is unlikely to directly impact individuals of the species and will therefore not lead to a long-term decrease in the size the Upper Hunter population of Green and Golden Bell Frog.
Reduce the area of occupancy of an important population	Unlikely	The proposal will impact 6.3 ha of potential habitat for Green and Golden Bell Frog within PCT 1071. The subject land is located outside the known extent of the Upper Hunter key population and is not known to directly support the species. As such, the proposed works are unlikely to permanently reduce the area of occupancy the population.
Fragment an existing important population into two or more populations	Unlikely	Located west 25 km west of the core population, and 4.8 km from the closest known occurrence of the species the subject site lies outside the known extent of the Upper Hunter key population. Therefore, impacts to the 6.3 ha of potential habitat in PCT 1071 will not fragment the existing known population into two or more populations.
Adversely affect habitat critical to the survival of a species	Unlikely	In order to sustain a viable local population, Green and Golden Bell Frogs require breeding habitat (permanent water bodies, culverts or drainage depressions), foraging habitat (grassland,

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		tussock vegetation, Typha sedgeland or modified habitat such as golf courses), shelter habitat (rock piles or tussock vegetation), movement habitat (wet areas, creek lines, laneways or drains) and over-wintering habitat (rock piles, logs or dense vegetation). This habitat is present within the subject site and could sustain Green and Golden Frog, should they occur. However, the species is not known to occupy the locality and it is unlikely the site constitutes core habitat relative to the Upper Hunter key population. As such, impacts to 6.3 ha of potential habitat provided by PCT 1071 is unlikely to adversely affect habitat critical to survival of the species.
Disrupt the breeding cycle of an important population	Unlikely	Green and Golden Bell Frog are not known to occupy suitable habitat provided by 6.3 ha of PCT 971 within the subject land, and as such does not support the breeding cycle of the Upper Hunter key population. Disturbance to this potential habitat is therefore unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposal will result in the removal or modification of 6.3 ha of potentially suitable Green and Golden Bell Frog habitat within PCT 1071. However, this potential habitat lies outside the known distribution of the extant population and does not constitute key habitat to the Upper Hunter key population. Therefore, it is unlikely that the proposal will directly impact habitat available to the species to the extent that the species is likely to decline as a result.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	The project is unlikely to exacerbate the current level of invasive species threat operating within the subject land. Species known to occur in the subject land in high densities listed as key threats for Green and Golden Bell Frog include Plague Minnow, Carp, European Red Fox and Black Rat (DAWE 2014, DECC 2007). The presence of these species pose and existing barrier to establishment within potential habitat, no new species are likely to result in an increased density or number as a result of the proposal.
Introduce disease that may cause the species to decline	Unlikely	Frog Chytrid Disease <i>Batrachochytrium dendrobatidis</i> is rapidly emerging as possible the single greatest threat to this species. However, the disease is currently widespread and it is unlikely that works within the subject area will introduce the disease into areas that were previously Chytrid-free as there is regular movement of vehicles and people throughout this area. It is still recommended that workers implement appropriate hygiene measures to reduce the likelihood of spreading the infection.
Interfere substantially with the recovery of the species	Unlikely	The Green and Golden Bell Frog Recovery Plan (DECC 2005) aims to:

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		<ul style="list-style-type: none"> • Further develop Green and Golden Bell Frog breeding and other habitat components, where appropriate, on public and private lands. • Improve habitat within Green and Golden Bell Frog key populations. • Develop awareness of Green and Golden Bell Frogs and encourage further on-ground actions through education and communication. • Reduce external threats to Green and Golden Bell Frogs. • Monitor and research to allow for better understanding of the extent and dynamics of the Parramatta River Green and Golden Bell Frog population. • Co-ordinate and communicate between various stakeholders, land managers and the community. <p>The proposed impacts to suitable habitat within the study area is unlikely to interfere with the aims of this recovery plan.</p>

Conclusion

Based on the distance from the core area of the Upper Hunter key population and lack of known Green and Golden Bell Frog populations in the locality, it is concluded that the proposed project impacts are unlikely to lead to a significant impact on the Green and Golden Bell Frog.

Central Hunter Valley eucalypt forest and woodland

Central Hunter Valley eucalypt forest and woodland is listed as critically endangered under the EPBC Act. This community is comprised of eucalypt woodlands and open forests; typically with a shrub layer of variable density and/or a grassy ground layer. Across its range, one or more of a complex of four eucalypt tree species typically dominate the canopy. This community occurs in the Hunter Valley (primarily in the Central Hunter) on Permian sedimentary substrates.

The community has undergone a severe decline and continues to face threats such as; heavy grazing, cropping, exotic plants and loss of community function (Threatened Species Scientific Committee 2015). There is no adopted or made Recovery Plan for this ecological community.

