

Appendix F Ecology Assessment



Newman Quarrying Pty Ltd

Sly's Quarry Environmental Impact Statement

Biodiversity Assessment Report

May 2015

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1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) was engaged by Newman Quarrying Pty Ltd (Newman Quarrying) to prepare a Biodiversity Assessment report to address the potential biodiversity impacts from the proposed expansion of a sandstone quarry at Lot 2 DP 1055044, Tullymorgan-Jackybulbin Road, Mororo, known as Sly's Quarry.

The proposal involves the expansion of the existing sandstone quarry by 11.1 hectares and an increase in the extraction rate up to 500,000 tonnes per annum. The primary purpose of the quarry would be to supply substantial quantities of quarry materials required for current and proposed Pacific Highway works, and for supply to Clarence Valley Council (CVC) and local contractors.

It is estimated that the quarry would have an available resource of about 7 million tonnes which would allow extraction for a period of between 30 and 40 years, depending on demand.

This biodiversity assessment report forms part of the EIS for the proposal.

1.2 Proposal description

The quarry operation would be carried out in stages and in response to demand. It is therefore difficult to predict exactly how the extraction would progress. In general, the extraction is proposed to move north and east initially, to the extent of the currently approved quarry. The eastern extent of the excavation would remain 10 m from the road reserve located along the eastern boundary. The excavation would be to the current floor level of 44 m AHD.

Stage 1 would cover an area of approximately 7 hectares and extract approximately 2.3 million tonnes.

Stage 1 already has approvals in place under an existing development application. Any references to site areas within this report relate to the proposed expansion of Stages 2 and 3.

Stage 2 would involve expanding the quarry to the north and south and to a depth of 44 m AHD. Stage 2 (south) would be exhausted prior to Stage 2 (north) being developed. This would expand the quarry by approximately 5.7 hectares and involve the extraction of approximately 2.8 million tonnes of material. This would involve the removal of 5.27 hectares of native vegetation.

Stage 3 would be the final stage and would expand the quarry further north and south. Stage 3 (south) would be exhausted prior to Stage 3 (north) being developed. Stage 3 would involve an expansion of approximately 5.4 hectares to a depth of 44 m AHD. This would involve extracting approximately 1.8 million tonnes of material. This would include the removal of approximately 5.2 hectares of native vegetation.

The extraction of all stages would progress in 10 m by 10 m benches to a final depth of 44m AHD. Following extraction, the material would be crushed, screened and where necessary blended with other materials from the quarry, or material imported to the quarry. The materials would be stockpiled on the quarry floor in numbered stockpiles of approximately 4,000 tonnes each. Samples from each stockpile would be analysed for compliance with RMS specifications before being transported offsite. This process takes approximately 20 days.

The proposed sequence of operations for each stage would generally be:

- Establish the sediment and erosion control measures and other environmental safeguards.
- Clearing vegetation, if necessary. The bulk of cleared vegetative wastes would be piled in a suitable location, clear of adjacent vegetated areas and mulched for future revegetation works.
- Topsoil would be stripped, stockpiled and protected against erosion for use in revegetation works.
- Excavation of the weathered rock material, where possible. The deeper layers would be excavated in a similar manner but would also include blasting. Blasting is anticipated to be carried out at a frequency of between two blasts per month to one blast per year, depending on demand and the material encountered. The blasting would be undertaken by a specialist contractor in accordance with regulatory requirements.
- If the rock is too large, a rock hammering, where required to break large rocks into smaller pieces.
- The rock is collected by an excavator and feed into a jaw crusher. The crusher produces an output of various sizes of fill or aggregate which are separated by a screening machine into various piles based on size. Sand is also produced in this process. The crusher and screener are moved around the quarry floor as necessary to be close to the quarry face and accumulated, excavated stone.
- Loading of the material directly from the stockpile onto trucks for removal from site.
- The excavation continues, as described above, within each stage until it reaches the ultimate depth of 44m AHD. During the excavation, 10 m high by 10 m wide benches are established at the quarry face. At the top of each bench, a safety bund/wall is constructed to prevent people or machinery falling over the bench. The benches and quarry floor would be graded to the sediment basin located in the south-western end of the quarry area.
- Once the extraction is complete, topsoil would be respread on the disturbed areas and revegetated, where possible. The established erosion and water control measures would be maintained until the rehabilitated surface is adequately stabilised.

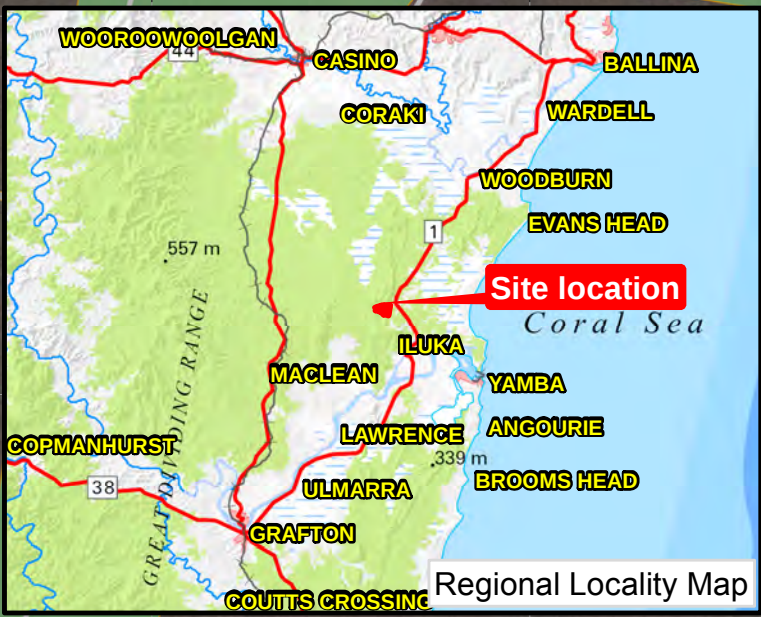
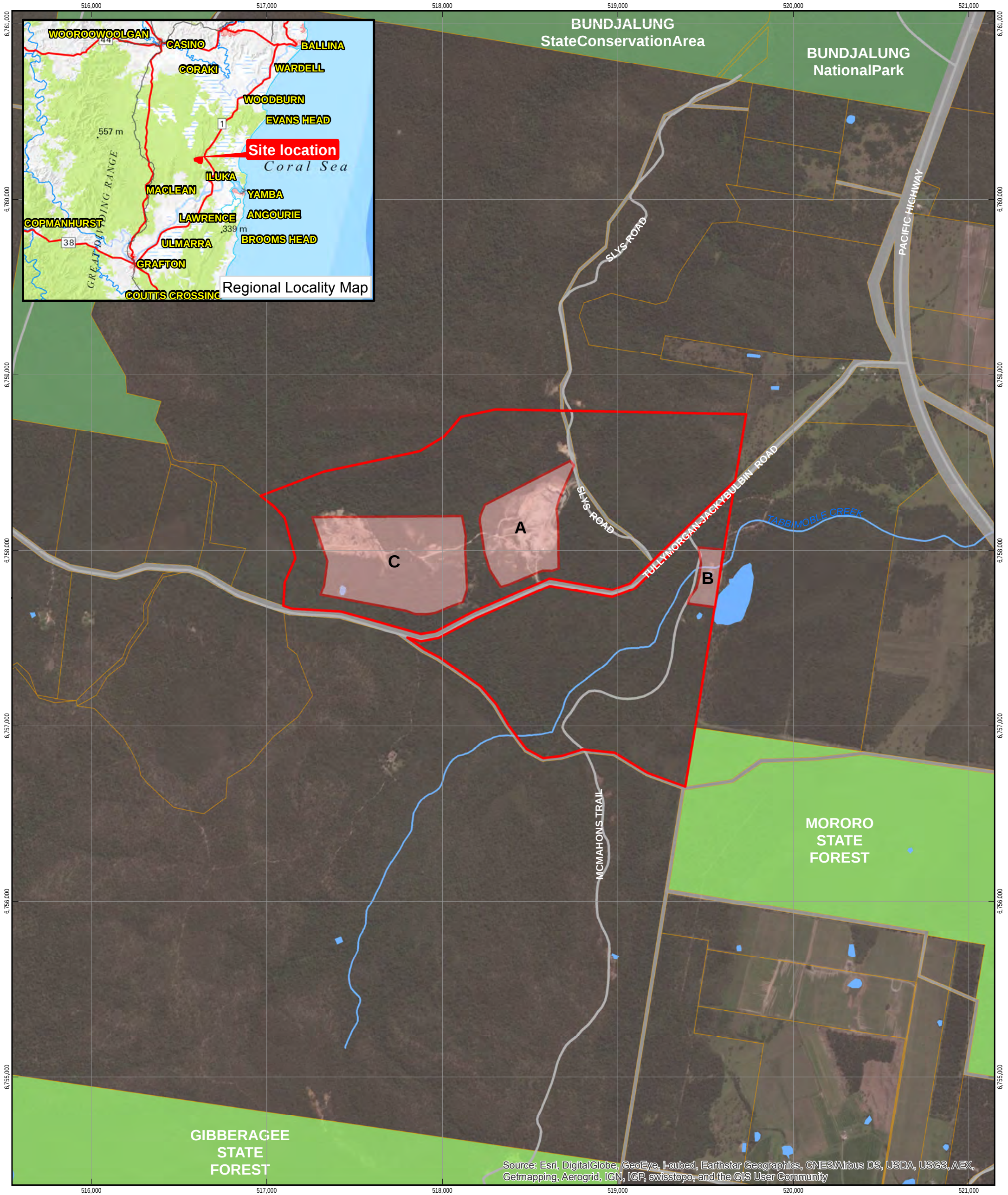
Other details relating to quarry operations include:

- If there is a special order for large boulders, for example for breakwater or river or sea wall repair or construction, these are set aside and transported as such.
- Occasionally, in order to comply with RMS specifications, materials won from the quarry would be blended with other materials won from the quarry, or with imported materials (eg, sand, clay), prior to being stockpiled on the floor of the quarry.
- Some sand is transported to the onsite wash plant for processing.

1.3 Proposal location and study area

The subject site is located at Lot 2 in DP 1055044 on land with frontage to the Tullymorgan-Jackybulbin Road approximately 2 kilometres west of the Pacific Highway, Mororo, NSW. The site is approximately 55 km north north-east of Grafton and 32 km south from the town of Woodburn, within the Clarence Valley Local Government Area (LGA). Slys Road is located along the eastern boundary of the site (see Figure 1).

The study area is 18.1 hectares in size and contains a previous area of disturbance that is currently being used as a quarry, several recently cleared access tracks and areas of regrowth native vegetation.



LEGEND

Current Quarry Areas

Lot 2 DP 1055044

Road

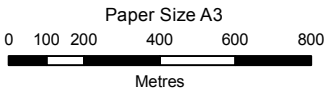
Lot

Waterbody

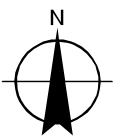
Natural Parks

Waterways

State Forest



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Newman Quarrying
Sly's Quarry Environmental Impact Statement

Job Number 22-17528
Revision A
Date 11 Dec 2014

Site location

Figure 1

1.4 Secretary's environmental assessment requirements

1.4.1 Overview

Approval under Part 4.1 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) is being sought for the proposal.

The Secretary's environmental assessment requirements (SEARs) for the proposal were issued on 21 August 2014. The SEARs have informed the preparation of the environmental impact statement for the proposal. The SEARs include a requirement for a biodiversity impact assessment to address the following:

- The likely biodiversity impacts of the development, having regard to OEH's requirements.
- A biodiversity offset strategy to ensure the development would maintain or improve the biodiversity values of the region in the medium to long term.

This assessment specifically considers matters relevant to biodiversity. The applicant has chosen to use the BioBanking Methodology (BBAM) in accordance with the NSW Biodiversity Offsets Policy for Major Projects (2014) and associated Framework for Biodiversity Assessment (FBA) to quantify the proposal's impacts and determine suitable offsets within the policies guidelines.

Table 1 outlines where the requirements of the SEARs have been addressed within this report. The methodology for this assessment is provided in Chapter 2 of this report.

Table 1 Secretary's environmental assessment requirements

SEAR reference (OEH recommendations)	Report section
A field survey should be conducted and documented in accordance with relevant guidelines, including: • The Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW 2009) • Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC 2004)	Section 4 Following consultation with OEH the biodiversity survey was conducted in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014b) and the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014) Initial surveys identified the presence of the threatened plant species, <i>Hibbertia marginata</i>. Additional targeted surveys were undertaken to identify plant locations and numbers within the proposed quarry footprint.
The EA should contain as a minimum	
a) The requirements set out in the Guidelines for Threatened Species Assessment (DoP 2005)	Section 4 Following consultation with OEH the biodiversity survey was conducted in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014b) Initial surveys identified the presence of the threatened plant species, <i>Hibbertia marginata</i>. Additional targeted surveys were undertaken to identify plant locations and numbers within the proposed quarry footprint.

SEAR reference (OEH recommendations)	Report section
b) A description and geo-referenced mapping of the study area, key habitat features, survey locations, vegetation communities and reported locations of threatened species, populations and ecological communities present in the subject site and study area.	Section 5
c) Description of survey methodologies use, including timing, location and weather conditions.	Section 4
d) Details, including qualifications and experience of all staff undertaking the surveys, mapping and assessment of the impacts.	Section 4.5
e) Identification of national and state listed threatened biota known or likely to occur in the study area and their conservation status.	Section 5.1 and Appendix A
f) Description of the likely impacts of the proposal on biodiversity and wildlife corridors, including direct and indirect and construction and operation impacts.	Section 6
g) Identification of the avoidance, mitigation and management measures that will be put in place as part of the proposal to avoid or minimise impacts including details about alternative options considered and how long term management arrangements will be guaranteed.	Section 7
h) Description of the residual impacts of the proposal. If the proposal cannot adequately avoid or mitigate impacts on biodiversity, then a biodiversity offset package is expected.	Section 8.4
i) Provision of specific Statement of Commitments relating to biodiversity.	Section 7
4. An assessment of the significance of direct and indirect impacts of the proposal for threatened biodiversity known or considered likely to occur in the study area based on the presence of suitable habitat.	This assessment has been carried out in accordance with the NSW Biodiversity Offsets Policy for Major Projects (OEH 2014e). Assessments of significance for threatened biota are therefore not required.
5. Use the Biobanking Assessment Methodology (BBAM) to assess biodiversity impacts arising from the proposal.	Section 8

SEAR reference (OEH recommendations)	Report section
6. Where appropriate, likely impacts (both direct and indirect) on any adjoining and/or nearby OEH estate reserved under the National Parks and Wildlife Act 1974 or any marine and estuarine protected areas under the Fisheries Management Act 1994 or the Marine Parks Act 1997 should be considered.	Not applicable
7. With regard to the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, the assessment should identify any relevant Matters of National Environmental Significance and whether the proposal has been referred to the Commonwealth or already determined to be a controlled action.	Section 6.5

1.5 Purpose of this report

This biodiversity assessment report has been prepared to assess the potential ecological impacts of the proposal and determine suitable offsets. Specifically, the objectives of this assessment are to:

- Address the SEARs for the proposal.
- Outline the methods used in the biodiversity assessment.
- Describe the existing environment of the study area in terms of its ecological values, including type and condition of vegetation communities and terrestrial and aquatic habitats.
- Identify flora and fauna species and ecological communities within the study area that have the potential to be impacted by the proposal.
- Provide a description of the proposal, including potential impacts on biodiversity values and measures to avoid or mitigate impacts.
- Present the data used to perform the FBA assessment and credit calculations for the proposal.
- Calculate the number and type of biodiversity credits using BBAM 2014 that would be required to offset impacts of the proposal and outline a Biodiversity Offset Strategy.
- Provide concluding statements to demonstrate that the proposal would 'improve or maintain' biodiversity values.

This biodiversity assessment and credit calculations were conducted by Dan Williams (accredited assessor number 0073) and Arien Quin (accredited assessor number 0120) in accordance with the FBA. The report was peer reviewed by Dan Williams.

1.5.1 Framework for biodiversity assessment

The NSW Government has developed a NSW Biodiversity Offsets Policy for Major Projects (the policy). Major Projects include State Significant Development (SSD) and State Significant Infrastructure (SSI). Under the policy, the FBA must be used by a proponent to assess all biodiversity values on the development site for the Major Project. Under the FBA, a Biodiversity

Assessment Report must be prepared to describe the biodiversity values present at the site, assess impacts of the proposal and determine the number of biodiversity credits required to offset impacts of the proposal. Where a proponent is proposing to establish an offset for the Major Project, the Biobanking Assessment Methodology (BBAM) must be used to assess the biodiversity values of the offset site and to identify the number and type of biodiversity credits that may be created on the offset site.

The Biodiversity Offset Strategy will outline how the proponent intends to offset the impacts of the Major Project. These reports form part of the EIS. These assessments must be made by a person accredited in accordance with section 142B(1)(c) of the *NSW Threatened Species Conservation Act 1995* (TSC Act).

This Biodiversity Assessment Report has been prepared by accredited assessors (see Section 4.5) and includes desktop assessments, site surveys and offset calculations in accordance with the FBA.

1.5.2 Biobanking assessment methodology

BioBanking was established by the New South Wales Department of Environment, Climate Change and Water (DECCW) (now the Office of Environment and Heritage (OEH)) as a method to address the loss of biodiversity and threatened species. The scheme attempts to create a market framework for the conservation of biodiversity values and the offsetting of development impacts.

BioBanking is established under Part 7A of the *NSW Threatened Species Conservation Act 1995* (TSC Act), which was enabled by the *Threatened Species Conservation Amendment (Biodiversity Banking) Bill 2006*. The *Threatened Species Conservation (Biodiversity Banking) Regulation 2008* provides additional rules for specific aspects of the scheme that are important for its operation.

The Biobanking Assessment Methodology (BBAM) sets out how biodiversity values will be assessed, establishes rules for calculating the number and class of biodiversity credits, and determines the trading rules that will apply. The BBAM includes a software package known as the BioBanking Credit Calculator (the credit calculator) which processes site survey and assessment data. The credit calculator is used to determine:

- The type and extent of surveys required for a biodiversity assessment.
- The number and type of biodiversity credits that are required for a development site to offset impacts on biodiversity either as part of a Major Project biodiversity assessment or an application for a BioBanking statement.
- The number and type of biodiversity credits generated through the conservation and management of a biobank site.

The credit calculator has been used in this Biodiversity Assessment Report to determine the number and type of biodiversity credits required to offset the impacts of the proposal. The credit calculator will also be used to determine the biodiversity credits generated at an appropriate offset site in order to finalise the Biodiversity Offset Strategy for the proposal, either through the survey and assessment of a suitable offset site or through the purchase of biodiversity credits from an established biobank.

1.6 Definitions

For the purpose of this document, the following definitions have been used:

- The 'proposal' refers to the proposed quarry expansion works which are discussed in Section 1.2.

- The 'subject site' refers to the area that would be directly impacted by the proposal (Stage 2 and 3).
- The 'study area' refers to the area that was subject to field survey and assessed for direct or indirect impacts that may arise from the proposal in this Biodiversity Assessment Report.
- The 'locality' refers to the area within a 10km radius of the proposal.

1.7 Glossary of terms

Term	Definition
Biobank site	Land that is designated by a biobanking agreement to be a biobank site.
Biobanking agreement	An agreement entered into between the landowner and the Minister under Part 7A of the TSC Act for establishing a biobank site.
BioBanking Assessment Methodology (BBAM)	The rules of BioBanking established under the TSC Act that determine credits created, credits required and the circumstances that improve or maintain biodiversity values.
BioBanking	The biodiversity banking and offsets scheme established under Part 7A of the TSC Act.
Biodiversity credit report	Specifies the number and type of biodiversity credits: required to offset the impacts of a development to obtain a Biobanking statement; or required to offset the impacts of a Major Project in accordance with the FBA; or that would be generated through conservation and management of a biobank site under a BioBanking agreement.
BioBanking Trust Fund	The Trust Fund established under Part 7A of the TSC Act to hold funds from the sale of credits.
Biodiversity credit	A unit of biodiversity value to measure specific development impacts or conservation gains in accordance with the FBA or the BBAM. Includes ecosystem credits or species credits.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems including threatened species, populations and ecological communities, and their habitats.
Ecosystem credit	A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
Locality	The area within a 10 km radius of the subject site.
Subject site	The area that would be directly impacted by construction and operation of the proposal.
Species Credit	A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Species Profile Database.
Study area	The area that was subject to a site survey and assessed for direct or indirect impacts arising from construction and operation of the proposal.
The policy	The NSW Biodiversity Offsets Policy for Major Projects
Threatened biota	Threatened species, populations or ecological communities listed under the TSC Act and/or the EPBC Act.
Major project	Major projects include State Significant Development (SSD) and State Significant Infrastructure (SSI)
FBA	The Framework for Biodiversity Assessment. The methodology to assess impacts on biodiversity that must be used by a proponent to assess all biodiversity values on the development site for a Major Project in accordance with The NSW Biodiversity Offsets Policy for Major Projects.

1.8 Scope and limitations

This report: has been prepared by GHD for Newman Quarrying Pty Ltd and may only be used and relied on by Newman Quarrying Pty Ltd for the purpose agreed between GHD and the Newman Quarrying Pty Ltd as set out in section 1.5 of this report.

GHD otherwise disclaims responsibility to any person other than Newman Quarrying Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.9 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.9 Assumptions and limitations

Given the short duration of the field survey it is likely that some species that utilise the study area (permanently, seasonally or transiently) were not detected during the survey. These species may include flora species such as annual, ephemeral or cryptic species. Some fauna species are also mobile and transient in their use of resources, and some are seasonal migrants, and it is likely that not all species that potentially occur in the study area were recorded during the survey period.

The habitat assessment conducted for the site allows for identification of habitat resources for species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal, with particular emphasis on endangered ecological communities, threatened species and their habitats.

It was beyond the scope of this assessment to undertake all detailed threatened species surveys. The BBAM predicts the type of threatened species requiring additional surveys and these results are only known after completion of the plot/transect surveys and results entered into the credit calculator. Targeted surveys were completed for *Hibbertia marginata* as this species was the only threatened flora species found within the study area that required further assessment.. All other threatened species were either included in the ecosystem credit calculations or deemed unlikely to occur at the site.

Site conditions (including the presence of threatened species of flora and/or fauna) may change after the date of this report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

2. Legislative context

2.1 State legislation

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EPA Act) forms the legal and policy platform for project assessment and approval in NSW and aims to, inter alia, 'encourage the proper management, project and conservation of natural and artificial resources'

The proposal will be assessed under Part 4.1 of the EPA Act as 'State significant development'. Approval from the Minister for Planning is required and an Environmental Impact Statement (EIS) is required to be prepared.

Under Clause 111(1) of the EPA Act, determining authorities must 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. This report addresses the biodiversity components of the 'environment' to assist the proponent with addressing the relevant sections considerations of section 111 of the EPA Act.

In addition, section 111(4) of the EPA Act provides that the determining authority must consider the effect of an activity on:

- Critical habitat (as defined under the TSC Act and FM Act).
- Species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a significant effect on those species, populations or ecological communities.
- Other protected fauna or protected native plants listed under the *National Parks and Wildlife Act 1974*.

Under the policy, the SEARs for an EIS will require a proponent to apply the FBA to assess impacts on biodiversity values. The FBA will also be applied to identify reasonable measures and strategies that can be taken to avoid and minimise impacts on biodiversity. A Biodiversity Assessment Report will describe the biodiversity values present on the development site and the impact of the Major Project on these values. A Biodiversity Offset Strategy will outline how the proponent intends to offset the impacts of the Major Project.

2.1.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) provides the statutory framework for biota of conservation significance in NSW. The Act aims to, inter alia, 'conserve biological diversity and promote ecologically sustainable project'. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 1, critically endangered species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2.
- The listing of Key Threatening Processes (under Schedule 3).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities (threatened biota) listed under the Act that have been previously recorded within the locality of the site and consequently could occur subject to the habitats present.

- Completion of plot/transect surveys in accordance with the BBAM.
- Targeted field surveys for threatened biota (to be completed).
- Identification of suitable impact mitigation and environmental management measures for threatened biota, where required.

2.1.3 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It provides for:

- The listing of threatened species, populations and ecological communities, with endangered species, populations and communities listed under Schedule 4, critically endangered species and communities listed under Schedule 4A, vulnerable species and communities listed under Schedule 5.
- The listing of Key Threatening Processes (under Schedule 6).
- Diseases affecting fish and marine vegetation (under Schedule 6B).
- Noxious fish and noxious marine vegetation (under Schedule 6C).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.

The FM Act has been addressed in the current assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the site and consequently could occur subject to the habitats present.
- Assessment of potential impacts on aquatic habitats.

2.1.4 Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) and *Native Vegetation Regulation 2005* guide the way native vegetation is managed in NSW by preventing broadscale clearing, unless it improves or maintains environmental outcomes.

Due to the proposal being considered designated development and State Significant development, by virtue of clause 25(f) of the NV Act and 89(j) of the EP&A Act, approval for clearing under the NV Act is not required.

2.1.5 Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* (NW Act), provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. As such, if present, noxious weeds on the site should be assessed and controlled.

2.2 Commonwealth legislation

The purpose of the Commonwealth EPBC Act is to ensure that actions likely to cause a significant impact on matters of national environmental significance undergo an assessment and approval process. Under the EPBC Act, an action includes a project, undertaking, project or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be

undertaken without prior approval from the Australian Government Minister for Sustainability, Environment, Water, Population and Communities (the Minister).

The EPBC Act identifies matters of national environmental significance (MNES) as:

- world heritage properties
- national heritage places
- wetlands of international importance (Ramsar wetlands)
- threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development

The EPBC Act has been addressed in this assessment through:

- desktop review to determine the ecological MNES that have been previously recorded within the locality of the site and hence could occur, subject to the habitats present
- targeted field surveys for species and ecological communities listed under the Act
- identification of suitable impact mitigation and environmental management measures for threatened species, where required
- assessment of potential impacts on MNES.

2.3 Local environmental planning instruments

2.3.1 Clarence Valley Local Environment Plan

Local Environmental Plans (LEPs) are prepared by Councils to guide planning decisions in their Local Government Areas and establish the requirements for the use and development of land.

Under the *Clarence Valley Local Environmental Plan 2011*, (CVLEP) the study area is zoned as RU2 Rural. Extractive industries, as defined in the Dictionary of the CVLEP, are not listed in the Land Use Table for the RU2 zone. However, the permissibility of the proposed development is determined by the *State Environmental Planning Policy (SEPP) (Mining, Petroleum Production and Extractive Industries) 2007* (MPEI SEPP) which prevails over the LEP.

For further discussion of the land use zoning of the study area refer to the EIS document (GHD 2014a).

2.3.2 Clarence Valley Comprehensive Koala Plan of Management (CKPoM)

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas. SEPP 44 also aims to ensure a permanent free-living population of Koalas over their present range, and reverse the current trend of Koala population decline by:

Schedule 1 of SEPP No. 44 lists LGAs to which the Policy applies. The site falls within the Maclean LGA (now part of the Clarence Valley Council) which is listed under this schedule. Where an approved Comprehensive Koala Plan of Management (CKPoM) exists for an LGA, this takes precedence over SEPP 44. Although a CKPoM has been prepared by the Clarence Valley Council, the site does not fall within any of the three management areas covered by the plan and therefore the CKPoM does not apply to this proposal.

Under SEPP 44, 'potential' Koala habitat is defined as areas of native vegetation where the trees of the types listed in Schedule 2 of the Policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. If potential habitat is identified at the site then further assessment is required to determine whether core habitat is present.

'Core' Koala habitat is defined as an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population. If core Koala habitat is to be impacted by a proposal, an approved Koala Plan of Management is required prior to approval of the proposed development.

In accordance with the requirements of SEPP 44, assessment of the site to determine whether it provides 'potential' or 'core' Koala habitat as defined by the Policy was undertaken and the potential impacts of the proposal on the Koala have been considered in this report (see Section 5.4.3).

3. Existing environment

3.1 Location and land uses

The subject site is located approximately 55 km north north-east of the city of Grafton and 32 km south from the town of Woodburn. The subject site consists of a cleared area in the centre which is currently used for quarry activities and there is another small patch of cleared land near the north east corner of the proposal site.

The lower slopes of Lot 2 north of Tullymorgan-Jackybulbin Road have been extensively cleared of vegetation although there is a substantial treed buffer of dry sclerophyll forest along most of the road frontage. The clearing may have resulted from the previous history of selective logging on the site and in the area. It is also associated with the sand extraction and quarrying activities approved for Lot 2 in the past (Newman, 2014).

To the south, west and north of the cleared portion are heavily forested areas. To the west the site is bound by Slys road. Mount. Doubleduke is a small mountain reaching 230 m above sea level in the north of the subject site. Several forested reserves are located in the surrounding locality. These include Bundjalung Crown Reserve, Devils Pulpit State Forest, Gibberagee State Forest and Mororo State Forest.

3.2 Geology, soils and geomorphology

The site area generally has poor soils of sandy composition mostly derived from the underlying sandstone. In lower-lying areas, soils may be derived from stream deposition. It is located in the southern end of the Clarence-Moreton Basin in northern NSW and includes extensive deposits of quartzose sandstone. The sandstone exists in the Kangaroo Creek Formation and related geological structures. In the locality of the quarry, these sandstone deposits are generally well-exposed and quite accessible. They are easily worked to produce a principal product of medium- to coarse-grained siliceous sandstone that is used in a number of engineering applications, particularly road works.

The Kangaroo Creek sandstone is estimated to range in thickness from 150 m to 500 m. At the existing quarry face, the sandstone exists in a series of beds ranging in thickness from less than 1 m to up to 3 m (Newman, 2014).

Reference to the Woodburn 1:100,000 scale soil landscapes sheet (Morand, 2001) shows the site is comprised of three landscape units. These include the Kooyong (ky), Cliff Road (cx) and Coraki (ck) landscape units which are all underlain by Kangaroo Creek Sandstone (quartz sandstone).

The most northern section of the site is comprised of Kooyong (ky) landscape unit. This is characterised by rolling low hills and hills. Relief is typically 100 – 200 m, elevation of 20 – 180 m and slopes of 20 - 35%. This unit has shallow to deep soils (50 – 150 cm) consisting of yellow and brown Kurosols and Tenosols throughout hill slopes and crests with moderately deep to deep (>60cm) Red Kurosols on highly ferruginised sandstone, usually on crests and upper slopes when present.

The southern section of the site is comprised of Cliff Road (cx) landscape unit. This is characterised by rolling low hills and hills on Kangaroo Creek Sandstone (quartz sandstone). Relief is typically 180-150 m, an elevation of 20-180 m, with slopes of 10 - 20% and occasionally 30 – 25%. Rock outcrop is common. These two landscape units have soil that generally overlies a combination of colluvium, friable, porous sandstone saprolite and fresh rock, often shattered and fragmented at the weathering front. Iron – indurated sandstone occur on ridge crests.

The Coraki (ck) landscape unit is found in a small section along the eastern boundary of the site. Landscapes of the Coraki unit consist of undulating rises, with a relief of 10 – 30 m and slopes of 2 – 10%, with elevation generally greater than 35 m. Well drained, deep soils (greater than 100 m depth) occur and consist of Otheric Tenosols or Aeris Podzols throughout hills slopes and crests. On the lower slopes, deep (greater than 150 m) Grey Kurosols soils occur.

A small section of the site near the centre of the site is considered disturbed terrain which has been disturbed by human activity to a depth of at least 100 cm and has removed, greatly disturbed or buried the original soil.

3.3 Topography

The natural topography of the site falls in a south westerly direction, and has been altered by the existing quarry activities. This site catchment is located within the southern foothills of Mount Doubleduke.

A ridgeline runs along the northern and eastern boundary of the site. The ridgeline starts at the northern end of the site at an elevation of about 100 m Australian Height Datum (AHD) and falls towards the southern extent of the site to about 42 m AHD. The existing quarry floor is relatively level at 44 m AHD.

A number of unnamed ephemeral tributaries drain around the site, being diverted around the works area, and discharge to Tabbimoble Creek. Tabbimoble Creek drains via the Bundjalung National Park marshes to the Clarence River near Iluka.

In the centre of the site the existing quarry has altered the natural topography by excavating the rock from the southern slopes of Mount Doubleduke.

3.4 Surface Water

The site is located within the Clarence River catchment with unnamed ephemeral drainage lines flowing in a southwest direction to Tabbimoble Creek. The ephemeral drainage lines are diverted around the works area and bypass the site water dams, discharging to Tabbimoble creek under Tullymorgan Jackybulbin Road.

Within the works area, the pit floor and stockpiled areas discharge to an initial sediment pond (approx. 2.4 ML), this overflows to the main sediment basin (7m deep, approx. 12.6 ML). The main sediment basin is the discharge point from the site. The site office, weighbridges, wash plant and other outbuildings along the site discharge to three smaller sediment basins (total approx. 0.55 ML). These basins discharge to the main sediment basin.

Some water quality information was collected from the main sediment basin before it exits the site (GHD 2014b). The results indicate the water quality is fresh, with neutral pH and low to moderate suspended solids.

3.5 Climate

The North Coast region is considered to be sub-tropical with warm, wet summers and dry, mild winter.

The Bureau of Meteorology website provides climatic information for the proposal area, taken from the Yamba weather station (site number 058012, closest station to the study area with detailed long-term climate statistics). The mean annual rainfall for this area is 1460.1 mm. Rainfall is typically highest in summer and early autumn and lowest in late winter and early spring. Mean daily maximum temperatures range from 26.7°C in summer to 20.1°C in winter with mean minimum temperatures ranging from 19.1°C in summer down to 9.7°C in winter (BOM 2014). The weather conditions during the field survey are outlined in Section 4.3. Weather during the survey was taken from recordings at Yamba Pilot Station.

4. Methodology

4.1 Approach

This Biodiversity Assessment Report has been prepared to describe the impacts of the project on biodiversity values using the FBA (OEH, 2014a).

The main components of the methodology for the biodiversity assessment were:

- Desktop assessment to describe the existing environment and landscape features of the study area and to identify the suite of threatened biota potentially affected by the proposal.
- Field survey to describe the biodiversity values of the proposal site and surrounding study area and determine the likelihood of threatened biota and their habitats occurring in the proposal site or being affected by the proposal.
- FBA calculations using the credit calculator v.4.1 to quantify the biodiversity impacts of the proposal and to determine the biodiversity credits that would be required to offset these impacts.

The biodiversity assessment and biodiversity credit calculations were performed by Arien Quin and Dan Williams in accordance with the FBA.

4.2 Desktop assessment

4.2.1 Literature and database review

A desktop database review was undertaken to identify threatened flora and fauna species, populations and ecological communities (biota) listed under the TSC Act and FM Act, and MNES listed under the EPBC Act, that could be expected to occur in the locality, based on previous records, known distribution ranges, and habitats present. These were also used to obtain the necessary site data to perform FBA calculations. Biodiversity resources pertaining to the proposal site and locality (i.e. within a 10 km radius of the site) that were reviewed prior to conducting field investigations included:

- The Commonwealth Department of the Environment (DoE) Protected Matters Search Tool (PMST), for Matters of National Environmental Significance (MNES) known or predicted to occur in the locality (DoE, 2014a).
- DoE online species profiles and threats database (DoE, 2014b).
- Office of Environment and Heritage (OEH) Wildlife Atlas database (licensed) for records of threatened species, populations and endangered ecological communities listed under the TSC Act that have been recorded within the locality of the proposal (OEH, 2014a).
- OEH threatened biota profiles for descriptions of the distribution and habitat requirements of threatened biota (OEH, 2014b). This resource was used to identify the suite of threatened ecological communities (TECs) that could potentially be affected by the proposal and to inform habitat assessments.
- The NSW vegetation types database (OEH, 2014c) to identify matching Plant Community Types (PCTs) known or likely to occur in the study area as required by the FBA.
- Department of Primary Industries (DPI) online protected species viewer for records of threatened aquatic species in the locality (DPI, 2014a).
- The list of species credit-type species identified by the FBA Credit Calculator based on the initial credit calculations.

- Aerial photographs and satellite imagery of the study area.
- Previous specialist studies undertaken at the site.

The threatened and migratory species identified in the desktop assessment are presented in Appendix A. Following collation of database records and threatened species and community profiles, a 'likelihood of occurrence' assessment was prepared for threatened and migratory species and ecological communities with reference to the broad vegetation types and habitats contained within the study area. This was further refined following field surveys and verification of vegetation types and identification and assessment of habitat present within the study area. A likelihood of occurrence ranking was attributed to these biota based on this information.

4.3 Site survey

4.3.1 Survey effort

Staged surveys of the development site were conducted with reference to the FBA and appropriate targeted survey guidelines. Site surveys included:

- Initial site stratification and vegetation mapping
- BioBanking plot/transect surveys
- Incidental threatened flora surveys
- Opportunistic fauna surveys
- Targeted flora surveys
- Preliminary investigation of potential biobank site

Survey effort that has directly contributed to this biodiversity assessment is summarised in Table 2 and described below.

Table 2 Survey effort

Stage	Date	Survey Technique
Initial FBA assessment survey	29 and 30 October 2014	Vegetation mapping; targeted threatened flora surveys; opportunistic fauna observations; fauna habitat assessment.
FBA assessment survey	25 and 26 November 2014	20 m x 50 m plot / transects; opportunistic fauna observations; fauna habitat assessment.
Additional FBA assessment survey	2-4 February 2015	Targeted <i>Hibbertia marginata</i> surveys; preliminary vegetation mapping of potential biobank site.

4.3.2 Site stratification

Pre-existing vegetation mapping was ground-truthed in the field via systematic walked transects across the entire proposal site and by walking the boundary of vegetation units. Necessary adjustments were made by hand on aerial photographs of the study area. The site was divided into relatively homogenous or discrete zones for assessment based on observed vegetation structure, species composition, soil type, landscape position and condition. Native vegetation was divided into vegetation zones which represented a distinct plant community type (PCT) and broad condition state. Three native PCTs were identified in the proposal site as shown on Figure 2. The remainder of the proposal site contains cleared areas used for quarrying activities.

4.3.3 Plot/transect surveys

Plot and transect surveys were conducted on site in accordance with the FBA to confirm vegetation types, assess site condition and where required to calculate biodiversity credits. The site value was determined by assessing ten site condition attributes against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement. Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect.

Plots were used to sample potential vegetation zones (i.e. PCTs and broad condition classes) based on the initial site stratification. Seven plot/transects were sampled within the proposal site as shown on Figure 2.

4.3.4 Targeted threatened flora surveys

Initial threatened plant surveys were limited to incidental sightings only and confirmed the presence of *Hibbertia marginata*. Further targeted surveys were undertaken in accordance with the BBAM to quantify the number of individuals being impacted by the proposal and to calculate the number of species credits that will be required to be secured to offset these impacts. This data was collected by walking along transects spaced approximately 5-10 m apart within Stages 2 and 3 of the proposed quarry footprint and recording the location and number of *Hibbertia marginata* plants as they were encountered. For accurate identification of the species, a sample was taken and sent to the NSW Botanical Gardens for confirmation in accordance with advice from OEH.

4.3.5 Fauna surveys

The site survey methodology included relatively limited targeted fauna survey techniques (e.g. no trapping) because the FBA assesses the majority of threatened fauna species that could occur based on habitat surrogates.

An assessment was made of the type and quality of habitats present in the study area for native fauna. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. The study area was searched for habitat features, such as hollow-bearing trees, feed trees for the Grey-headed Flying-fox and Koala and water bodies. Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Casual fauna observations were made in suitable areas of habitat throughout the course of the survey and while incidentally traversing the development site. This included visual inspection of trees and woody debris, active searches for small fauna and opportunistic observation of scats, tracks, burrows or other traces.

4.4 FBA calculations

The proposal was assessed according to the methodology presented in the FBA (OEH, 2014a), the DECC (2009) *BioBanking Assessment Methodology and Credit Calculator Operational Manual* and the *Draft Operational Manual for using the BioBanking Credit Calculator v4.1* (OEH, 2011). The credit calculator is a software application that is used to apply the FBA as well as BioBanking assessments. Data is entered into the credit calculator based on information collected in the desktop assessment, site surveys and from using GIS mapping software.

The FBA credit calculations were performed by Arien Quin and Dan Williams using credit calculator Version 4.1. The credit calculations will be submitted to OEH. The biodiversity credit report is included as Appendix D.

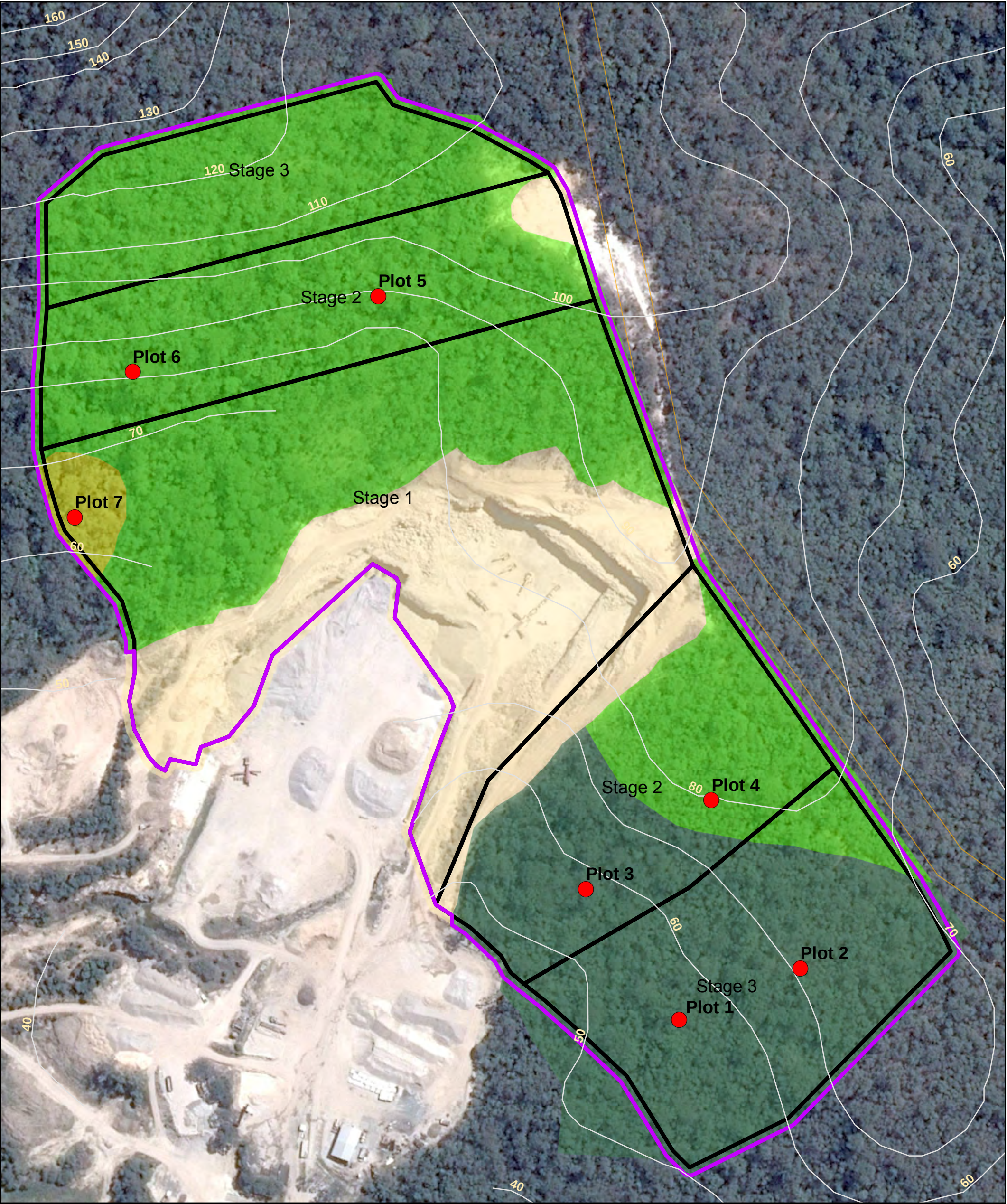
The data and assumptions used to perform the FBA credit calculations are summarised in Chapter 8.