Occurrence in the study area

Central Hunter Valley eucalypt forest and woodland ecological community generally occurs on soils derived from the Permian sedimentary bedrock found on the valley floors and on lower hillslopes and low ridges. (Threatened Species Scientific Committee 2015). Much of it occurs in, or close to, the Central Hunter Valley, mainly in Muswellbrook, Singleton and Cessnock LGAs.

The Central Hunter Valley eucalypt forest threatened community aligns with PCTs 1603 and 1691 which occur along the northern boundary of the subject land. While of low condition, relating to historical grazing and land use, the vegetation fringes a significant remnant of the community more than 400 ha in area and is at the transitional edge between the community and the Hunter River Floodplain.

Vegetation comprising Central Hunter Valley eucalypt forest and woodland will not be directly impacted by the proposal, and will largely be protected and managed under a VMP as shown in Figure 11. Remaining areas will continue to be grazed under existing agricultural use.

Significant impact assessment

Based on a strong understanding of the extent and condition of this community in the study area, it is concluded that project impacts will not lead to a significant impact to the Central Hunter Valley eucalypt forest critically endangered ecological community. An assessment and justification is provided in Table A.6 below.

Table A. 6 Central Hunter Valley eucalypt forest, critically endangered - assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (critically endangered / endangered community)	Likelihood of significant impact	Justification
Reduce the extent of an ecological community.	Unlikely	The proposal will not remove the 6.1 ha of low condition Central Hunter Valley eucalypt forest as the community does not fall within the disturbance footprint. However, increased edge effects and ground disturbance within proximity of the community has some potential to result in indirect impact to the community. However, it is unlikely that this would lead to a reduction in the extent of the ecological community in the locality. Furthermore, much of this area will be fenced from cattle and managed under a VMP to improve the overall condition of the community and connectivity within the landscape in the locality.

Significant impact criteria (critically endangered / endangered community)	Likelihood of significant impact	Justification
Fragment or increase fragmentation of an ecological community.	Unlikely	Central Hunter Valley eucalypt forest vegetation is currently bounded by existing quarry and grazing operations south of the mapped extent shown in Figure 6. Additionally, the community occurs at the interface between wooded slopes and riparian floodplain and would be unlikely to extend southward to any notable degree, if habitat were available. Connectivity with remnant vegetation north of the subject land will be retained, and as such the proposal will not fragment or increase fragmentation of the ecological community.
Adversely affect habitat critical to the survival of an ecological community.	Unlikely	There is no adopted or made Recovery Plan for this ecological community and no critical habitats have been formerly identified by the Australian Government. Habitat critical for the occurrence of the community within the subject land will not be directly impacted, or removed by the proposal. Additionally, in recognition of the buffer function provided by degraded vegetation in the subject land the community will be managed under a VMP to improve condition and reduce edge effects on adjoining higher condition vegetation.
Modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	Unlikely	Ground and surface water assessments concluded the proposed works will not result in significant alteration to groundwater or surface water drainage pattern to a degree harmful to Central Hunter Valley eucalypt forest (Umwelt 2020, Hydrogeologist 2021).
Cause a substantial change in the species composition of an occurrence of an ecological community, including a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting.	Unlikely	The community occurs in a highly fragmented agricultural landscape where existing land use impacts have reduced community integrity and functionality (e.g. loss of small native mammals, reduced flora species richness, reduced genetic exchange across the community due to fragmentation). The community occurrence within the subject land is degraded to the degree that it unlikely to achieve regeneration of all strata and representative species without direct intervention. The proposal is unlikely to result in further decline as a result of expanded quarry operations. Furthermore the proposal will protect and improve the condition of the community under a VMP.

Significant impact criteria (critically endangered / endangered community)	Likelihood of significant impact	Justification
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: <i>- Assisting invasive species establishment</i> <i>- Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.</i>	Unlikely	Central Hunter Valley eucalypt forest within the subject land currently occurs in a degraded and weedy state. The proposal will not result in actions which substantially alter existing pressures on the community. Furthermore, much of the community will be fenced to protect from accidental encroachment and cattle and managed under a VMP to reduce weeds and other pressures. Therefore the proposal will not cause a substantial reduction in the quality or integrity of the occurrence of the ecological community.
Interfere with the recovery of an ecological community.	Unlikely	There is no adopted or made Recovery Plan for this ecological community and therefore recovery priorities (actions and locations) have not been formerly articulated by the Australian Government. The action is considered unlikely to interfere with recovery actions, and will address pressures such as disturbance and weeds in the subject land.

Conclusion

Based on the retention of all occurrences of Central Hunter Valley eucalypt forest within the subject land, it is concluded that the proposed project impacts are unlikely to lead to a significant impact on the critically endangered ecological community.