4.5 Staff qualifications

Field surveys were conducted by Ben Harrington, Arien Quin, Kaycee Simuong and Amanda Ayres. Credit calculations and reporting was performed by Daniel Williams and Arien Quin. The assessment was peer reviewed by Dan Williams Staff qualifications are presented in Table 3.

Table 3 Staff qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Dan Williams	Principal ecologist / , credit calculations and report review	B. App. Sc. Cons Tech BioBanking Assessor Accreditation	15+ years
Arien Quin	Ecologist / site surveys / credit calculations / reporting	BA, BSc BioBanking Assessor Accreditation	8+ years
Ben Harrington	Senior Ecologist / site surveys	BSc, MSc (Physical Geography) BioBanking Assessor Accreditation	10+ years
Amanda Ayres	Ecologist / targeted <i>Hibbertia marginata</i> surveys / reporting	BEnvSc	10+ years
Quan Chang	GIS/ mapping	M App.Sc	8+ years
Kaycee Simuong	Ecologist / targeted <i>Hibbertia marginata</i> surveys / site surveys / reporting	BEnvSc (Hons)	1 year



LEGEND

- biobanking plot/transects
- Subject site
- Stages
- 10m contour

- cadastre
- Blackbutt - Turpentine dry heathy open forest on sandstones
- Blackbutt - bloodwood dry heathy open forest on Quaternary sands

- Swamp Mahogany swamp forest of the coastal lowlands
- Cleared

Paper Size A3

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Job Number 22-17528
Revision A
Date 20 Mar 2015

Vegetation types and survey locations

Figure 2

5. Results

5.1 Desktop assessment

5.1.1 Threatened ecological communities

Seven threatened ecological communities (TECs) listed under the TSC Act have been recorded in the Northern Rivers –Clarence Sandstones IBRA subregion (OEH 2014b). In addition one TEC listed under the EPBC Act is predicted to occur in the locality (DotE 2014a) (Appendix A).

5.1.2 Threatened populations and species

The Atlas of NSW Wildlife database (OEH 2014a) identifies 10 threatened flora species listed under the TSC Act previously recorded in the locality. The protected matters search (DoTE 2014a) identifies 16 threatened flora species listed under the EPBC Act as potentially occurring in the locality (see Appendix A).

The Atlas of NSW Wildlife database (OEH 2014a) identifies 44 threatened fauna species listed under the TSC Act as having been previously recorded in the locality. The protected matters search (DotE 2014a) identifies 20 threatened fauna species listed under the EPBC Act as potentially occurring in the locality (note that exclusively marine species have been excluded from this list). A copy of the EPBC protected matters search is provided in Appendix C.

Three threatened species listed under the FM Act have been previously recorded in the locality (see Appendix A).

5.1.3 Migratory species

The protected matters search (DotE 2014a) identifies 14 migratory species listed under the EPBC Act as potentially occurring in the locality (not including marine and pelagic species).

5.1.4 Other matters of national environmental significance

No other ecological MNES were identified by the protected matters search as occurring or likely to occur in the locality.

5.2 Flora survey results

5.2.1 Flora species

A total of 101 flora species were recorded within the study area. All of these species are native other than one exotic species (*Lantana camara*). The full list of flora species recorded is presented in Appendix B. The diversity of species present in the study area is likely to be greater than this list, as the cryptic nature of some species means detection is only possible at certain times of year and following specific weather events such as rainfall.

Flora species recorded are discussed below in relation to the vegetation communities occurring within the study area.

5.2.2 Plant community types

Two PCTs occur within the study area, these communities are described below.

Blackbutt - Bloodwood dry heathy open forest on sandstones of the northern North Coast (NR114)

Blackbutt-bloodwood dry heathy open forest is a tall open forest that occurs on deep sands of old dune systems along the NSW North Coast.

This community is dominated by Pink Bloodwood (*Corymbia intermedia*), Tallowwood (*Eucalyptus microcorys*), Blackbutt (*Eucalyptus pilularis*) and Angophora paludosa to 25 metres tall. Over a tall shrub layer to 10 metres dominated by *Acacia leiocalyx*, Red Ash (*Alphitonia excelsa*), Logon Apple (*Acronychia imperforata*) and Salwood (*Acacia disparrima*). A lower layer of shrubs includes Coffee Bush (*Breynia oblongata*), Cheese Tree (*Glochidion ferdinandi*) and Tree Heath (*Trochocarpa laurina*). The ground storey consists of a dense layer of leaf litter with a sparse cover (< 3%) of herbs and grasses. Common species within the ground layer include Many-flowered Mat-rush (*Lomandra multiflora*), Blue Flax Lily (*Dianella cerulea* var. *producta*), Rough Saw Sedge (*Gahnia aspera*), Spear Grass (*Austrostipa pubescens*) and Creeping Beard Grass (*Oplismenus imbecillis*) (refer to plate 2).

This vegetation type covers approximately 4.23 hectares of the study area.



Plate 1 Blackbutt - bloodwood dry heathy open forest in the south west of the study area

Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the North Coast (NR123)

Blackbutt-Turpentine dry heathy forest is a tall open forest that occurs on sandstone geologies of the Clarence-Moreton Basin from the southern Richmond Range east to the Coast Range.

Within the study are this plant community is dominated by Blackbutt (*Eucalyptus pilularis*), Turpentine (*Syncarpia glomerata*), Red Mahogany (*Eucalyptus resinifera*) and Angophora woodsiana to 25 metres tall with a cover of approximately 40%. The midstorey consists of a tall shrub layer to 8 metres dominated by *Acacia leiocalyx*, Red Ash (*Alphitonia excelsa*), Tree Heath (*Trochocarpa laurina*), Flaky-barked Tea-tree (*Leptospermum trinervium*) *Persoonia conjuncta*, Cheese tree (*Glochidion ferdinandiana*) and Blackthorn (*Bursaria spinosa*) over a dense low shrublayer to 2 metres dominated by Handsome Flat Pea (*Platylobium formosum*),

Hibbertia marginata, *Leucopogon lanceolatus* and Coffee Bush (*Breynia oblongata*). The groundlayer is dominated by Wire Grass (*Entolasia stricta*), Grass Trees (*Xanthorrhoea* sp), Spiny-headed Mat-rush (*Lomandra longifolia*), Rough Saw-sedge (*Gahnia aspera*), Common Bracken (*Pteridium esculentum*), Crinkle Bush (*Lomatia silaifolia*), Blue Flax-lily (*Dianella cerulea*) and *Lepidosperma laterale*. This community also contains a variety of vines and climbers including Wonga Wonga Vine (*Pandorea pandorana*), Lawyer vine (*Smilax australis*), Sweet Sarsaparilla (*Smilax glycyphylla*), Molucca Bramble (*Rubus moluccanus* var. *trilobus*) and Stiff Jasmine (*Jasminum volubile*).

This vegetation type covers approximately 6.27 hectares of the study area.



Plate 2 Blackbutt - Turpentine dry heathy open forest in the north of the study area

5.2.3 Noxious and environmental weeds

One flora species declared as noxious under the NW Act occurs within the study area. This species (*Lantana* (*Lantana camara*)) is a class 4 noxious weed which in accordance with the NW Act must be managed in a manner that continuously inhibits the ability of the plant to spread.

Within the study area *Lantana* occurs as small isolated patches scattered through the site.

5.3 Fauna and habitat survey results

5.3.1 Fauna species

A total of 20 fauna species were recorded within the study area including 19 birds and one reptile. These species were recorded incidentally during the site visit and no targeted surveys for fauna were undertaken. It is likely that the site would be utilised by a range of other fauna species not recorded during this survey. A full list of fauna species recorded in the study area is presented in Appendix B.

5.3.2 Fauna habitat

The main fauna habitats that occur within the subject site are associated with the dry open forest communities. These habitat types are described in detail below.

The study area would be expected to support a moderately high diversity of native fauna species. Habitat values within the study area are somewhat lower than might be given the previous selective logging that has occurred at the site. There are, however, scattered mature-age trees which were likely retained throughout the logging process: these occur across the study area. There are also other ongoing habitat disturbances such as noise from quarry operations.

The study area contains a range of habitat features which would provide shelter and foraging resources for a variety of native fauna, including:

- Myrtaceous trees and shrubs, including preferred feed tree species for threatened birds and arboreal mammals and a tall midstorey of *Allocasuarina* spp., which would provide foraging resources for granivorous birds including the threatened Glossy Black-cockatoo.
- Small patches of dense, low shrubs, mainly the exotic Lantana, which provide shelter and foraging habitat for a range of small woodland birds and terrestrial mammals.
- Moderate density of woody debris and fallen logs which would provide shelter and foraging habitat for a range of native reptiles, and foraging substrate for native insectivorous birds and mammals.
- A moderate density of hollow-bearing trees with a range of hollow sizes and positions, including trees with hollows at ground level, limb hollows, trunk fissures and dead trees (stags). These would provide potential roost sites for several native birds, arboreal and terrestrial mammals and microbats.
- Small ephemeral drainage lines which would provide foraging and breeding habitat for a range of native frogs, reptiles and birds.
- The quarry face itself, which is uneven and may provide basking, shelter and foraging resources for native reptiles, and potential shelter habitat for small terrestrial mammals or birds as well as diurnal roosts for microbats.

Dry Heathy Open Forest

Blackbutt – Bloodwood dry heathy open forest and Blackbutt – Tallowwood dry heathy open forest are the dominant vegetation types within the study area. These vegetation types are characterised by Blackbutt (*Eucalyptus pilularis*), Pink Bloodwood (*Corymbia intermedia*) and Tallowwood (*Eucalyptus microcorys*) with Red Mahogany (*Eucalyptus resinifera*), *Angophora woodsiana* and *Angophora paludosa* occurring in lesser abundance.

These eucalypts would provide foraging habitat for a wide variety of bird species including cuckoos, honeyeaters, thornbills, gerygones, whistlers, fantails, bowerbirds and figbirds as well as a range of arboreal mammals. A range of threatened birds could forage on occasion in this community, including the Varied Sittella (*Daphoenositta chrysoptera*). Forest owls including the Powerful Owl (*Ninox strenua*) may prey on arboreal mammals at the site on occasion.

The presence of *Allocasuarina littoralis* within the small tree stratum is likely to provide foraging resources for local populations of the Glossy Black-cockatoo (*Calyptorhynchus lathami*), which have been previously recorded near the site (OEH 2014). This species is known to frequent preferred feed trees which are mature, healthy, in dense stands and bear good quantities of fruit (DECCW, 2010b). This species may forage on occasion at the site.

A number of hollow bearing trees were recorded within these vegetation types. Hollows ranged in size from small large and are likely to provide habitat for a number of hollow-dependent fauna, such as possums, gliders, bats and a variety of birds. These hollows may also provide habitat for threatened species such as the Yellow Bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolkensis*) and Brush-tailed Phascogale (*Phascogale tapoatafa*) all of which have been recorded within the locality.

Dense leaf litter is present in most areas, and some small logs scattered throughout which is likely to provide habitat for a range of reptile species.

Feed trees

The study area supported a range of trees which would provide foraging resources for native birds, bats and arboreal mammals. This includes a variety of flowering eucalypts, including profusely flowering species identified as keystone nectar feed trees (DECC 2007), which would be used by a range of native nectarivorous birds, including the Noisy Friarbird (*Philemon corniculatus*), Scarlet Honeyeater (*Myzomela sanguinolenta*) and Lewin's Honeyeater (*Meliphaga lewinii*), by arboreal mammals such as the Sugar Glider (*Petaurus breviceps*) and Common Brushtail Possum (*Trichosurus vulpecula*) and by the threatened Grey-headed Flying-fox, all of which were recorded during surveys. Eucalypts and other canopy species also provide foraging substrates for insectivorous birds such as the Willy Wagtail (*Rhipidura leucophrys*), Thornbill species (*Acanthiza* spp.) and Cicadabirds (*Coracina tenuirostris*).

Eucalypts recorded include both summer and winter flowering species meaning the study area would be able to support nectarivorous species at most times of year, although flowering times and productivity may vary from year to year. Winter flowering species are particularly important for threatened species such as the Grey-headed Flying-fox, which suffers food bottlenecks in winter and spring (Eby and Law 2008).

Eucalypt species present at the site would provide potential foraging resources, including sap, foliage or nectar for a range of threatened species, including: birds such as the Little Lorikeet (*Glossopsitta pusilla*); threatened arboreal mammals, including the Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolkensis*) and the Koala (*Phascolarctos cinereus*); and bats such as the Grey-headed Flying-fox. Other threatened species may also forage within or above the canopy or on the trunks of these trees, including the Varied Sittella (*Daphoenositta chrysoptera*) and a range of threatened microbats.

5.3.3 Habitat connectivity

Vegetation and habitats within the study area are contiguous with extensive areas of native vegetation that extends in all directions. This vegetation includes vegetated fauna movement corridors that connect the site to the Mororo State Forest to the south east, Devils Pulpit State Forest to the north east, Bundjalung Crown Reserve and Tabbimobile State Forest to the north.

This connectivity would allow a broad range of mobile fauna species to use habitats within the study area, either as part of their home territory or as an adjunct to their core areas of habitat in response to seasonal resource availability. Connectivity of the site to large tracts of surrounding native vegetation is likely to increase the overall diversity of fauna species which may use habitats within the study area but also increases the likelihood that only a subset of these species will be present during any one season or survey period.

5.4 Conservation significance

5.4.1 Threatened ecological communities

No EECs were recorded within the study area.

5.4.2 Threatened flora species

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*) listed as vulnerable under both the TSC and EPBC Acts was recorded within the subject site during the current assessment. This species was found growing within areas of Blackbutt–Turpentine dry heathy open forest and Blackbutt-Bloodwood dry heath open forest.

Locations of where this species was recorded are shown on Figure 3.

This plant was recorded opportunistically during initial vegetation surveys and mapping. Additional systematic targeted surveys were undertaken at a later date to determine the extent and size of this population within the subject site.

In addition to Bordered Guinea Flower there is potential habitat within the study area for four other threatened flora species to occur. These species are listed in Table 4 below.

Table 4 Threatened flora with potential habitat in the study area

Species Name	Common Name	TSC Act status	EPBC Act status
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V
<i>Lindsaea incisa</i>	Slender Screw-Fern	E	-
<i>Paspalidium grandispiculatum</i>	A Grass	V	V
<i>Polygala linariifolia</i>	Native Milkwort	E	-

The codes used in this table are; E – endangered; V – vulnerable;

None of these species were identified during field surveys.

No threatened flora species listed under the FM Act are likely to occur in the study area, or immediately downstream of the study area.

5.4.3 Threatened fauna species

No threatened fauna species were identified within the study area during the current field surveys. A total of 23 threatened fauna species are considered to have the potential to occur at the site based on the presence of suitable habitat. These species are listed in Table 5, and can be divided into the following seven guilds on the basis of habitat requirements and life-history characteristics.

No threatened fauna species listed under the FM Act are likely to occur in the study area, or downstream of the study area.

The current survey did not include any targeted threatened species surveys. It is therefore assumed that threatened fauna species which have been recorded in the locality and for which there is suitable habitat within the study area have potential to occur.

Forest owls and raptors

Four species, comprising the Powerful, Barking and Masked Owls and the Square-tailed Kite, may potentially occur within the study area. None of these species was recorded during current or previous surveys.

The three owls all require large tree hollows in large, mature trees for nesting, while the Square-tailed Kite nests in forks or large horizontal branches of large, mature trees, generally along or near watercourses. Larger mature trees are scattered throughout the study area. A subset of these trees contains hollows which may be of a sufficient size for the three threatened owls,

which require large tree hollows for nesting. Some trees may also be of a suitable size for use by the Square-tailed Kite. No evidence of nesting (such as regurgitated pellets, extensive whitewash) was observed.

All four species listed above may forage above and within habitats present within the study area. Woody debris and small tree hollows present within the study area would provide shelter and foraging habitats for small mammals, birds, reptiles and frogs which would provide potential prey for these birds. All four species all have very large home ranges (in the order of hundreds to thousands of hectares), and individuals of these species may use roosting, nesting and foraging habitats within the study area as part of a much larger territory.

Woodland birds

None of the five species of threatened woodland birds considered to have the potential to occur were observed within the study area.

Preferred feed trees of the Glossy Black-cockatoo occur within the study area and although no evidence of chewed *Allocasuarina* cones was observed the species has been previously recorded immediately east of the study area (OEH 2014a). This species requires large hollows for nesting and may nest within a subset of the hollows available within the study area. The Glossy Black-cockatoo feeds almost exclusively on the seeds of *Casuarina* and *Allocasuarina* species (OEH 2013b). The study area had *Allocasuarina* species scattered in low abundance throughout the site and it is likely that the Glossy Black-cockatoo would forage within the site on occasion.

The Little Lorikeet occurs from the coast to the inland slopes; however the box gum-ironbark woodlands of the western slopes are regarded as being the core habitats of this species (Courtney and Debus 2006). They have highly specialised nest-hollow requirements, typically using hollows with small entrances in living wood, which serves to exclude many competitors. They appear to reuse the same hollows for several decades, suggesting suitable hollows are limiting (Courtney and Debus 2006, OEH 2014a). They may also breed in coastal areas and may nest within a subset of the hollows present within the study area. This species is regarded as being semi-nomadic and would be likely to occur and forage within the study area in response to seasonal eucalypt flowering events.

The Varied Sittella may forage and breed within the study area. This species is insectivorous and would forage on rough barked eucalypts (such as *Eucalyptus resinifera*, *C. intermedia* and *E. carnea*). The species nests in tree forks high in the canopy and may reuse nests over successive years: no nests were observed but the species is relatively common within the locality. The habitat value of the study area for this species may be somewhat reduced by the effects of historic logging and recent burning: the Varied Sittella is sedentary and sensitive to habitat simplification, including reductions in shrub and ground cover, logs, fallen branches and litter (Watson et al. 2001; Seddon et al. 2003).

Arboreal mammals

The study area contains potential habitat for four species of threatened arboreal mammal, the Yellow-bellied Glider, Squirrel Glider, Brush-tailed Phascogale and Koala. The Yellow-bellied glider had been previously recorded directly adjacent to the study area (OEH 2014).

The study area supports potential foraging habitat for the Yellow-bellied and Squirrel Gliders, including identified feed trees for the Yellow-bellied Gliders and highly productive nectar-producing eucalypts which may be used by the Squirrel Glider. There are 55 records of the Yellow-bellied Glider within the locality, with the closest occurring less than 200 metres to the east of the study area. There are ten records of the Squirrel Glider within the locality. The most recent record of the Squirrel Glider from 2002 is approximately 2 km to the south. The presence

of records of these species within contiguous areas of vegetation surrounding the site indicates that both species could occur and forage within the study area.

Both of these gliders require tree hollows for nesting and roosting. Yellow-bellied Gliders live in small family groups, with actual numbers varying between locations (NPWS, 2003). Family groups occupy large home ranges of approximately 20-85 hectares (Goldingay, 1992) which are exclusive to a single family group (Goldingay, 1994). Yellow-bellied Gliders typically occupy tall, large diameter trees with large hollows, with family groups using up to 13 den trees within their home range (Goldingay and Kavanagh, 1990). Squirrel Gliders also require abundant tree hollows for refuge and nest sites, with family groups utilising a number of hollows within their home range (OEH, 2011). Hollows used by Squirrel Gliders are small (approximately 5 centimetres diameter). They live in family groups of 2-10 individuals (Quin, 1995) and maintain home ranges of 0.65 and 10.5 hectares, varying according to habitat quality and food resource availability (Quin, 1995; Goldingay and Jackson 2004).

A subset of the hollows present within the study area may therefore provide potential roosting and breeding habitat for these Gliders.

The Brush-tailed Phascogale also typically roosts and nests in hollows or rotted stumps, using up to 40 nests per year (Soderquist and Rhind 2008). Individuals have relatively large, overlapping (though females exclude unrelated females) home ranges, spanning 20-40 hectares for females and over 100 hectares for males (Soderquist and Rhind 2008). The study area contains potential roosting, breeding and foraging habitat for this species, and may contribute to the home range of several individuals.

SEPP 44 – Koala habitat assessment

The development footprint contains several preferred feed tree species of the Koala, including Tallowwood (*Eucalyptus microcorys*), Red Mahogany (*E. resinifera*) and Pink Bloodwood (*Corymbia intermedia*).

Tallowwood is the only feed tree species listed under Schedule 2 of SEPP 44. This species is considered to constitute at least 15% of the total number of trees at the site. Consequently in accordance with the definitions outlined under the Policy (see Section 2.3.2), the site constitutes 'potential' Koala habitat.

The Koala has been recorded relatively frequently, with 58 sightings recorded within the locality within the NSW Wildlife Atlas since 1980. This includes two records from 2006 and 2010 within 200 metres of the development footprint and another record from approximately 2km to the west (OEH 2014a). Targeted surveys for the Koala were not undertaken during field surveys and opportunistic sightings were not recorded. Large scratches were observed opportunistically on a number of trees, however due to the nature of these scratches, it is believed to be evidence of the Lace Monitor (*Varanus varius*) which was observed during the survey, as opposed to the Koala which tends to leave small, 'poc' marks on trees.

Despite the presence of 'potential' Koala habitat as defined by SEPP 44, the limited number of recent records within close proximity to the site suggests that the site does not provide 'core' Koala habitat as defined by the Policy (see Section 2.3.2). Although the Clarence Valley CKPoM does not cover the site, using the definitions outlined in the plan, the site is classified as 'preferred Koala habitat: secondary (class A)' due to presence of listed primary (Tallowwood) and secondary food tree species (Red Mahogany and Pink Bloodwood).

Based on this information, the presence of the Koala was considered likely on a transient basis and consequently this species has been included in the credit calculations accordingly (see Chapter 8).

Terrestrial mammals

The study area would represent suitable habitat for threatened terrestrial mammals such as the Common Planigale and Spotted-tailed Quoll (note that the Quoll may also use arboreal habitats, including tree hollows).

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2014b). According to a study conducted in Limeburners Creek, quolls used hollows in trees and logs with medium to large circumferences (typically greater than 50 cm dbh for logs and greater than 70 cm dbh for trees), and entrances between 16-41 cm diameter (average 26.13) in logs and between 7-27 cm (average 15.85cm) in tree hollows (Andrews 2005). In a study in south-eastern Australia, two Spotted-tailed Quolls were recorded using 15 den sites, and females used a number of dens while rearing young (Belcher and Darrant 2006). Spotted-tailed Quolls are solitary, with the female being territorial (although they do tolerate their own female offspring). Female home ranges are between 180-1000 ha. Male home ranges are between 2000-5000 hectares and overlap with other males and a number of females (Belcher et al. 2008). Quolls have been observed to selectively use gullies, creeklines and escarpments when moving, avoiding mid slope areas (Belcher 2000, in Andrews 2005).

Habitat value for the Spotted-tailed Quoll would be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present with hollow-bearing trees (including trees with ground-level hollows), logs and other woody debris. The species may forage throughout the study area, although woody debris and other shelters for prey species such as small mammals, frogs and reptiles are also concentrated in lower slopes and gully areas.

There is limited information available on the ecology of the Common Planigale, however it is known to shelter under rocks, fallen timber and bark, human debris (e.g. sheet iron) and in termite mounds. It is also known to forage amongst leaf litter, dense grass and low vegetation (Burnett 2008). They are able to tolerate some degree of disturbance and occur close to human habitation (Burnett 2008).

As for the Spotted-tailed Quoll, the habitat value of the study area for the Common Planigale may be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present under logs and other woody debris.

Bats

A total of eight species of bats are considered to have the potential to occur within the study area given the presence of local records and the habitats present. Seven of these species are microbats, Microbat species with the potential to occur within the study area may be divided into cave-roosting species which would use the study area as foraging habitat only, and hollow-roosting species which may roost and/or breed within the study area.

The eighth species is the Grey-headed Flying-fox which roosts and breeds in large social camps with up to several thousand individuals. The study area does not contain a roost camp for this species, but there is large camp near Iluka which is situated approximately 18 km to the south east of the study area (Roberts 2006). The Grey-headed Flying-fox may travel up to 50 km in a night to forage (Eby and Law 2008) and individuals using these camps would therefore be likely to forage within the study area, which contains several identified feed trees for the species. These trees include species which flower in winter and spring, during identified food bottlenecks for this species.

Reptiles

Stephen's Banded Snake is an arboreal snake that occurs in moist eucalypt forest and rainforest, foraging on the ground but sheltering in tree hollows. Individuals may use between 5 and 30 hollows and have large home ranges, averaging approximately 5 hectares for females and 20 hectares for males. Within these home ranges, snakes have been shown to select refuges (mostly tree hollows but also including tree crevices, termitaria or vines) within trees which were significantly taller, thicker, with more hollows and later growth stages than other trees in the area (Fitzgerald et al 2002a). The closest record of Stephen's Banded Snake is approximately 4 km to the south (OEH 2014a); however this species is relatively cryptic and may be more widespread than suggested by recorded sightings.

Moister vegetation along the drainage lines would be potentially suitable for this threatened species, and contains a moderate density of potential shelter sites. Individuals may also forage within drier, less suitable habitat upslope from the drainage lines but this would be regarded as marginal foraging habitat only.

Table 5 Threatened fauna with the potential to occur within the study area

Species name	Common Name	TSC Act Status	EPBC Act status
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-
<i>Coracina lineata</i>	Barred Cuckoo-shrike	V	-
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-
<i>Ninox connivens</i>	Barking Owl	V	-
<i>Ninox strenua</i>	Powerful Owl	V	-
<i>Tyto novaehollandiae</i>	Masked Owl	V	-
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat	V	-
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-
<i>Nyctophilus bifax</i>	Eastern Long-eared Bat	V	-
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-
<i>Phascolarctos cinereus</i>	Koala	V	V
<i>Planigale maculata</i>	Common Planigale	V	-

Species name	Common Name	TSC Act Status	EPBC Act status
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-
<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake	V	-

The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; M – migratory

5.4.4 Migratory species

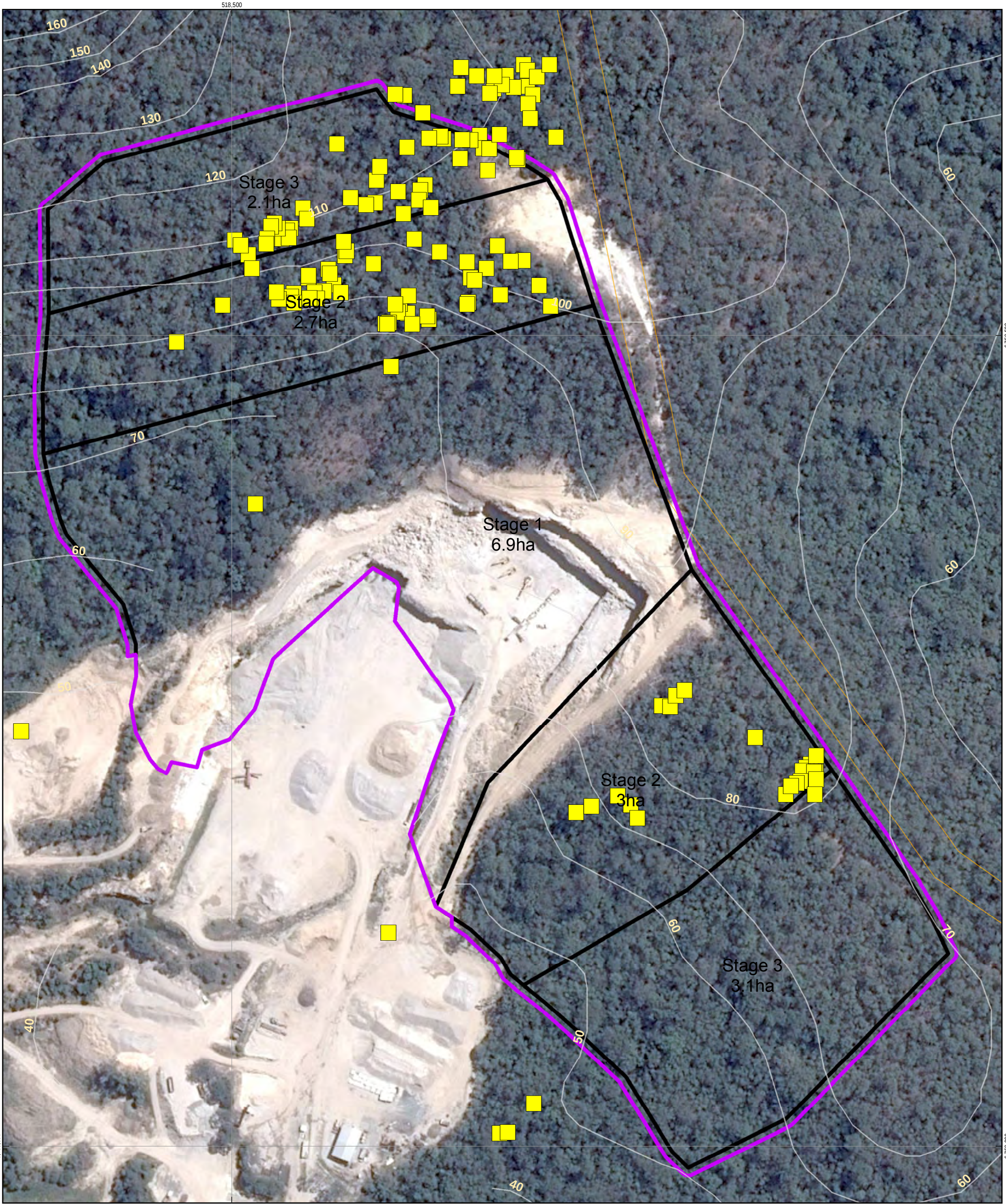
One migratory species (Rainbow Bee-eater), listed under the EPBC Act was recorded within the study area and a further 13 migratory bird species listed under the EPBC Act are known or predicted from the locality of the study area. Some of these species can be reliably excluded from occurring, based on their broad habitat requirements, however a total of four species (including the Rainbow Bee-eater) have the potential to occur on an occasional or transient basis in response to favourable conditions within the subject site (see Table 12 and discussion below).

The Fork-tailed Swift (*Apus pacificus*) and White-throated Needletail (*Hirundapus caudacutus*) both breed in the northern hemisphere and are almost exclusively aerial while in Australia during the non-breeding season. These birds may forage and fly over the study area but would be unlikely to land and/or be dependent on the habitats present within the study area.

Two migratory woodland species may occur within the study area, Satin Flycatcher tends to prefer moist, densely vegetated habitats, though they may occur in more open habitats while migrating. The Rainbow Bee-eater (*Merops ornatus*) is generally found in open forests and woodlands and roosts in banks and sand dunes. Both of these species are likely to forage and/or breed within the study area.

Table 6 Migratory fauna listed under EPBC Act with the potential to occur within the study area

Species Name	Common Name	Likelihood of occurrence
<i>Apus pacificus</i>	Fork-tailed Swift	Possible Non-breeding visitor. Potential aerial foraging habitat present.
<i>Hirundapus caudacutus</i>	White-throated Needletail	Possible Non-breeding visitor. Potential aerial foraging habitat present.
<i>Merops ornatus</i>	Rainbow Bee-eater	Known -Potential breeding and foraging habitat present.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	Possible -Potential breeding and foraging habitat present.



LEGEND

Subject site Hibbertia Marginata

Stages

cadastre

10m contour

Paper Size A3

0 10 20 40 60 80

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

Threatened species recorded
within study area

Job Number 22-17528
Revision A
Date 18 Feb 2015

Figure 3

6. Impact assessment

6.1 Direct impacts

6.1.1 Clearing of vegetation

The proposal would require the clearing of 10.5 hectares of native vegetation, comprising 4.23 hectares of Blackbutt - Bloodwood dry heathy open forest and 6.27 hectares of Blackbutt - Turpentine dry heathy open forest. Vegetation clearing in these communities would involve removal of a moderately diverse range of non-threatened native plants, including mature trees, as well as potential habitat for threatened biota. The extent of proposed clearing of each vegetation community is summarised in Table 7.

Table 7 Proposed removal of native vegetation within the proposal site

Plant Community	TSC Act Status	EPBC Act Status	Condition	Area Impacted (ha)
Blackbutt - Bloodwood dry heathy open forest	-	-	Moderate/good	4.23
Blackbutt - Turpentine dry heathy open forest	-	-	Moderate/good	6.27
TOTAL				10.5

Clearing of native vegetation is listed as a Key Threatening Process under both the NSW TSC Act and the Commonwealth EPBC Act. Under the TSC Act, native vegetation is made up of plant communities, comprising primarily indigenous species. Clearing is defined as the destruction of a sufficient proportion of one or more strata layers within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of a stand or stands (NSW Scientific Committee 2001). There would be a total of 10.5 hectares of clearing of native vegetation for construction of the proposal (see Table 7).

6.1.2 Removal of habitat resources

The development would require the clearing of habitat for native fauna, including native vegetation within the site footprint and important habitat resources (hollow-bearing trees) for native biota. The proposed clearing of this habitat has potential to have impacts on local fauna populations within the site, including displacement or mortality of individuals and removal of habitat resources within sites. The magnitude of these 'likely' impacts is assessed below. The development would require the clearing of 10.5 hectares of native vegetation as a result of direct surface disturbance during construction.

A range of native bird species that could potentially occupy the site would be affected by the removal of native vegetation and other habitat resources. The majority of these species are mobile, widespread and common, the exception being Powerful Owl (*Ninox strenua*), Masked Owl and Barking Owl which may forage in the area occasionally as part of a wider area of occupation. Further, there are large quantities of equivalent habitat and resources in the locality. Overall, it is likely that the impact on local populations of native birds would be minor.

Potential foraging habitat for Grey-headed Flying-fox (*Pteropus poliocephalus*), Squirrel Glider (*Petaurus norfolcensis*), Yellow-Bellied Glider (*Petaurus australis*), Brush Tailed Phascogale (*Phascogale tapoatafa*) and Koala (*Phascolarctos cinereus*) occurs within the study area. Construction would clear an area of potential foraging habitat for these species, however given

the potential alternative foraging resources in the local area, the loss of this potential habitat is considered to be minor.

Large mobile mammals that may occur within the site (ie. Swamp Wallabies (*Wallabia bicolor*)) could readily evade injury as there is ample opportunity to escape into alternative habitats to the north, east or south of the site. There is the potential for adverse effects on smaller or less mobile terrestrial mammals, reptiles or frogs sheltering within the native vegetation at the time of removal, as a result of direct surface disturbance during the construction. Smaller species may be sheltering in dense vegetation or beneath woody debris during construction.

Potential foraging and denning habitat occurs onsite for arboreal mammals. A number of common and potentially threatened microbats may occur at the site and may forage across the entire site and potentially roost within the hollow-bearing trees onsite. The proposed works would remove foraging habitat for these species as well as a large number of potential roost sites. It is likely that individuals would be adversely affected during clearing, particularly individuals sheltering in tree hollows. Mitigation measures outlined in Section 7 would partially ameliorate impacts on these species. The removal of hollow-bearing trees is important because of the time it takes for these resources to develop in regenerating vegetation. However given the extensive areas of alternative habitat surrounding the site, this development would affect a minor proportion of available habitat resources for hollow-dependant fauna in the locality.

A range of native reptiles have the potential to occupy the site. These species are likely to be widespread and common. No threatened reptiles are likely to occur within the site. It is possible that individuals would be adversely affected during clearing, particularly those which burrow or shelter beneath woody debris. Mitigation measures outlined in Section 7 would partially ameliorate these impacts.

There are likely to be ongoing impacts on fauna utilising adjacent areas of habitat associated with noise and other disturbances as quarrying is already conducted at the site although resident fauna are likely to be adapted to these disturbances.

6.1.3 Fragmentation and barrier effects

The proposal will not result in the isolation or fragmentation of any areas of native vegetation. The proposal would, however, slightly reduce connectivity of vegetation within the study area by removing vegetation from around the area once used as a quarry. Given the extensive area of native vegetation surrounding the site connectivity would not be significantly impacted.

Vegetation outside the boundary of the study area (to the north, south and east) will allow fauna movement around the boundary of the study area, despite removing vegetation from the central portion of the site. The proposal would not affect local or migratory movements of any native fauna species outside of the study area.

The site is located to the south and east of a number of state forests that are included within a key regional habitat corridor and is also immediately adjacent to land mapped as key fauna habitat (DECC 2001) (see Figure 4). Any existing movements of mobile fauna species and ecosystem processes through this area would be largely unaffected by the proposal.

6.1.4 Fauna injury and mortality

The proposed works present an inherent risk of injury and mortality to native fauna. Specific risks include:

- During construction when vegetation and habitats are being cleared
- Through machinery and plant
- Operational traffic

Remnant native vegetation would have greater habitat value for native fauna and there is an increased risk of injury or mortality of native fauna which may be sheltering in this habitat during the construction period. There is considerable scope for native fauna to evade injury and/or seek alternative habitat in an extensive area of native vegetation surrounding the site.

Recommendations have been made in Section 7 to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

6.1.5 Degradation of aquatic habitats

There are no aquatic habitats within the subject site, but small drainage lines do occur which would provide water to creeks in the surrounding locality during periods of high rainfall. Aquatic habitats could provide breeding and shelter resources for common frog and reptile species.

Potential sources of impacts to surface water within the site include:

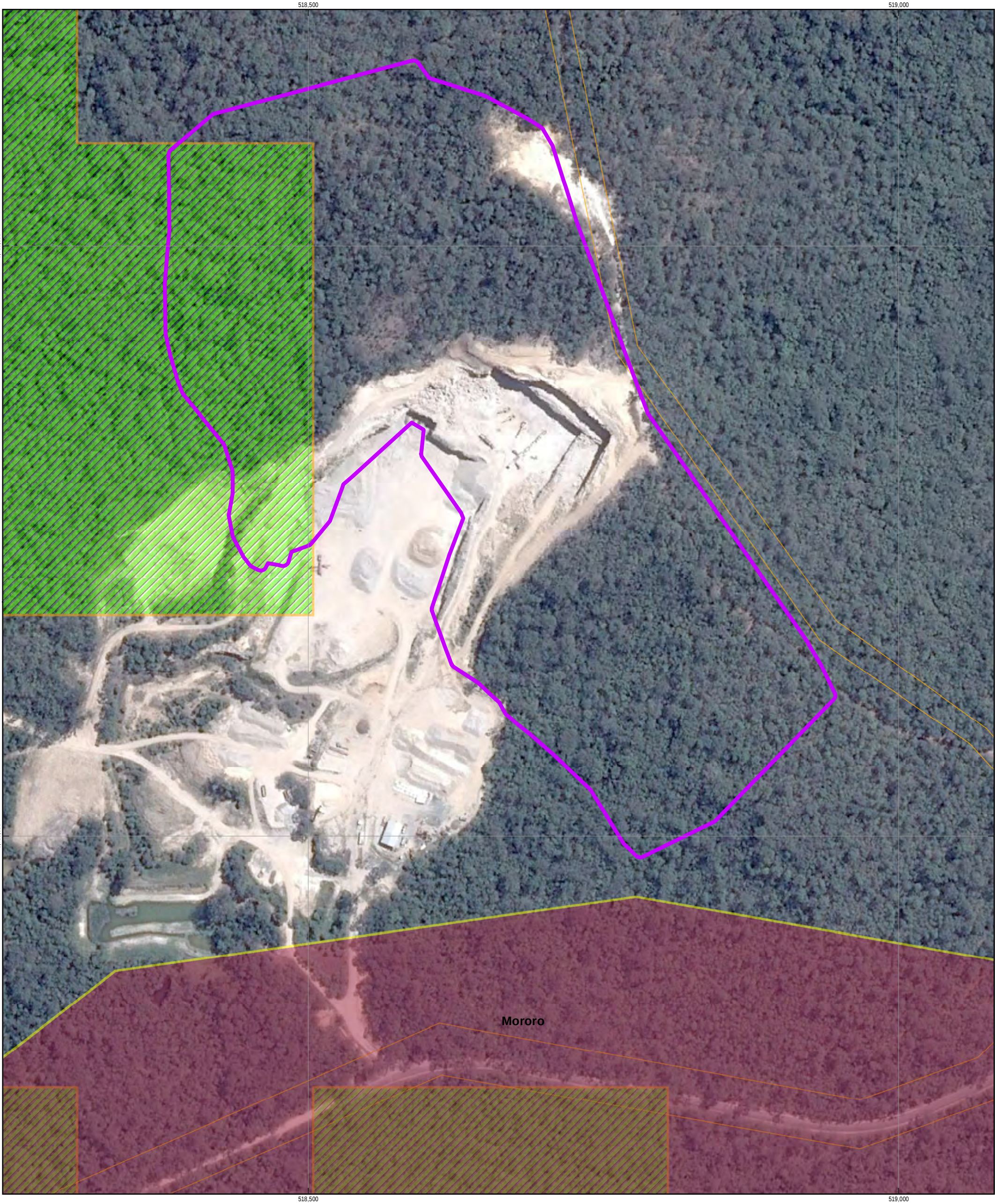
- Runoff from areas stripped of vegetation
- Runoff from hardstand areas, including roads, processing areas and site facilities
- Leakage or spillage of hydrocarbon products from vehicles, wash down areas and workshops
- Refuelling bays and fuel, oil and grease storages

The nearest sensitive aquatic habitats within the immediate vicinity of the site is Tabbimoble Creek, located about 600 metres to the south of the site.

Potential water quality impacts may be associated with runoff from disturbed areas, including vegetation clearing, construction lay down areas and access roads if risks are not effectively managed and appropriate mitigation measures implemented.

Soil protection measures and techniques would be implemented during construction and operation of the quarry. Any localised increases in erosion hazard would be limited to the immediate construction footprint and there would be appropriate control devices and buffers in place. The proposal is unlikely to impact sensitive aquatic habitats at the site or the locality.

The site currently contains both hardstand areas and vegetated areas. The proposal would result in a slight increase in hardstand areas but not to the extent that significant changes to surface water flows or quality are likely to occur. Existing flows to and through existing culverts would be maintained. The proposal is unlikely to result in changes to the existing hydrological regimes at the site.



LEGEND

Subject site

cadastre

Key Habitat

regional

Fauna Key Habitats

6.2 Indirect impacts

6.2.1 Edge effects

'Edge effects are inherent or natural in nature (i.e. wherever changes in vegetation or landscape cause sudden changes in vegetation structure) but can have negative impacts if their creation alters ecological processes. They also change habitat conditions created at or near the boundary between areas. In general, edge effects increase in relation to the dissimilarity between adjoining habitats.

Removal of vegetation causes a number of new environmental conditions to develop along the edges of the cleared environments, in particular in environments that originally contain the upper strata levels (canopy and/ or shrub layer) of vegetation. The removal of vegetation generally promotes the invasion of exotic species and/or disturbance tolerant native plants. With the invasion of these new species it often becomes difficult for the original plant species to recolonise once disturbed.

The proposed quarry area and immediate surroundings are already somewhat disturbed, with evidence of minor weed infestations around the perimeter of the existing cleared area. The proposal would increase the size of the quarry and result in areas that are currently not exposed to edge effects being exposed to possible detrimental impacts as a result of quarry expansion. Impacts are likely to include the introduction or spread of weed species, light and dust to new areas of vegetation, which are currently less affected by these impacts, reducing flora and fauna habitat values in the newly exposed edge areas.

6.2.2 Introduction or spread of weeds

The proposal may cause the dispersal of weed propagules (seeds, stems and flowers) into adjacent areas of native vegetation via plant and machinery, erosion (wind and water) and via workers shoes and clothing. Some sections of the study area already support infestations of Lantana, however there is a possibility that additional, more invasive or otherwise damaging environmental weeds may be introduced to the retained vegetation, or that existing Lantana infestations may be further spread into areas that are currently free from infestations. Depending upon the weeds introduced to the site, this could result in a decline in the condition of retained native vegetation and associated native fauna habitats.

6.2.3 Pests and pathogens

The proposal has the potential to introduce or spread pathogens such as *Phytophthora cinnamomi* (Phytophthora) and *Uredo rangelii* (Myrtle Rust) within the study area through vegetation disturbance and increased visitation unless appropriate mitigation measures are put in place. Spread of *Batrachochytrium dendrobatidis* (Chytrid fungus) is also possible, given the presence of drainage lines in the study area but is unlikely as these drainage lines are relatively small and would not hold water for long periods. Where present, Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can wipe out entire populations once introduced into an area. Mitigation measures are included in Section 7 to minimise the potential for any impacts such as pathogen introduction as a result of the proposal.

One cane toad was also identified during surveys. Should this species be identified in the potential biobank site additional management actions would be included to ensure its control?

6.2.4 Erosion, dust generation and sedimentation

Clearing of vegetation may increase erosion and sedimentation in the study area. Uncontrolled erosion of topsoil from excavated areas and exposed soils and corresponding deposition into native vegetation or freshwater creeks can cause weed problems and stifle plant growth. Sedimentation runoff to waterways from exposed soils due to riparian vegetation clearing and/or earthworks can adversely affect aquatic life in ephemeral creeks downslope by altering water quality and filling aquatic habitat with fine sediment. This reduces the habitat value of these areas for fauna such as frogs.

The topography of the site and the nature of the proposal mean that there is potential for impacts resulting from erosion and sedimentation if adequate controls are not in place during the expansion of the quarry and vegetation clearing activities. Mitigation measures are described in Section 7 to minimise potential impacts of sedimentation and erosion.

6.2.5 Soil and water pollution

The proposal has the potential to result in pollution and contaminated runoff within the proposal footprint and adjoining areas through soil disturbance and quarry expansion activities. Potential sources of soil and water pollution include:

- Soil disturbance during quarry expansion and vegetation clearing activities
- Inappropriate management of soil and material stockpiles
- Hydrocarbon leaks or spills from vehicles or equipment used in quarrying or vegetation clearance activities, as well as during works on the access road
- Increased runoff from hardstand areas
- Increased sediment transfer and erosion potential in areas cleared of vegetation

The topography of the study area and nature of the proposal means that there is potential for soil and water pollution as a result of the proposal if appropriate controls are not adopted during quarry expansion and vegetation clearing and soil disturbance activities.

It is anticipated that any water released into the environment as a result of the proposal would be of a similar quality to present conditions. There is potential for a slight increase in turbidity, however mitigation measures to reduce the potential for such matters are described in Section 7, and include minimising the disturbance area, the use of erosion and sediment control devices and pollution control methods.

6.2.6 Noise and vibration

There would be noise and vibration impacts during the various stages of quarry operation as a result of vegetation clearing, vehicle movement, operation of plant and blasting for expansion of the quarry itself. Due to the topography of the site and staging of the proposed works, noise and vibration impacts would likely be limited to the areas immediately around the study area.

Raised levels of noise and vibration may deter native fauna from using the area surrounding the source of any noise or vibration. This may potentially interrupt dispersal within the locality if an individual is unwilling to travel through an area where increased levels of noise or vibration is detectable, or may cause some species to abandon an area in search of areas where it is not detectable. It is likely that fauna species that occur in the vicinity of the study area are somewhat habituated to noises and vibration resulting from the existing quarry, and that species which are sensitive to any increased levels have moved away given the existing quarry has been operational for some time.

The expansion of the quarry will expose new areas to increased noise and vibration levels, due to quarry expansion activities, resulting in regular blasting activities and the presence of heavy vehicle traffic in and around the quarry. Given the current noise and vibration levels in the vicinity of the proposal, the proposal has the potential to result in additional short-term impacts on native biota.

Mitigation measures to reduce noise and vibration generated by the proposal are outlined in Section 7.

6.2.7 Artificial lighting

Night time security and/or operational lighting can potentially discourage native species from using habitat where diffuse light penetrates into adjoining areas of vegetation. The foraging and nesting regimes of some nocturnal native mammals and birds can therefore be disrupted by lighting. In addition the eyesight of nocturnal species (such as owls and possums) is hindered by bright lights, and where they are affected by this, they can become more susceptible to predation.

The proposal would involve works during daylight hours only, meaning there would be no need for any new additional lighting associated with the proposal. As such, impacts associated with increased light are unlikely and would not result in any negative effects on native biota within the study area.

6.2.8 Aquatic impacts

The proposal has the potential to indirectly impact on aquatic habitats through alterations to hydrology in the study area, including changes to surface and groundwater flows and increased sedimentation or contamination in runoff. Potential impacts have been assessed as part of the Surface and Groundwater Assessment (GHD 2014). Impacts that could modify aquatic habitat value include:

Alterations to groundwater flows

The Surface and Groundwater Assessment indicates that changes to groundwater flows would be minor as the proposal is not anticipated to intercept groundwater (GHD 2014b). There will be no change to access routes, buildings or facilities as part of the proposal. Therefore it is assumed that there will be minimal impact on recharge due to any change in impervious area. There may be a slight increase in recharge in the fractured and porous aquifer due to removal of overlying rock strata.

Impacts on groundwater would be monitored quarterly. Should the monitoring indicate that impacts are likely to be outside the identified and approved impact range then appropriate mitigation measures would be developed and implemented in consultation with the relevant agencies.

Alterations to surface water flows

The proposed works would alter the local topography at the site, which would affect the drainage of surface water. It is likely that surface water from beyond the works area would be diverted around the works, which could lead to a concentration and discharge of flows rather than distributed discharges. The impact of this could be increased risk of erosion and sedimentation if not adequately managed.

Surface water discharging from the work areas could entrain sediment from disturbed areas. If these are not adequately managed, decreased water quality could enter waterways. The sediment could include dust generated from the operations and sediment tracked by vehicular movements on the site.

The proposed operation would potentially expose a larger proportion of rock areas and other impervious areas compared with the existing site. This could lead to increased runoff volumes during rain events and larger runoff peaks during storm events.

Day to day operations would require the handling of chemicals or hydrocarbons, and other contaminants. If management practices are not adequately implemented, then risk of accidental spillage with potential contamination of surface water could exist

These potential impacts would be managed as described in the Surface and Groundwater Assessment. Mitigation measures would include the collection of runoff from construction/operational areas. This water would be treated in a similar manner as per the current operation. For the future works area the main sediment and other basins provide sufficient storage. Runoff collected in the basin will be used for onsite purposes (dust suppression and operational water) in the first instance. Any additional water will be pumped and discharged to the unnamed ephemeral drainage line after appropriate treatment.

In addition catch drains, contour and diversion drains across exposed areas will be installed, immediately following clearing, and maintained until the site is stabilised. Key areas of flow concentration will be provided with rock protection to prevent erosion.

As discussed above the hydrology of the study area has already been substantially modified by works for the existing quarry. Given the extent of existing modifications to the local catchment the proposal would result in only a minor change to hydrology and would be highly unlikely to adversely affect any aquatic habitats.

Water quality impacts

Surface water quality in the proposal area may be modified by increased sediment loads from disturbed area and the potential for chemical or hydrocarbon residues, leaks and spills from machinery and operational practices.

The potential for adverse impacts on water quality would be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 7 and the Surface and Groundwater Assessment (GHD 2014b). These would include the use of existing settlement basins to collect and treat surface flows from the quarry as described above. Water discharged into nearby areas would be required to meet water quality standards imposed by the relevant licensing conditions.

6.2.9 Aquatic disturbance and impacts on fish habitat

The introduction of pollutants from the proposal into the surrounding environment and increased sedimentation if uncontrolled, could potentially impact on water quality.

The potential for water quality impacts on Tabbimoble Creek are considered to be low given the distance of the creek from the subject site. Notwithstanding potential water quality impacts would be managed through the implementation of mitigation measures, including the use of sedimentation basins.

No endangered aquatic communities, aquatic fauna or marine vegetation listed under the FM Act or EPBC Act occur in the study area and no significant impacts on riparian vegetation or habitats downstream of the proposal site are anticipated as a result of the proposal. There would be no impact on Key Fish Habitat as a result of the proposal.

6.3 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act (DEC 2005) as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities.
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 38 KTPs listed under the TSC Act and eight listed under the FM Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are listed in Table 8 below. Mitigation measures to limit the impacts of these KTPs are discussed in Chapter 7.

Table 8 Key Threatening Processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	TSC Act EPBC Act	Clearing of native vegetation has occurred historically within and around the site though selective logging and associated with the existing quarry. This has resulted in a variety of impacts on the remaining native vegetation including increased weed invasion due to soil disturbance and edge effects. This KTP would be exacerbated by the removal of 10.5 hectares of native vegetation within the site.
Clearing of hollow-bearing trees	TSC Act	Past clearing at the site is likely to have resulted in a loss of hollow-bearing trees. At present there is a mixture of mature and immature vegetation within the site. This KTP would be exacerbated by the removal of numerous hollow-bearing trees within the site.
Removal of dead wood and dead trees	TSC Act	The vegetation to be removed has a lower density of dead wood and dead trees than other areas of vegetation which would be retained within the study area, however still contains a low-moderate density of dead wood and dead trees. Mitigation measures are provided in Section 7 to limit the potential for impacts to native biota as a result of removal of dead wood and dead trees.
Invasion and establishment of exotic vines and scramblers	TSC Act	Vegetation within the study area has the potential to be invaded by exotic vines and scramblers, particularly within areas of TEC vegetation. Vehicles and plant have the potential to introduce propagules of exotic vines and scramblers, as could soil disturbance during quarry expansion activities. The implementation of a Weed Management Plan is recommended to limit the spread of weeds.
Invasion establishment and spread of <i>Lantana camara</i>	TSC Act	The site has been subject to historical disturbance and consequently <i>Lantana</i> has invaded areas of the site. This KTP is likely to be exacerbated onsite without the implementation of weed management.
Invasion of plant communities by perennial exotic grasses	TSC Act	Parts of the study area have been subject to historical forestry activities, and as a result, there are exotic weed species in some areas of the study area. Weeds have also been introduced in edge areas associated with the existing cleared area. Vehicles and plant could further spread exotic grass species, as could soil disturbance during quarry activities and vegetation clearing. There is the potential for perennial exotic grasses to invade retained and adjacent native vegetation through disturbance during quarry expansion activities. The implementation of a Weed Management Plan is recommended to limit the spread of weeds.

KTP	Status	Comment
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Quarry operation activities have the potential to introduce Myrtle Rust to the study area. Mitigation measures to reduce the potential for the introduction myrtle rust are recommended to reduce the potential for impacts on native vegetation.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Quarry operation activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. This is unlikely, however, given no works would be undertaken within the drainage line or major dams. The implementation of a Flora and Fauna Management Plan with specific measures to reduce the potential for the introduction chytrid fungus is recommended to limit impacts on fauna and their habitats.
Predation by the European Red Fox	TSC Act; EPBC Act	Evidence of foxes were observed in the study area. The proposal is unlikely to increase the incidence of this species.

6.4 Impacts on threatened biota listed under NSW legislation

The proposal may result in direct and indirect impacts on threatened biota listed under the TSC Act including the removal of occurrences of the threatened plant, *Hibbertia marginata* and the removal of habitat for up to 23 threatened fauna species that may occur in the study area (see Table 5). Impacts on threatened biota listed under the TSC Act have been assessed through the FBA calculations included in Chapter 8.

No aquatic threatened biota listed under the FM Act or their habitats are likely to occur in the study area or to be affected by the proposal.

6.5 Impacts on Matters of National Environmental Significance

6.5.1 Threatened ecological communities

There are no threatened ecological communities listed under the EPBC Act within the subject site.

6.5.2 Threatened flora species

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*)) listed under the EPBC Act occurs within the study area. Based on the presence of suitable habitat there is also a possibility that a further two flora species listed under this Act may occur. These include:

- Leafless Tongue Orchid (*Cryptostylis hunteriana*) and
- A Grass (*Paspalidium grandispiculatum*)

Bordered Guinea Flower (Hibbertia marginata)

Bordered Guinea Flower is restricted to the southern Richmond Range between Casino and Grafton and grows in grassy or shrubby dry open eucalypt forest at low altitudes on sandstone. A total of 1,190 individuals of Bordered Guinea Flower were identified within the subject site during targeted searches for the species. The locations where this species was identified are shown on Figure 3.

Leafless Tongue Orchid (*Cryptostylis hunteriana*)

Cryptostylis hunteriana is a small perennial terrestrial orchid that lacks leaves. In NSW, the species occurs between Batemans Bay and Nowra with additional records in Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park, Ben Boyd National Park, the Catherine Hill Bay area, Dolphin Point and Bulahdelah. There are no records of the species in the locality of the proposal; however it is predicted to occur within the locality.

The flowering period for this species in NSW is generally from December to February (OEH 2014a).

The species was not recorded during the field survey; however potential habitat exists for this species in the 10.5 hectares of native vegetation that may be impacted by the proposal

A Grass (*Paspalidium grandispiculatum*)

In NSW, is known from the north of Grafton in the Mount Neville, Gibberagee and Doubleduke vicinities. It is likely to be restricted to poor sandy soils on sandstone. It has been found in open forest of Turpentine (*Syncarpia glomulifera*) on undulating topography as well as in drier forest types on ridges.

Within the study area there is suitable habitat for this species within the 4.23 hectares of Blackbutt - bloodwood dry heathy open forest

There are two records for this species in the locality, both occur approximately 8 km north of the subject site.

Under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment in relation to the impacts on the identified *Hibbertia marginata* population. Other potential MNES have been addressed through the FBA and its associated BioBanking assessment.

6.5.3 Threatened fauna species

No threatened fauna species as listed under the EPBC Act have been recorded within the study area; however potential habitat for three threatened fauna species listed under the Act exists within the study area. These include:

- Grey-headed Flying Fox (*Pteropus poliocephalus*)
- Koala (*Phascolarctos cinereus*)
- Spotted Tailed-quoll (*Dasyurus maculatus*)

Grey-headed Flying Fox

The Grey-headed Flying-fox is predicted to occur within 10 km of the subject site (DoE 2014). The Grey-headed Flying-fox may forage on occasion in the proposal site when eucalypts are in flower. The proposal would not directly or indirectly affect any roost camps. Construction for the proposal would remove 10.5 hectares of foraging habitat including all remnant and regrowth species in the proposal site. Large expanses of foraging habitat are available in the locality. Habitat to be removed comprises a negligible proportion of the available habitat present in the locality.

Koala

Feed trees of Koalas are present at the site as Tallowwood (*Eucalyptus microcorys*), Red Mahogany (*E. resinifera*) and Pink Bloodwood. The presence of these species indicates that the majority of vegetation at the site would qualify as 'potential' Koala habitat. As discussed in Section 5.4.3, the presence of the Koala was considered likely on a transient basis and consequently this species has been included in the credit calculations accordingly (see Chapter 8).

Spotted-tailed Quoll

Spotted-tailed Quolls use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites (OEH 2014b). According to a study conducted in Limeburners Creek, quolls used hollows in trees and logs with medium to large circumferences (typically greater than 50 cm dbh for logs and greater than 70 cm dbh for trees), and entrances between 16-41 cm diameter (average 26.13) in logs and between 7-27 cm (average 15.85cm) in tree hollows (Andrews 2005).

Habitat value for the Spotted-tailed Quoll would be somewhat reduced within the study area by the effects of historic logging. Shelter habitats for this species are still present with hollow-bearing trees (including trees with ground-level hollows), logs and other woody debris. The species may forage throughout the study area, although woody debris and other shelters for prey species such as small mammals, frogs and reptiles are also concentrated in lower slopes and gully areas.

Potential MNES have been addressed through the FBA and its associated BioBanking assessment.

6.5.4 Migratory species

One migratory bird species (Rainbow Bee-eater) listed under the EPBC Act was recorded during surveys. There is also potential habitat for the Fork-tailed Swift, White-throated Needletail and Satin Flycatcher.

The Fork-tailed Swift and White-throated Needletail are both predominantly aerial species that may fly over the site or use the study area for foraging on occasion. It is unlikely that the proposal area would provide any significant habitat for these birds and any individuals that may occur would occur on a transient basis only.

The proposal would remove up to 10.5 hectares of known and potential foraging habitat for the remaining three woodland bird species. Individuals of these species may also breed within the study area or locality. The vegetation that would be removed makes up a very small proportion of similar habitats present within the locality, which includes over 6000 hectares in conservation reserves. The Significant Impact Guidelines (DotE 2013c) for migratory species listed under the EPBC Act define important habitat as follows:

'An area of 'important habitat' for a migratory species is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species range, and/or
- habitat within an area where the species is declining'

The study area is not considered important habitat for any of these species, according to the significant impact criteria for migratory species (DotE 2013c). This is due to the fact that potential habitat in the study area would not support an ecologically significant proportion of the population of these species, is not of critical importance to these species at particular life-cycle stages, is not at the limit of these species ranges, and is not within an area where these species are declining. No assessments of significance have been prepared for these species. Based on the above considerations the proposal is unlikely to impose “a significant effect” on any of the listed migratory fauna species predicted to occur within the locality.

7. Mitigation and management measures

7.1 Introduction

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts.

The proposal would result in direct impacts on native biota and their habitats within the proposed quarry area. There is also the potential for impacts on habitats outside the disturbance area through indirect impacts such as noise, sedimentation, runoff or edge effects. Specific mitigation measures are recommended to minimise such impacts on the natural environment.

The proposal would result in some unavoidable impacts imposed upon some elements of the natural environment, including removal of regrowth native vegetation and imposition of edge effects on adjoining areas of retained native vegetation. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened species, TECs and their habitats, which occur in the study area or in adjoining habitats.

The following sections detail recommended measures to avoid and mitigate impacts required offset contributions that have been calculated in accordance with the FBA to offset residual impacts of the proposal.

7.2 Avoidance of impacts

The proposal is for the expansion of an existing quarry. The majority of the proposed quarry expansion area falls within land that has been modified by historical land uses, including logging and past quarry activities. As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

Results of the field survey were used to identify ecological constraints within the study area. This information informed the detailed design phase of the proposal, which entailed modification of the original plans so as to avoid areas of high ecological constraint, namely identified areas of TEC vegetation and some occurrences of the threatened species Bordered Guinea Flower (*Hibbertia marginata*). This alteration to the original plans has reduced the overall area of planned quarry in order to avoid direct impacts on these areas.

Siting of construction compounds and other construction infrastructure in already cleared areas would also avoid impacts on native biodiversity values.

7.3 Mitigation of impacts

The proposal will impact native vegetation communities and habitat for threatened flora and fauna. In order to minimise the potential impacts of the proposal on biodiversity, the mitigation measures detailed below are recommended.

7.3.1 Detailed design phase

During the detailed design process, the impact of the proposal on areas with high biodiversity values should be minimised wherever possible by:

- Undertaking targeted threatened species surveys to determine the occurrence and extent of threatened species within the subject site and mapping of significant habitat features such as hollow bearing trees.
- Minimising the area of native vegetation to be cleared wherever possible.

- Avoidance of identified hollow-bearing trees wherever possible.
- Minimising disturbance to adjacent retained vegetation, aquatic and riparian areas.

These measures aim to guide the vegetation clearing process by encouraging the contractor to avoid unnecessary clearing of vegetation, and limiting vegetation clearing to that which is required for the proposal only. Any establishment of laydown areas, site compounds or similar should be located within existing cleared areas or within the proposal footprint, so as to avoid any additional impacts outside the proposal footprint.

7.3.2 Environment management plan

An Environment Management Plan (EMP) would be prepared for the proposal. The EMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures including the environmental impact mitigation measures outlined below. While some of these mitigation measures are relevant to other assessments completed as part of this EMP (e.g. Surface and Groundwater Assessment), they are included here as they are relevant to maintaining existing levels of habitat and biodiversity values associated with the study area and adjacent habitats.

Worker induction

Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the subject site and study area and measures to be implemented to protect biodiversity.

Water quality management

A Water Management Plan would be incorporated into the EMP and designed to minimise the impact of altered groundwater and surface water flows at the site. This would include measures to ensure the impact of water releases from the settlement ponds would have minimal impact on adjacent areas of native vegetation and aquatic habitats. Mitigation measures would include, but not be limited to:

- Monitoring of all water to be pumped into the environment prior to pumping, targeting turbidity levels.
- Use of results of monitoring to determine the need to treat water to be discharged (e.g. flocculation).
- Appropriate management of surface flows from the quarry area, including sufficient settlement time within overflow ponds to allow sediment load to be deposited.
- Treatment (if necessary) of excess surface water in accordance with relevant licensing standards to ensure water quality in adjacent aquatic habitats is not impacted.
- Staged release of excess water where necessary to reduce erosion potential of additional surface flows into adjacent vegetation and aquatic areas.
- Ongoing contamination, sediment and erosion control measures as per the EMP.
- Use of an oil sock to remove any hydrocarbons in water to be pumped into the environment.
- Ongoing monitoring of surface and groundwater quality and development of contingency measures to address any decrease in quality due to quarrying activities.

Erosion control

A Sediment and Erosion Control Plan will be incorporated in the EMP and should contain detailed mitigation measures to reduce soil erosion and pollutant run-off during all quarry operations as well as during all works on the access road. These would include:

- Installation of erosion and sediment control measures prior to any works.
- Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality.
- Stockpile management measures which minimise the potential for erosion and surface water runoff.
- Construction and maintenance of silt fences to capture and isolate any surface water runoff.
- Immediate removal offsite of excavated materials.

Dust

Specific measures will be incorporated into the EMP to minimise the generation of dust and associated impacts on adjacent natural environments. These would include:

- Setting maximum speed limits for all traffic within the proposal area to limit dust generation.
- Use of a water tanker or similar to spray unpaved roads during quarry operation where required.
- Application of dust suppressants or covers on soil stockpiles.
- Stockpile management to limit the potential for dust generation.

Chemical spills

Specific measures will be incorporated into the EMP to minimise the potential for chemical spills and associated impacts on adjacent natural environments. These would include:

- All chemicals must be kept in clearly marked bunded areas.
- Regularly inspect vehicles and mechanical plant for leakage of fuel or oil.
- No re-fuelling of vehicles, washing of vehicles or maintenance of vehicles and plant to be undertaken within 20 m of waterways.

Management of bushfire risk

A Bushfire Management Plan would be incorporated into the EMP to minimise the risk of bushfire and associated impacts on the natural environment, and would include the following measures:

- Hot works permits will be obtained for all activities likely to generate sparks. Restrictions contained within these permits would be based on the forecast fire danger.
- Pre-planned fire response action plans will be prepared in accordance with the nationally endorsed 'Prepare, Act, Survive' format. The action plans will be issued as part of the site induction for all site personnel.
- Limitations on relevant quarrying procedures will be developed which would be applied during the fire season based on specific fire danger ratings. An example of such restrictions may include the halting of all works during extreme or catastrophic fire danger days.

7.3.3 Flora and fauna management plan

A Flora and Fauna Management Plan (FFMP) should be prepared as a sub-plan to the EMP for the proposal. The FFMP would identify environmental management measures to protect the natural environment (e.g. weed and pathogen controls) and detailed site-specific and species-specific mitigation measures and management protocols to be implemented before, during and after all quarry activities to further avoid or reduce impacts on threatened biodiversity.

The FFMP would include but not be restricted to key protocols for the protection of threatened flora, fauna and their habitats as outlined below. More detailed species-specific management and mitigation protocols for threatened species or groups of species with similar habitat requirements of relevance to the proposal would be developed and documented in detail in the FFMP. As noted above, these specific protocols will be important to address remaining uncertainties with respect to potential impacts.

Pre-quarry expansion

Minimising vegetation clearance and habitat loss

Disturbance and removal of some areas of regrowth native vegetation and habitat will be unavoidable during the expansion of the quarry. To reduce the potential for adverse impacts on ecologically sensitive areas the following measures would be implemented:

- Locating stockpiles in already cleared and disturbed areas to avoid further removal of native vegetation and/or hollow-bearing trees.
- Delineation and protection of exclusion zones around native vegetation to be retained.

Pre-clearance surveys

Pre-clearing surveys of fauna and flora habitat would be carried out by a qualified ecologist. Pre-clearing surveys would largely focus on:

- Mapping and marking of hollow-bearing trees that would require removal.
- Mapping and marking any significant habitat features (large woody debris or hollow logs) for relocation into adjacent habitat areas.
- Inspections of habitat trees for resident fauna, including inspections of hollows, nests and under exfoliating bark.
- Pre-clearing surveys for threatened plants in areas of potentially suitable habitat. Target species would include:
 - Boarded Guinea Flower (*Hibbertia marginata*)
 - Leafless Tongue Orchid (*Cryptostylis hunteriana*)
 - Slender Screw-Fern (*Lindsaea incisa*)
 - A Grass (*Paspalidium grandispiculatum*)
 - Native Milkwort (*Polygala linariifolia*)
- Protocols to protect any identified threatened plants from quarry expansion works whilst appropriate mitigation options are assessed.
- Consideration of feasibility of site/species specific mitigation techniques, including seed collection/cuttings.

Phytophthora management

Phytophthora may occur in the proposed development area given annual rainfall for the area is greater than 600 mm (McDougall and Summerell, 2003).

Hygiene measures in accordance with national best practice guidelines for Phytophthora (DEH 2006) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal should be incorporated into the FFMP and include decontamination of personnel and plant equipment prior to entering the subject site and when traversing between areas of vegetation within the subject site.

These measures relate to the vegetation clearing and access road construction/upgrade stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the expansion has been completed and during day to day quarry operations when machinery movement is restricted to established roads and tracks, that these measures would not be required.

Chytrid fungus management

Vegetation clearing and quarrying activities have the potential to introduce amphibian chytrid fungus to the study area, which could lead to death of local frogs. This potential is limited, however, as there would be no works in aquatic areas. Hygiene measures to prevent the introduction or spread of the pathogen during the vegetation clearing should be incorporated into the FFMP and include decontamination of plant equipment prior to entering the subject site. These measures would be developed with reference to OEH Hygiene protocol for the control of disease in frogs (DECCW, 2008).

These measures relate to the vegetation clearing and access road construction stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the expansion has been completed and during day to day quarry operations when machinery movement is restricted to established roads and tracks, that these measures would not be required.

Myrtle rust management

Vegetation clearing activities have the potential to introduce myrtle rust to the study area, which could lead to death of native myrtaceous vegetation. Hygiene measures to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal should be incorporated into the FFMP. These would include exclusion zones around retained areas of native vegetation and/or provision of machine and footwear washdown stations for all equipment and personnel working in areas of native vegetation.

These measures relate to the vegetation clearing stages of the proposal only, and should accompany measures that ensure plant and machinery does not enter any areas of retained vegetation within the study area. It is envisaged that once the expansion has been completed and during day to day quarry operations when machinery movement is restricted to established roads and tracks, that these measures would not be required during quarry expansion.

Management of weeds and edge effects

A weed management plan would be included within the FFMP, and would include a description of the following:

- Type and location of weeds of concern (including noxious weeds) within the proposal disturbance footprint.
- Sensitive receivers (such as native vegetation and waterways) within or adjacent to the proposal disturbance footprint.
- Measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing.
- Proposed weed control methods and targeted areas.
- Weed disposal protocols.

The weed management plan would include measures designed to mitigate edge effects that reduce impacts outside the footprint of the proposal (namely within surrounding retained vegetation). The aim of these measures would be to control the possible impacts at their source within existing weed infested areas and soften the edge between the earthworks and the retained native vegetation. Measures that would be adopted include:

- Avoid stockpiling of materials adjacent to native vegetation wherever possible.
- Avoid stockpiling of fill in areas of remnant vegetation but instead in adjacent already cleared areas.
- Implementing soil erosion and sediment control measures.
- During quarry expansion areas of vegetation to be retained should be demarcated to restrict access by site staff and machinery to remnant vegetation.
- During quarry expansion undertake maintenance of silt fences and other mitigation measures to isolate runoff, and immediately rehabilitate disturbed vegetation to limit the potential for colonisation by weeds.
- Implementing a weed management strategy.
- Undertake water quality monitoring program during quarry expansion to assess extent of impact on waterways.

Managing vehicle movements

The proposal would increase the risk of injury or mortality of native fauna due to vehicle strike by increasing the rate of vehicle visitation to the site. This risk would be reduced by:

- Restricting vehicle movements to operational (daylight) hours.
- Implementing and enforcing appropriate speed limits for vehicles traversing the site.

Groundcover clearance protocol

Groundcover substrate, in particular fallen logs, provides important habitat for native fauna, including threatened species. A groundcover clearance protocol would be incorporated into the FFMP, including the following measures:

- Remove large woody debris and rock fragments using excavator grabs or manual handling if practicable.
- Place intact large woody debris within adjacent areas of intact vegetation.
- Scrape and stockpile leaf litter and topsoil separately from deeper fill material.

Tree-dwelling fauna management protocol

A plan for the management of impacts on tree-dwelling species, in particular those that utilise tree-hollows would be developed. A hollow-bearing/habitat tree clearance protocol would be incorporated into the FFMP, including the following measures:

- Pre-clearing surveys undertaken by a suitably qualified ecologist or wildlife handler.
- Installation of suitable nest boxes in adjacent vegetation will be considered prior to clearing to provide a safe location for hollow-dwelling fauna to be transferred to during clearing operations. The number of hollow-bearing trees and types of hollows identified during pre-clearance surveys should be used to determine the number and types of nest boxes installed.
- Protocols for the safe inspection of trees and tree-hollows for fauna and methods to encourage fauna to vacate trees with minimal potential for distress or harm, including clearing surrounding vegetation prior to felling hollow-bearing trees.
- Protocols for the management and release of captured animals, including consideration of the appropriate management of injured or deceased individuals.
- Wildlife should not be handled wherever possible. Quarry staff should only handle wildlife in an emergency situation. Uninjured wildlife should be gently encouraged to leave the site by the ecologist/ wildlife specialist. Injured wildlife would be taken to a local WIRES carer or veterinarian for treatment and care if necessary.
- Capture and relocation or captive rearing of less mobile fauna (such as Koalas or nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required.
- Targeted pre-clearing surveys for hollow-dwelling fauna species including but not limited to microbats, arboreal mammals and birds.

8. Impact summary and thresholds

8.1 Introduction

The FBA credit calculations were performed by Arien Quin and Dan Williams using credit calculator Version 4.1. The credit calculations will be submitted to OEH and the biodiversity credit report is included as Appendix D.

The data and assumptions used to perform the FBA credit calculations are summarised below according to the structure and information requirements outlined in Appendix 7 of the FBA (OEH, 2014a).

8.2 Impact summary

8.2.1 Areas not requiring assessment

An assessor is not required to assess areas in a proposal site without native vegetation unless the SEARs for the proposal specifically require it.

Existing quarry disturbance comprise 'cleared land' according to the FBA and the BioBanking methodology (DECC, 2009) because it contains no native over storey or mid storey vegetation and greater than 50% exotic ground cover or >90% bare earth. Further, the majority of the vegetation that is present is located on cuttings or fill material associated with unnatural landforms such as embankments.

These areas do not comprise native vegetation or threatened species habitat according to the FBA and so were not sampled with plot/transects.

8.2.2 Areas requiring offsets

All vegetation within the study area is in moderate/good condition and has a score of greater than 17. Therefore all areas mapped as containing native vegetation communities that will be impacted by the proposal would require offsetting. This is the trigger for completing the credit impact calculations in accordance with section 9.3.1.1(c) of the FBA.

8.2.3 Impacts requiring further consideration

Certain impacts on biodiversity values of a Major Project require further consideration by the consent authority. These are impacts that are particularly complicated or severe. A decision will be made by the consent authority on whether it is appropriate for these impacts to occur or whether modifications to the Major Project are required to avoid or minimise the impact.

In accordance with section 9.2.1.3 of the FBA, impacts that require further consideration include:

- Significant impacts on landscape features.
- Impacts on CEECs or impacts on EECs that are likely to significantly affect the persistence or viability of an EEC.
- Impacts on critical habitat or on threatened species that are likely to significantly affect the persistence or viability of a population of a threatened species that has not previously been recorded in the IBRA subregion (see Section 9.2.5.1 of the FBA).

The proposal does not include any impacts that require further consideration in accordance with these criteria.

8.2.4 Summary of impact avoidance

The proposal is an expansion of a quarry in an area that has been used historically as a quarry, so its location is fundamentally limited by the location of the previous quarry. The majority of the proposed quarry extension area falls within land that has been modified by historical land uses, including logging and past quarry activities. As a result, impacts on native flora and fauna are somewhat less than would be associated with a less disturbed site.

Results of the field survey were used to identify ecological constraints within the study area. This information was used during the detailed design phase of the proposal, which entailed modification of the original plans so as to avoid areas of high ecological constraint, namely the identified areas of TEC vegetation and some of the identified occurrences of the threatened species Bordered Guinea Flower (*Hibbertia marginata*). Amendments to the quarry footprint included removing both the north east and south west corners of the extraction area where a large population of *Hibbertia marginata* occurs. This alteration to the original plans has reduced the overall area of planned quarry expansion, reduced the impact to *Hibbertia marginata* and has seen the proposed quarry expansion area be repositioned in order to minimise direct impacts on these areas.

Unfortunately, the *Hebertia marginata* is located on the bulk of the resource due to previous minor disturbance (access tracks and the like) as this species prefers habitats subject to disturbance. It is considered unfeasible to modify the layout of the quarry further as it would limit the amount of resource that could be accessed to meet demand. It would also impact on the functionality and efficiency of the quarry. To the west and south the volume and quality of the resource is not suitable and expansion to the east is restricted by the Crown Land road reserve.

To limit the impact on the *Hebertia marginata*, the quarry is proposed to be developed in stages, with Stage 1 containing few individuals. Stage 2 (south) would be excavated next which has less *Hebertia marginata* than Stage 2 (north). Stage 1 and Stage 2 (south) contain over half the total resource, so depending on the demand, the quarry may never proceed past these stages. If Stage 3 is extracted, Stage 3 (south) would be extracted first which would avoid impacting the *Hebertia marginata*, within Stage 3 (north), until absolutely necessary.

Siting of construction compounds and other construction infrastructure in already cleared areas would also avoid impacts on native biodiversity values.

8.2.5 Summary of impact mitigation

Measures to mitigate impacts on biodiversity include:

- Refinement of impacts during the detailed design phase
- Development of an EMP which would include detailed measures to minimise impacts associated with the proposal. The EMP would include the following subplans.
 - Water Management Plan
 - Erosion and Sediment Control Plan
 - Bushfire Management Plan
 - Flora and Fauna Management Plan

Further details regarding mitigation measures for the proposal are described in detail in Section 7.

8.2.6 Direct impacts

The proposal would result in direct impacts within the subject site comprising:

- Disturbance of an overall construction footprint of 11.07 hectares of which 0.57 hectares is cleared land associated with the existing quarry or other infrastructure.
- Removal or modification of 10.5 hectares of native vegetation and associated habitat resources for threatened species and other native biota.
- Removal of approximately 1,190 counts of the threatened flora species, *Hibbertia marginata*.

A more detailed description of direct impacts and the likely effect on the biodiversity values of the study area is provided in Chapter 6.

8.2.7 Indirect impacts

Indirect impacts associated with the proposal have been described in detail in Chapter 6 and include potential edge effects, introduction and/or spread of weeds, introduction and/or spread of pests and pathogens, effects of erosion and sedimentation, generation of dust, noise and vibration.

Provided mitigation measures outlined in Section 7 are implemented there are unlikely to be any substantial indirect impacts associated with construction or operation activities. Therefore no additional, indirect impacts have been included in the credit calculations.

9. Framework for biodiversity assessment calculations

Impacts associated with the proposal have been assessed in accordance with the BBAM for Major Projects with the results outlined below.

9.1 Landscape features

The FBA requires the assessment of landscape features to help describe the biodiversity values of the study area and assess the impacts of the proposal. Landscape features relevant to the FBA calculations are shown on Figure 5 and summarised in Table 9.

Table 9 Landscape features

Landscape feature	Proposal site
Interim Biogeographic regionalisation of Australia (IBRA) bioregion and IBRA subregions	The proposal site is located entirely within the 'NSW North Coast IBRA bioregion and Clarence Sandstone IBRA subregion.
Mitchell landscapes	The proposal site contains the Clarence-Manning Basin Margin Mitchell landscapes (DECC 2008a).
Rivers, streams and estuaries	The proposal site does not contain any rivers, streams or estuaries.
Wetlands	The proposal site does not contain any important or local wetlands as defined in the FBA (OEH, 2014a).

9.2 Landscape value

The landscape assessment for the site is shown on Figure 5 and summarised in Table 8. The approach to the landscape assessment is described below.

One hundred (100) hectare and 1,000 hectare assessment circles were used to estimate the extent and connectivity of native vegetation and habitat surrounding the site. Vegetation cover and connectivity was estimated based on the current situation and after the development of the site using GIS measurement of foliage projective cover within the assessment circles. The assessment circles were placed so as to capture the greatest change in vegetation cover as a result of the development. The percentage change in vegetation cover was estimated by subtracting the area of vegetation that would be impacted as a result of the proposal from the existing area of native vegetation within the assessment circles. There is currently approximately 82 hectares of vegetation within the 100 hectare circle. This would be reduced to around 71.5 hectares. Within the 1,000 hectare assessment circle vegetation cover would be reduced from approximately 925 hectares to 914.5 hectares (See Figure 5).

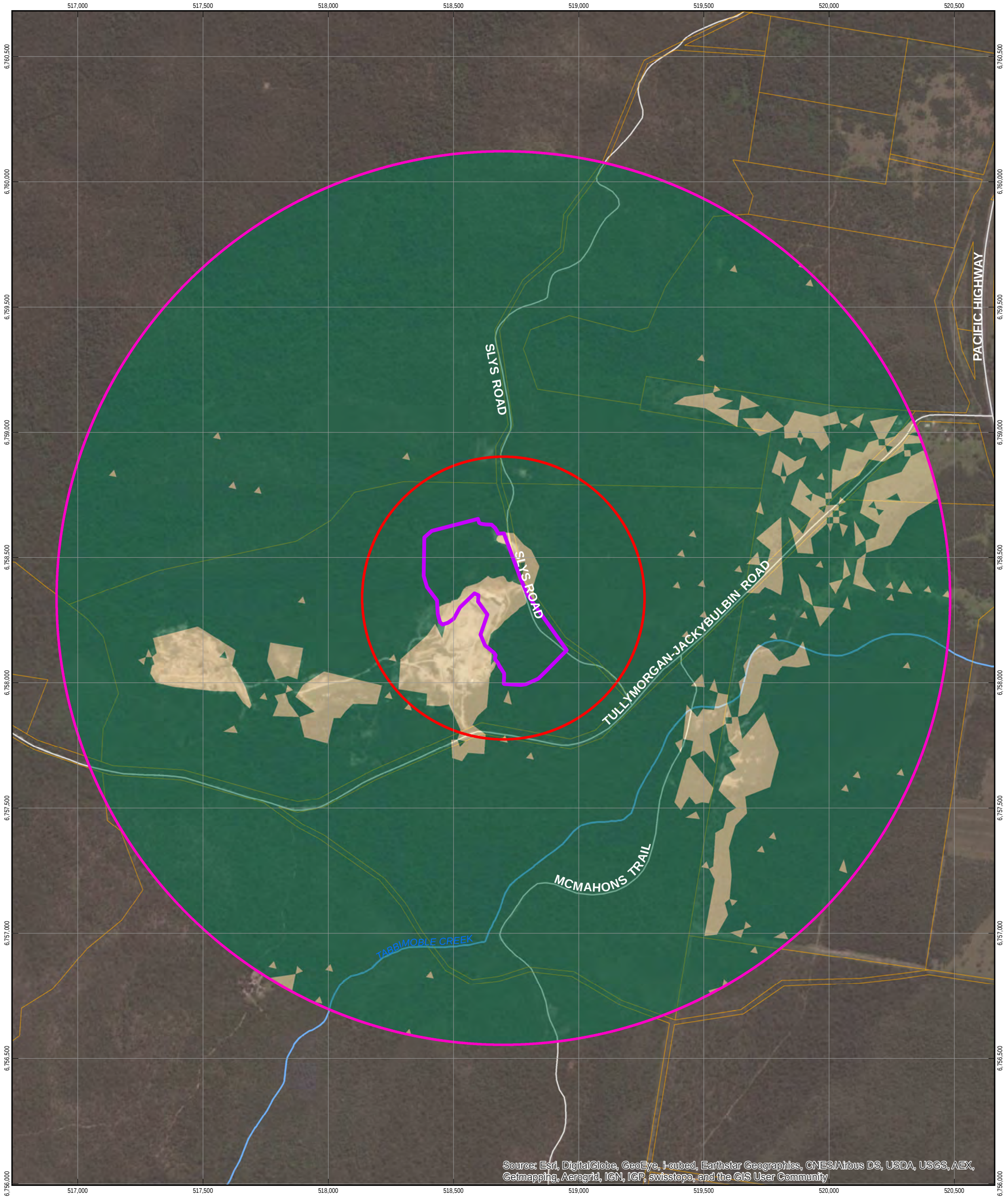
Patch size and connectivity were assessed using GIS and air photo interpretation of native vegetation cover within the assessment circles and adjoining areas of native vegetation. Impacts on connectivity are calculated by entering the 'primary link' for the development site. The primary link before the proposed development is > 500 m, the maximum value for a FBA assessment. This would remain unchanged after the development.

Based on site surveys the over-storey vegetation, as well as mid storey and groundcover vegetation, within the primary link are in good condition and is at benchmark values.

Table 8 Landscape assessment values summary

Landscape Attribute	Before development	After development
% Native vegetation cover in 1000 ha assessment circle	91-95% (925 ha)	91-95% % (914.5 ha)
% Native vegetation cover in 100 ha assessment circle	81-85% (82 ha)	71-75% (71.5 ha)
Connectivity value width	> 500 m	> 500 m
Connectivity value over-storey condition	PFC at BM	PFC at BM
Connectivity value mid-storey or groundcover condition	PFC BM	PFC BM

*PFC = percentage foliage cover; BM = benchmark values for the attribute (OEH, 2014d)



Source: Esri, DigitalGlobe, GeoEye, I-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

Subject site

Cleared

roads

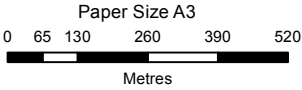
cadastre

100ha circle

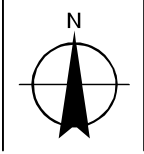
Vegetation

Waterways

1000ha circle



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56



Newman Quarrying
Sly's Quarry Environmental Impact Statement
Biodiversity Assessment

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Landscape Assessment

Figure 5

9.3 Native vegetation

One vegetation zone and threatened species sub zone was created for each PCT and broad condition state in the proposal site. The area of each zone was calculated using GIS. Vegetation zones within the proposal site are summarised below in Table 10.

All vegetation zones within the study area are in Moderate/good condition and are connected to an extensive area of native vegetation extending to the north, south east and west of the site. The area of contiguous treed vegetation connected to the study area was calculated with GIS and is greater than the maximum value for adjacent remnant area in the FBA of 500 hectares, so for all Moderate/good condition vegetation zones the adjacent remnant area was entered as 501 hectares. Patch size, including low condition vegetation is also equal to the maximum area within the FBA of 501 hectares.

Site value data was collected using the BioBanking plot/transect methodology and was entered for each plot/transect field in each vegetation zone. This data is provided in Appendix B.

Table 10 Vegetation zones

Veg Zone ID	Plant Community Type	Veg Type Code	Adjacent remnant area (ha)	Patch size (ha)	Extent cleared in the CMA sub region (percent)	Area (ha)	Plot / transects required	Plot / transects completed
1	Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion	NR123	501	501	10	6.27	3	3
2	Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion	NR114	501	501	40	4.23	3	3
					TOTAL	10.5	7	7

9.4 Threatened species

9.4.1 Predicted threatened species

The credit calculator reports the suite of threatened fauna species that are predicted to be associated with ecosystem credits generated for the proposal. That is, the threatened fauna species that are predicted to use habitat within the vegetation types at the proposal site. Each of these species has a 'Threatened species multiplier' that feeds into the ecosystem credit calculations. If that fauna species or specific habitat resources for that species are not present at the development site, then the Threatened species multiplier may be adjusted.

The suite of threatened species associated with ecosystem credits for the development is shown in Table 11 along with an assessment of whether habitat components for these threatened species are present in the vegetation zones within the proposal site (refer to Appendix A).

Table 11 Predicted threatened species (ecosystem credit species)

Common Name	Scientific Name	Threatened species multiplier	Habitat components present in vegetation zones ?
Barking Owl	<i>Ninox connivens</i>	3	Yes
Barred Cuckoo-shrike	<i>Coracina lineata</i>	1.5	Yes
Beccari's Freetail-bat	<i>Mormopterus beccarii</i>	2.2	Yes
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus</i> subsp. <i>victoriae</i>	2	Yes
Bush Stone-curlew	<i>Burhinus grallarius</i>	2.6	No
Common Blossom-bat	<i>Syconycteris australis</i>	1.2	No
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	2.2	Yes
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	1.8	Yes
Golden-tipped Bat	<i>Kerivoula papuensis</i>	1.3	No
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	2.2	Yes
Grey-crowned Babbler (eastern subspecies)	<i>Pomatostomus temporalis</i> subsp. <i>temporalis</i>	1.3	No
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	2.1	Yes
Little Eagle	<i>Hieraaetus morphnoides</i>	1.4	Yes
Little Lorikeet	<i>Glossopsitta pusilla</i>	1.8	Yes
Masked Owl	<i>Tyto novaehollandiae</i>	3	Yes
New Holland Mouse	<i>Pseudomys novaehollandiae</i>	2.6	No
Powerful Owl	<i>Ninox strenua</i>	3	Yes
Speckled Warbler	<i>Chthonicola sagittata</i>	2.6	No
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	2.6	Yes
Square-tailed Kite	<i>Lophoictinia isura</i>	1.4	Yes
Swift Parrot	<i>Lathamus discolor</i>	1.3	Yes
Varied Sittella	<i>Daphoenositta chrysoptera</i>	1.3	Yes
Yellow-bellied Glider	<i>Petaurus australis</i>	2.3	Yes
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	2.2	Yes

9.4.2 Species credits

The credit calculator references geographic, vegetation and habitat data for the proposal site to generate a list of the species credit-type threatened species predicted to occur and requiring targeted survey.

One threatened flora species (*Hibbertia marginata*) was recorded within the study area. Targeted surveys were undertaken in order to accurately assess the extent of impacts on this species and the final number of species credits required. In addition, three threatened fauna species were considered likely to occur at the site and have been included in the credit calculations accordingly.

9.4.3 Biodiversity credits

The data from the fieldwork and mapping was entered into Version 4.1 of the BioBanking credit calculator as a 'Major Project' assessment to determine the number and type of biodiversity credits that would be required to offset impacts at the proposal site. The Biodiversity credit report is included in Appendix D and summarised below.

Ecosystem Credits

A total of 768 ecosystem credits would be required to offset the impacts of the proposal as shown in Table 12.

Table 12 Ecosystem credits required to offset impacts of the proposal

Vegetation Zone	Area (ha)	Current site value score	Future site value score	Change in landscape value score	Ecosystem credits required
NR 123	6.27	100	0	100	283
NR 114	4.23	85.94	0	85.94	485
TOTAL					768

Species Credits

A total of 17,437 species credits would be required to offset the impacts of the proposal as shown in Table 13.

Table 13 Species credits required to offset impacts of the proposal

Common name	Scientific name	Extent of impact (individuals)	Species credits required
Bordered guinea flower	<i>Hibbertia marginata</i>	1,190	16,660
Koala	<i>Phascolarctos cinereus</i>	10.5 ha	273
Common planigale	<i>Planigale maculata</i>	10.5 ha	273
Squirrel glider	<i>Petaurus norfolcensis</i>	10.5 ha	231
Total			17,437

10. Biodiversity offset strategy

10.1 Overview

This section presents the draft Biodiversity Offset Strategy, which outlines how the proponent intends to offset the impacts of the proposal.

The credit calculator has been used in this Biodiversity Assessment Report to determine the number and type of biodiversity credits required to offset impacts of the proposal. The Biodiversity credit report is included in Appendix D.

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the following biodiversity credits as calculated in accordance with the FBA:

- 485 ecosystem credits for Blackbutt-Turpentine dry heathy open forest (NR 123)
- 283 ecosystem credits for Blackbutt-Bloodwood dry heathy open forest (NR 114)
- 16,660 species credits for *Hibbertia marginata*
- 273 species credits for the Koala
- 231 species credits for the Squirell glider
- 273 species credits for the Common planigale

A Biodiversity Offset Strategy developed in accordance with the FBA is likely to satisfy the biodiversity offsetting requirements of the EPBC Act and associated policy.

A Biodiversity Offset Strategy for the proposal is to conserve an appropriate portion of land onsite in a biobanking agreement.

It is anticipated that the survey and assessment of a preferred biobank site in accordance with the BBAM, and the application for a BioBanking agreement would occur within 12 months of the issuing of Conditions of Consent. The necessary credits would then be retired. Further consultation is expected with OEH during the assessment of the biobank site to agree on the exact number and type of species credits required to adequately offset the proposal. Preliminary surveys have confirmed the preferred biobank site contains 'matching' vegetation for the ecosystem credits required and contains populations of the threatened flora species *Hibbertia marginata* as well as suitable habitat for the three threatened fauna species requiring offsetting. In regard to these species, it is expected that due to the approach taken in this assessment to assume these species are present based on known records and habitat conditions, the same outcome would apply to the proposed biobank as it is located immediately adjacent to the development site in a contiguous patch of the same vegetation type and in the same or better condition.

Details of the preferred biobank site are included below.

10.1.1 Potential BioBank site

A preliminary investigation of a potential biobank site located to the south of Jackybulbin Road (refer Figure 6), was undertaken to identify and map vegetation communities.

Preliminary investigations confirmed the presence of the following five vegetation types:

- Blackbutt-Bloodwood dry heathy open forest on Quaternary sands (NR 114)
- Blackbutt-Turpentine dry heathy open forest on sandstones (NR 123)
- Swamp Mahogany swamp forest of the coastal lowlands (NR 254)

- Paperbark swamp forest of the coastal lowlands (NR 217)
- Spotted Gum-Grey Ironbark-Pink Bloodwood open forest of the Clarence Valley lowlands (NR 246)

Broad-scale mapping of these vegetation types is provided at Figure 6. The approximate area of each vegetation type within the biobank site is provided in Table 14.

Table 14 Areas of vegetation types within the BioBank site

Vegetation Type	Vegetation Type ID	Area (ha)
Blackbutt-Bloodwood dry heathy open forest on Quaternary sands	NR 114	74.4
Blackbutt-Turpentine dry heathy open forest on sandstones	NR 123	13.5
Swamp Mahogany swamp forest of the coastal lowlands	NR 254	30
Paperbark swamp forest of the coastal lowlands	NR 217	15.1
Spotted Gum-Grey Ironbark-Pink Bloodwood open forest of the Clarence Valley lowlands	NR 246	1.9
Total		134.9

It is anticipated that results from the detailed biobanking assessment associated with establishing a biobank site would inform consultation with OEH to agree on the minimum size and final shape of the biobank site. Initial calculations indicate that less than 134.9 hectares will be required to adequately offset the ecosystem credits however, as mentioned, consultation with OEH will be required to agree on the final credits to adequately offset all of the proposals impacts in accordance with the trading guidelines associated with the FBA.

Preliminary assessment of the potential biobank site revealed that the vegetation types and condition are comparable with those identified within the proposed quarry footprint. Occurrences of the threatened plant, *Hibbertia marginata*, were also identified (refer Figure 6) suggesting that the proposed biobank site provides suitable habitat for this species.

Based on these initial findings it is proposed that a BioBanking assessment be undertaken for the potential biobank site, subject to approval of the proposed expansion. A summary of the proposed approach is provided as follows.

10.2 Summary of the BioBanking process

The offsets strategy for the proposal will include the proposed offset site being formally titled and conserved under a BioBanking agreement. To deliver the biodiversity outcomes required by a BioBanking agreement, the following biodiversity management framework would be implemented at the proposed offset site:

- **Conservation** – A 'conservation covenant' would be placed over the proposed offset site in perpetuity. This covenant extinguishes all potential future land uses other than exploration/mining rights.
- **Vegetation Rehabilitation** – Existing vegetation would have a 'targeted' weed control program applied to improve 'condition' throughout the proposed offset site. Revegetation activities would increase the extent of native vegetation, through time, of the proposed offset site.
- **Maintenance and monitoring** – An annual maintenance and monitoring regime would be applied to the proposed offset site in perpetuity to ensure improvements in ecological values are maintained.

10.3 Conservation covenant (BioBanking agreement)

Entering into a BioBanking agreement places a conservation covenant over the land, regardless of zoning. This covenant is the strongest available on private lands and extinguishes all land uses other than conservation. The estimated timeline for completing the BioBanking agreements for the biobank site is shown in Table 15.

Table 15 Program for obtaining a BioBanking Agreement for the Proposed Offset Site

Task description	Timing
Complete site surveys and BioBanking assessment	Within 6 months from approval of the Offsets Proposal
Complete draft Managements Actions Plan and costing template	Within 6 months from approval of the Offsets Proposal
BioBanking agreement signed	Within 12 months from approval of the Offset Proposal
Implementation of Management Actions Plan	Commence immediately after BioBanking agreement signed, the Total Fund Deposit has been paid and the agreed minimum number of credits are retired.

There are circumstances where additional approval from the NSW Minister for the Environment may overturn the covenant for mining rights and, potentially, significant infrastructure but the BioBanking methodology includes mechanisms to ensure any impacts from these activities are, again, suitable offset as an addition to any offsetting activities required by a given project in its own right. Details of this policy can be provided by the BioBanking Unit.

BioBanking agreements include detailed contractual and financial obligations on the landowner and purchaser and, in the absence of draft BioBanking agreements (including the draft detailed management actions plan and contractual obligations on both parties), it is unreasonable to expect a land owner to commit at this stage as these are the documents to be prepared/ negotiated and agreed in the next 12 months. The offset proposal can commit to entering the

next stage of negotiations and, as contingency, can commit to retiring the minimum number of credits required to offset its impact. This is the most important point when using BioBanking as this achieves the 'improve or maintain' outcome for ecology required for approval.

10.4 Management actions

10.4.1 Approach

The following describes the actions that would likely be required for ongoing management of the proposed offset site. A Management Actions Plan (prepared in accordance with the BioBanking Methodology), detailing rehabilitation activities and an associated management program, would be prepared and included in the final BioBanking agreement. The Management Actions Plan forms the basis of the funds required to be placed in the BioBanking Trust when purchasing the credits. The BioBanking Trust then funds the BioBank site owner to implement the management actions plan.

BioBank sites may have two types of management actions applied:

- Standard Management Actions
- Site Specific Management Actions

Standard management actions are those actions required on the proposed offset site to improve vegetation condition when entering into a BioBanking agreement. The standard management actions for all BioBank (Table 16) are:

- Management of grazing for conservation
- Weed control
- Management of fire for conservation
- Management of human disturbance
- Retention of regrowth and remnant native vegetation
- Replanting or supplementary planting where natural regeneration would not be sufficient (note: it is anticipated that natural regeneration would be sufficient for the proposed biobank site and hence supplementary planting works would not be undertaken)
- Retention of dead timber
- Erosion control
- Retention of rocks

Based on the habitat resources within the site and the suite of threatened species which are predicted to occur, the credit calculator nominates management actions that would be required to alleviate site-specific threats. Undertaking these actions is over and above the minimal requirements for a BioBank site. Additional management actions that are likely to be required at the proposed offset site are summarised below:

- Cat and/or fox control
- Exclude miscellaneous feral species
- Control of feral and/or overabundant native herbivores (e.g. rabbit, goats, deer etc)
- Maintain or reintroduce flow regimes (aquatic flora)

The Management Actions Plan will identify site specific vegetation rehabilitation and management actions appropriate for the proposed offset site which would be completed during the preparation of the BioBanking agreement. A summary of the likely actions, including an estimate of timeframe, are included below.

Table 16 Summary of rehabilitation and management for proposed offset site

Management measure	Activities required	Timing
Management of grazing	Install stock fencing in accordance with the MAP	Within the first year of establishing the BioBank site
	Maintenance and repair	Annually
Weed control	Control of noxious and large woody weeds (target 80% control)	Within first 3 years of establishing BioBank site
	Completion of primary and secondary bush regeneration programs targeting other weeds	Within first 10 years of establishing BioBank site
Management of human disturbance	Install controlled access point/s and fencing in accordance with the MAP	Within the first 6 months of establishing the BioBank site
Retention of vegetation and retention of dead timber	Installation of protective fencing in accordance with MAP	Within the first 6 months of establishing the BioBank site
Erosion control	Installation of erosion control measures in accordance with the MAP	Within first 3 months of establishing the BioBank site.
Feral animal control	Trapping and targeted removal of pest species	Immediately upon establishment of BioBank site and monitored regularly
Maintain or reintroduce flow regimes (aquatic flora)	Removal of any 'barriers' to flow regimes	Within first year of establishing BioBank site
Monitoring and reporting	Reports will be prepared and issued in accordance with MAP by OEH	Annually in perpetuity

10.5 Monitoring of the offset site

The purchase of credits includes two components: Part A being the cost of rehabilitation and management and, Part B being the 'profit' to the relevant landowner. The Part A funds are the equivalent of all costs associated with the rehabilitation, management and monitoring of the BioBank site/s in perpetuity.

The BioBanking methodology includes preparation of a Management Actions Plan for each BioBank site. The methodology also includes a credit pricing tool which places a commercial value for completing each of the actions listed in the Management Actions Plan. These funds are held by the BioBanking Trust and managed by OEH. The funds are provided to the land owner on an annual basis for the amount equivalent to works required in that year. The BioBank owner is then required to submit standards reports, outlining the works completed, their success and monitoring results. OEH then review the reports and, if works have been completed satisfactorily, provide the next payment for the following years work. The OEH also include site visits as part of their auditing process.

10.6 Compliance assurance

BioBanking includes a range of provisions to ensure delivery of the conservation outcomes. The OEH have the ability to:

- Enforce the provisions of the conservation covenant placed over the land.
- Adjust rehabilitation and management actions program depending on how the site responds.
- Includes contingency for things such as natural disasters which may impact on the success or otherwise of the program.
- Have the authority to take legal actions against Biobank site owners for non-compliance including, as a last resort, acquisition of the land.

11. Conclusions

The proposal involves the expansion of Sly's Quarry and would require the removal of approximately 10.5 hectares of native vegetation. This includes 6.27 hectares of Blackbutt-Turpentine dry heathy forest and 4.23 hectares of Blackbutt-Bloodwood dry heathy forest.

Vegetation at the site has been previously disturbed due to past logging practices, however it remains relatively weed free with only small patches of the noxious weed Lantana (*Lantana camara*) scattered through the site.

The habitats within the study area are contiguous with large tracts of native vegetation that surround the site. To the south and east of the site is an identified key regional fauna habitat corridor which connects coastal habitats with those of the ranges to the west. This corridor also includes Mororo State Forest, Gibberagee State Forest, Bungalong Crown Reserve and Devils Pulpit State Forest. This habitat connectivity would allow a broad range of mobile fauna species to use habitats within the study area, either as part of their home territory or as an adjunct to their core areas of habitat in response to seasonal resource availability.

11.1 Impacts on state-listed biota

One threatened flora species (Bordered Guinea Flower (*Hibbertia marginata*)) listed as vulnerable under the TSC Act was identified within the study area. There is also potential habitat for up to three additional threatened flora species listed under the TSC Act to occur and be impacted by the proposal. A total of 10.5 hectares of native regrowth vegetation which constitutes potential habitat for these threatened flora species would be impacted by the proposal.

No threatened ecological communities listed under the TSC Act were identified within the study area.

No threatened fauna species were identified within or directly adjacent to the study area as a result of the current field surveys, however the site provides potential habitat for up to 23 threatened fauna species listed under the TSC Act, including:

- Forest owls and raptors
- Woodland birds
- Wetland birds
- Hollow-dependent arboreal mammals
- Terrestrial mammals
- Hollow-roosting microbats, cave-roosting microbats and the Grey-headed Flying-fox
- One reptile

No threatened biota listed under the FM Act are likely to occur in the study area, or downstream of the study area.

11.2 EPBC Act MNES

One threatened flora species, Bordered Guinea Flower (*Hibbertia marginata*), listed as vulnerable under the EPBC Act was identified within the subject site. Further detailed survey was undertaken to determine the size and extent of this species within the subject site.

The subject site also contains potential habitat for an additional two threatened flora species, three threatened fauna species and four migratory bird species listed under the EPBC Act. There are no other MNES within the locality which would be affected by the proposal.

Under the provisions of the EPBC Act, the proposed development is being referred to the Department of the Environment in relation to the impacts on the identified *Hibbertia marginata* population. Other potential MNES have been addressed through the FBA and its associated BioBanking assessment.

11.3 Avoidance and mitigation of impacts

The proposal has been resized and repositioned during the detailed design phase in order to avoid sensitive ecological receptors such as threatened ecological communities and known threatened species.

Recommended mitigation measures are included in this report in order to minimise the impact of the proposal on native flora, fauna and ecological processes within the study area and adjacent land. These measures would be incorporated into an Environmental Management Plan for the proposal, and would include:

- Pre-clearing surveys and clearing protocols to minimise risk of damage to resident fauna, minimise clearing of native vegetation and prevent encroachment into retained adjoining habitats.
- Installation of nest-boxes will be considered prior to clearing to provide alternative roosting sites for hollow-dependant fauna. The number and types of nest-boxes used should be determined based on the results of the pre-clearance surveys.
- Standard environmental management measures to minimise the risk of indirect impacts on adjoining habitats through contaminated runoff, sedimentation, erosion, noise and vibration.

11.4 Requirement to offset impacts under the FBA

The Biobanking credit calculator V 4.1 has been used in this Biodiversity Assessment Report to determine the number and type of biodiversity credits required to offset impacts of the proposal. The Biodiversity credit report is included in Appendix D.

The Biodiversity Offset Strategy for the proposal would include the purchase and retirement of the following ecosystem credits as calculated in accordance with the FBA:

- 485 ecosystem credits for Blackbutt-Turpentine dry heathy open forest (NR 123)
- 283 ecosystem credits for Blackbutt-Bloodwood dry heathy open forest (NR 114)
- 16,660 species credits for *Hibbertia marginata*
- 273 Koala species credits
- 231 Squirell glider credits
- 273 Common planigale credits

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Appendix A – Likelihood of occurrence table

Threatened Biota Habitat Table

Databases Searched

Office of Environment and Heritage (OEH) (2014a) Threatened species profiles- threatened ecological communities known or predicted to occur within the Northern Rivers CMA subregion.

Department of the Environment (DoE) (2014) EPBC PMST Online Search 3 December 2014 - 10 km buffer.

Department of Primary Industries (DPI) (2014) Records viewer search for threatened and protected aquatic species - Northern Rivers CMA.

Office of Environment and Heritage (OEH) (2014b) NSW Wildlife Atlas Search - threatened species results within a 10 km buffer

Likelihood of Occurrence

Matters considered in determining the likelihood of occurrence include:

- Known natural distributions including prior records (database searches) and site survey results.
- Geological/ soil preferences.
- Specific habitat requirements (e.g. aquatic environs, seasonal nectar resources, tree hollows etc).
- Climatic considerations (e.g. wet summers; snow fall).
- Home range size and habitat dependence.
- Topographical preferences (e.g. coastal headlands, ridgetops, midslopes, gilgai, wetlands).

The likelihood of occurrence scale is defined as follows:

Likelihood of Occurrence Scale

Scale	Description
Known	Species known to occur within the site (e.g. breeding and foraging habitat; foraging habitat; movement corridors). Detected on or immediately adjacent to the site.
Likely	Presence of high value suitable habitat (e.g. breeding and foraging habitat; important movement corridors). Not detected.
Possible	Presence of medium value suitable habitat (e.g. disturbed breeding conditions; constrained foraging habitat; movement corridors). Not detected.

Scale	Description
Unlikely	Presence of low value suitable habitat (e.g. disturbed conditions; isolated small habitat area; fragmented movement corridors). Not detected.
Nil	No suitable habitat or corridors linking suitable habitat present. Not detected.

Note: Marine species which are restricted to marine environments only (such as whales, dolphins, sharks and seabirds) are excluded from the Likelihood of Occurrence Table as there is no marine habitat in the subject site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
EECs						
Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion		EEC		Coastal Cypress Pine Forest is apparently restricted to the NSW North Coast bioregion. The dominant species, <i>C. columellaris</i> , extends into south-east Queensland as far north as Hervey Bay. Any occurrence of the community in south-east Queensland is likely to be highly restricted. In NSW, Coastal Cypress Pine Forest is currently known from the local government areas of Tweed, Byron, Ballina, Richmond Valley and Clarence Valley, but may occur elsewhere within the bioregion.	Recorded within 10km (OEH 2014)	Does not occur.
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	V	This community occurs in the intertidal zone along the NSW coast. Species composition varies with elevation and latitude, with Saltmarsh in southern NSW being generally more species-rich than further north.	Recorded within 10km (OEH 2014)	Does not occur.
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	-	Occurs in coastal areas subject to periodic flooding with standing fresh water for at least part of the year. Typically on silts, muds or humic loams below 20 m elevation in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. Structure and composition varies spatially and temporally depending on the water regime, though is usually dominated by herbaceous plants and has few woody species.	Recorded within 10km (OEH 2014)	Does not occur.
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		EEC	CEEC	Occurs along the NSW coast, usually within 2km of the ocean on a variety of substrates. Variable structure and composition, typically with closed canopy. Generally rainforest species with vines a major component.	Recorded within 10km (OEH 2014) Predicted to occur within 10km (DotE 2014)	Does not occur.
<i>Lowland Rainforest of Subtropical Australia</i>		EEC	CE	This ecological community occurs on basalt and alluvial soils, including sand and old or elevated alluvial soils as well as floodplain alluvia. The community mostly occurs in areas < 300m asl. It differs from Littoral rainforest in that it typically occurs more than 2 km from the coast.	Recorded within 10km (OEH 2014) Predicted to occur within 10km (DotE 2014)	Does not occur.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Low land Rainforest on Floodplain in the New South Wales North Coast Bioregion		EEC	CE	Low land Rainforest on Floodplain generally occupies riverine corridors and alluvial flats with rich, moist silts often in subcatchments dominated by basic volcanic substrates. Major examples once occurred, and remnants remain, on the floodplains of the Tweed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. Other minor river systems also support the community.	Recorded within 10km (OEH 2014)	Does not occur.
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion		EEC	-	Subtropical Coastal Floodplain Forest is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, but may occur elsewhere in this bioregion. Major examples once occurred on the floodplains of the Tweed, Richmond, Clarence, Macleay, Hastings and Manning Rivers, although smaller floodplains would have also supported considerable areas of this community.	Recorded within 10km (OEH 2014)	Does not occur.
Swamp Sclerophyll forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions		EEC	-	Usually occurs below 20m asl (sometimes up to 50m). Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Characterised by open to dense tree layer of eucalypts and paperbarks, with trees up to or higher than 25 m. Includes areas of fern land and tall reed or sedge land, where trees are sparse or absent.	Recorded within 10km (OEH 2014)	Does not occur within the subject site.
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregion		EEC		Occurs on a range of substrates in the NSW North Coast, Sydney Basin and South East Corner bioregions. The community is found on a range of substrates, although stands on sandstone are infrequent and small.	Recorded within 10km (OEH 2014)	Does not occur.

Threatened flora known or predicted from the locality, habitat associated and likelihood of occurrence.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
FLORA						
Acronychia littoralis	Scented Acronychia	E	E	Scented Acronychia is found on sand in humid, high rainfall zones (greater than 1600 mm), within 2 km of the ocean. The species occurs in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest and cleared land.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.
Anthraxon hispidus	Hairy-joint Grass	V	V	Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.
Cyperus aquatilis	Water Nutgrass	E	-	In NSW, known only from a few sites north from Grafton. Also occurs in Queensland, Northern Territory, Western Australia and New Guinea. Grows in ephemerally wet sites, such as roadside ditches and seepage areas from small cliffs, in sandstone areas.	1 record within 10km (OEH 2014)	Unlikely. No suitable habitat present at site.
Cryptocarya foetida	Stinking Cryptocarya	V	V	Grows in dry rainforest on steep basalt boulder slopes on soil that is scarce but relatively high in nutrients and very well-drained.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and low land forest. Prefers open areas in the understorey and is often found in association with Cryptostylis subulata and Cryptostylis erecta. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	Predicted to occur within 10km (DotE 2014)	Possible. Potential habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	Found on the north coast of NSW and in separate districts: near Casino where it can be locally common, and farther south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	Predicted to occur within 10km (DotE 2014) 7 records within 10km (OEH 2014)	Unlikely. No suitable habitat present at site.
<i>Gossia fragrantissima</i>	Sweet Myrtle		E	Occurs in south-east Queensland and in north-east NSW south to the Richmond River. Mostly found on basalt-derived soils. Found in dry subtropical and riverine rainforest.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.
<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	E	-	Occurs in eastern Queensland and eastern NSW. In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Likes moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest	3 records within 10km (OEH 2014)	Unlikely. No suitable habitat present at site.
<i>Hibbertia marginata</i>	Bordered Guinea Flower	V	V	Occurs only in north-east NSW, where it is restricted to the southern Richmond Range between Casino and Grafton. Grows in grassy or shrubby dry open eucalypt forest at low altitudes on sandstone.	Predicted to occur within 10km (DotE 2014) 17 records within 10km (OEH 2014)	Known. Found throughout site during field surveys.
<i>Lindsaea incisa</i>	Slender Screw Fern	E	-	In NSW it is known only from a few locations between Woombah and just south of Coffs Harbour. Also occurs in north and south-east Queensland. Found in dry eucalypt forest on sandstone and moist shrubby eucalypt forest on metasediments. It is usually found in waterlogged or poorly drained sites along creeks, where ferns, sedges and shrubs grow thickly.	6 records within 10km (OEH 2014)	Unlikely. Some suitable conditions present, however no waterlogged areas or creeklines which are preferred habitat.
<i>Marsdenia longiloba</i>	Slender Marsdenia	E	V	Scattered sites on the north coast of NSW north from Barrington Tops. Occurs in subtropical and warm temperate rainforest, low land moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
<i>Maundia triglochoides</i>		V	-	Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong; former sites around Sydney are now extinct. Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	3 records within 10km (OEH 2014)	Unlikely. No suitable habitat present at site.
<i>Melichrus</i> sp. Gibberagee	Narrow-leaf Melichrus		E	Restricted to north-east NSW. Known only from a single population in Gibberagee State Forest and adjacent private property, about 40 km south of Casino. Low-altitude dry eucalypt forest on gentle slopes. Found mainly in grassy forests under tall spotted gum and ironbarks.	Predicted to occur within 10km (DotE 2014) 1 record within 10km (OEH 2014)	Unlikely. No suitable habitat present at site.
<i>Parsonsia dorrigensis</i>	Milky silkpod		E	Milky Silkpod is found only within NSW, with scattered populations in the north coast region between Kendall and Woolgoolga. Found in subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m, on brown clay soils.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.
<i>Paspalidium grandispiculatum</i>	A grass	V	V	In NSW, it is known from the north of Grafton in the Mount Neville, Gibberagee and Doubleduke vicinities. It is likely to be restricted to poor sandy soils on sandstone. It has been found in open forest of Turpentine (<i>Syncarpia glomulifera</i>) on undulating topography as well as in drier forest types on ridges.	Predicted to occur within 10km (DotE 2014) 2 records within 10km (OEH 2014)	Possible. Suitable habitat and associated species present at site.
<i>Persicaria elatior</i>	Tall Knotweed	V	V	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). Normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Predicted to occur within 10km (DotE 2014)	Unlikely. Minimal preferred habitat on site, but small potential to be present in swamp areas.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Suitable habitat present?
<i>Phaius australis</i>	Lesser Swamp-orchid		E	Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Occurs in swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas.	Predicted to occur within 10km (DotE 2014)	Unlikely. Targeted searches were conducted across the site and it was determined that the species was unlikely to be present.
<i>Polygala linariifolia</i>	Native Milkwort	V	-	North from Copeton Dam and the Warialda area to southern Queensland; also found on the NSW north coast near Casino and Kyogle, and there is an isolated population in far western NSW near Weebah Gate, west of Hungerford. Found on sandy soils in dry eucalypt forest and woodland with a sparse understorey.	1 record within 10km (OEHL 2014)	Possible Suitable habitat present within open dry eucalypt forest at site.
<i>Prostanthera palustris</i>	Swamp Mint-bush	-	V	Only known from the Jerusalem Creek area in the north of Bundjalung National Park, near Evans Head. Grows in wet shrubland to heathland subject to extended waterlogging in poorly drained white siliceous sandy soil with a high organic content.	Predicted to occur within 10km (DotE 2014) 1 record within 10km (OEHL 2014)	Unlikely. Targeted searches undertaken in areas of suitable habitat and this species was not recorded.
<i>Streblus pendulinus</i>	Siah's Backbone, Siah's Backbone, Isaac Wood	-	E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island (ATRP 2010; Jessup 2003; The Royal Botanic Gardens and Domain Trust 2011). Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010).	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.
<i>Thesium australe</i>	Austral Toadflax	V	V	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. It may persist in some areas in the broader region. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.

Threatened fauna known or predicted from the locality, habitat association and likelihood of occurrence in the subject site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
FAUNA						
Birds						
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	Predicted to occur within 10km (DotE 2014) 2 records within 10km (OEH 2014)	Unlikely. Suitable habitat not present at the site. Some potential habitat present in the wider study area.
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly <i>Typha</i> spp. and <i>Eleocharis</i> spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Predicted to occur within 10km (DotE 2014)	Unlikely. No permanent wetlands with emergent vegetation present at site.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber.	3 records within 10km (OEH 2014)	Unlikely - . Suitable habitat not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of <i>Allocasuarina</i> species. Prefers woodland and open forests, rarely away from <i>Allocasuarina</i> . Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	45 records within 10km (OEH 2014)	Possible. Could potentially use <i>Allocasuarina littoralis</i> on site for foraging. Trees suitable for nesting found throughout site.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses.	20 records within 10km (OEH 2014)	Unlikely. Suitable habitat not present.
<i>Coracina lineata</i>	Barred Cuckoo-shrike	V	-	Coastal eastern Australia from Cape York to the Manning River in NSW. Barred Cuckoo-shrikes are generally uncommon in their range, and are rare in NSW. Found in rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses.	1 record within 10km (OEH 2014)	Possible. Suitable habitat present however no watercourses on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Cyclopsitta diophthalma coxeni</i>	Coxen's Fig-Parrot	CE	E/M	Coxen's Fig-Parrot occurs in rainforest habitats including subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, and vine forest.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	8 records within 10km (OEH 2014)	Possible. Suitable habitat present at site. No Noisy Miners observed at site and site is surrounded by forest.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present and study area is outside of known distribution
<i>Dromaius novaehollandiae</i>	Emu	EP	-	The species is now restricted to coastal and near-coastal areas between Evans Head and Red Rock and a small isolated population further west in the Bungawalbin area. It now appears to be absent from Broadwater National Park,	5 records within 10km (OEH 2014)	Unlikely. Suitable habitat not present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				there are few recent sightings from its former stronghold in Bundjalung National Park and it is not known whether a natural population continues to persist in the Port Stephens area. On the NSW north coast, Emus occur in a range of predominantly open lowland habitats, including grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities, as well as the ecotones between these habitats. They also occur in plantations of tea-tree and open farmland, and occasionally in littoral rainforest.		
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. This species breeds during summer, nesting in or near a freshwater swamp	9 records within 10km (OEH 2014)	Unlikely. No permanent wetlands or watercourses on site.
<i>Erythroriorchis radiatus</i>	Red Goshawk	V	CE	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types with a large source of birds as food and permanent water nearby. In NSW, preferred habitats include mixed subtropical rainforest, <i>Melaleuca</i> swamp forest and riparian <i>Eucalyptus</i> forest of coastal rivers.	Predicted to occur within 10km (DotE 2014)	Unlikely. Preferred habitat types not on site and no permanent water sources on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands <i>Eucalyptus albens</i> and <i>E. melliodora</i> are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially <i>Eucalyptus viminalis</i> , <i>E. blakelyi</i> and <i>E. dealbata</i> . Most breeding records are from the western slopes.	20 records within 10km (OEH 2014)	Possible. May occasionally forage within the study area.
<i>Grus rubicunda</i>	Brolga	V	-	The Brolga was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range. Though Brolgas often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged.	5 records within 10km (OEH 2014)	Unlikely. No wetlands or swamp present on site.
<i>Irediparra gallinacea</i>	Comb-crested Jacana	V	-	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in	1 record within 10km (OEH 2014)	Unlikely. No wetlands or swamp present on site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				south-eastern NSW (possibly in response to unfavourable conditions further north). Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.		
<i>Lathamus discolor</i>	Swift Parrot	E	E.M	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. <i>Eucalyptus robusta</i> , <i>Corymbia maculata</i> and <i>C. gummifera</i> dominated coastal forests are also important habitat.	Predicted to occur within 10km (DotE 2014)	Unlikely. Suitable habitat not present at the site. Some potential habitat present in the wider study area.
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	1 record within 10km (OEH 2014)	Possible Suitable habitat present at site.
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	-	The south-eastern form (subspecies <i>cucullata</i>) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies <i>picata</i> . Two other subspecies occur outside NSW. Prefers lightly wooded country,	1 record within 10km (OEH 2014)	Unlikely. Suitable habitat not present.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.		
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>).	4 records within 10km (OEH 2014)	Unlikely Suitable habitat not present
<i>Ninox connivens</i>	Barking Owl	V	-	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including <i>Eucalyptus camaldulensis</i> , <i>Eucalyptus albens</i> , <i>Eucalyptus polyanthemos</i> and <i>Eucalyptus blakelyi</i> . Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	11 records within 10km (OEH 2014)	Possible. May utilise site for foraging at times, however no roost sites or preferred nesting trees available.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Ninox strenua</i>	Powerful Owl	V	-	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	1 record within 10km (OEH 2014)	Possible. Suitable habitat and hollows present on site.
<i>Pandion cristatus</i>	Eastern Osprey	V	M	Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	8 records within 10km (OEH 2014)	Unlikely. No suitable habitat or prey present at site.
<i>Pezoporus wallicus wallicus</i>	Eastern Ground Parrot	V	-	In NSW populations have declined and contracted to islands of coastal or subcoastal heathland and sedgeland habitats. The species is found in small numbers on the north coast (Broadwater, Bundjalung, Yuraygir NPs) and Myall Lakes on the central coast. The largest populations occur on the NSW south coast, particularly Barren Grounds NR, Budderoo NP, the Jervis Bay area and Nadgee NR. Small numbers are recorded at Morton and Ben Boyd NP and other areas on the south coast. Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and	2 records within 10km (OEH 2014)	Unlikely. No suitable habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				very dense (up to 90% projected foliage cover).		
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	-	In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains.	21 records within 10km (OEH 2014)	Unlikely. Suitable habitat not present.
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	13 records within 10km (OEH 2014)	Possible Preferred habitat at site and hollows for nesting and breeding
<i>Turnix melanogaster</i>	Black-breasted Button-quail	CE	V	The Black-breasted Button-quail prefers drier low closed forests including dry rainforests, vine forest and vine thickets. Understorey may be dense or sparse but has a deep moist leaf-litter layer.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat present at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Mammals						
<i>Aepyprymnus rufescens</i>	Rufous Bettong	V	-	The original range from Coen in north Queensland to central Victoria has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. Inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter.	3 records within 10km (OEH 2014)	Unlikely. Only marginal habitat present at the site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable roosting habitat present at site.
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat	V	-	In north east NSW it extends from Port Macquarie in the south, north to the Queensland border. The species has been recorded as far west as Armidale and Ashford. Occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Because it flies fast below the canopy level, forests with naturally sparse understorey layers may provide the best habitat.	4 records within 10km (OEH 2014)	Possible. Suitable habitat present.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den subject sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.	Predicted to occur within 10km (DotE 2014) 3 records within 10km (OEH 2014)	Possible. Some suitable habitat but densely vegetated creeklines absent. May occasionally utilise site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill 2008, Law et al 2008).	3 records within 10km (OEI 2014)	Unlikely. Preferred habitat not present at site.
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats (Churchill 2008, Hoyer and Hall 2008).	19 records within 10km (OEI 2014)	Possible. Many records within locality and suitable habitat present
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	2 records within 10km (OEI 2014)	Possible. Some habitat present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).	1 record within 10km (OEH 2014)	Possible. Roosting and foraging habitat present on site.
<i>Myotis macropus</i>	Southern Myotis	V	-	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).	2 records within 10km (OEH 2014)	Unlikely. No foraging habitat on site and no permanent waterways.
<i>Nyctophilus bifax</i>	Eastern Long-eared Bat	V	-	In NSW they appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour. The species can be locally common within its restricted range. Lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest.	2 records within 10km (OEH 2014)	Possible. Some preferred habitat present on site.
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with	55 records within 10km (OEH 2014)	Likely. Many records in locality. Some preferred habitat present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.		
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin et al 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004).	10 records within 10km (OEH 2014)	Likely. Many records in locality. Some preferred habitat present on site.
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west to the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	3 records within 10km (OEH)	Possible. Some records in locality. Some preferred habitat present on site.
<i>Phascolarctos cinereus</i>	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	Predicted to occur within 10km (DotE 2014) 58 records within 10km (OEH 2014)	Likely. Previously observed very close to site. Some preferred feed trees present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Planigale maculata</i>	Common Planigale	V	-	Coastal north-eastern NSW, coastal east Queensland and Arnhem Land. The species reaches its confirmed southern distribution limit on the NSW lower north coast however there are reports of its occurrence as far south as the central NSW coast west of Sydney. Inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water.	1 record within 10km (OEH)	Possible. Some preferred habitat present on site.
<i>Potorous tridactylus</i>	Long-Nosed Potoroo	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	Predicted to occur within 10km (DotE 2014)	Unlikely. Minimal suitable habitat present on site.
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	V	-	In NSW the Eastern Chestnut Mouse mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. There are however isolated records in the Jervis bay area. Mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands.	1 record within 10km (OEH)	Unlikely. Minimal suitable habitat present on site.
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in	Predicted to occur within 10km (DotE 2014)	Unlikely. Minimal suitable habitat present on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
				size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).		

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	Predicted to occur within 10km (DotE 2014) 10 records within 10km (OEH 2014)	Likely. Potentially uses site for foraging habitat. Many records nearby.
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	2 records within 10km (OEH 2014)	Possible. Foraging habitat present and some large hollows available for roosting.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).	4 records within 10km (OEH 2014)	Possible. Foraging habitat present and some large hollows available for roosting.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
<i>Thylogale stigmatica</i>	Red-legged Pademelon	V	-	Patchily distributed along coastal and subcoastal eastern Australia from Cape York to the Hunter Valley in NSW. Southern range records are from the Watagan Mountains and the Wyong district. There are unconfirmed records from the western New England Tablelands (e.g. west of Emmaville). This species is also found in New Guinea. Inhabits forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub.	3 records within 10km (OEH 2014)	Unlikely. Minimal suitable habitat present at the site.
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	1 record within 10km (OEH 2014)	Unlikely. Suitable habitat not present at the site.
<i>Xeromys myoides</i>	Water Mouse	-	V	Although the Water Mouse had been documented in three distinct locations (Northern Territory, Central south Queensland, south-east Queensland) they require similar habitat including mangroves and the associated saltmarsh, sedgeland, clay pans, heathlands and freshwater wetlands. The main habitat difference at each location is the littoral, supralittoral and terrestrial vegetation which differs in structure and composition. These differences dictate the species' nesting behaviour.	Predicted to occur within 10km (DotE 2014)	Unlikely. No watercourses on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Frogs						
<i>Crinia tinnula</i>	Wallum Froglet	V	-	Wallum Froglets are found only in acid paperbark swamps and sedge swamps of the coastal 'wallum' country. In NSW the species extends from north of the Queensland border south to Kurnell (OEH 2012).	5 records within 10km (OEH 2014)	Unlikely. Minimal suitable habitat present at the site.
<i>Litoria brevipalmata</i>	Green-thighed Frog	V	-	Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland. Green-thighed Frogs 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 northern NSW and southern Queensland.	1 record within 10km (OEH 2014)	Unlikely. Minimal suitable habitat present at the site.
<i>Litoria olongburensis</i>	Olongburra Frog, Wallum Sedge Frog	V	V	This frog has been recorded in south-east Queensland and north-east NSW, from Lake Wonnegeel, Fraser Island south to Woolgoolga. It is found in ephemeral, semi-permanent and permanent wetlands with emergent reeds, ferns and/or sedges, in undisturbed coastal wallum. May also be found around creeks and freshwater lakes in coastal wallum.	Predicted to occur within 10km (DotE 2014) 2 records within 10km (OEH 2014)	Unlikely. Minimal suitable habitat present at the site.
<i>Mixophyes iteratus</i>	Giant Barred Frog	E	E	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable breeding or foraging habitat on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Reptiles						
<i>Hoplocephalus stephensii</i>	Stephens' Banded Snake	V	-	Coast and ranges from Southern Queensland to Gosford in NSW. Inhabits rainforest and eucalypt forests and rocky areas up to 950 m in altitude.	1 record within 10km (OEH 2014)	Possible. Some suitable habitat present.
<i>Coeranoscincus reticulatus</i>	Three-toed Snake-tooth Skink	V	V	The Three-toed Snake-tooth Skink occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. It is very uncommon south of Grafton. Inhabits rainforest and occasionally moist eucalypt forest, on loamy or sandy soils.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat on site.
Insects						
<i>Phyllodes imperialis smithersi</i>	Pink Underwing - moth	-	E	The Pink Underwing Moth is distributed from Nambour, south-east Queensland, to Dorrigo in northern. It is currently known from five locations, of which Mary Cairncross Scenic Reserve, near Maleny (Queensland), contains the only confirmed breeding habitat. This subspecies occurs within the Burnett Mary and South East (Queensland) and Northern Rivers (NSW) Natural Resource Management Regions. It is found below the altitude of 600 m in undisturbed, subtropical rainforest. It occurs in association with the vine <i>Carronia multiseppalea</i> , a collapsed shrub that provides the food and habitat the moth requires in order to breed.	Predicted to occur within 10km (DotE 2014)	Unlikely. No suitable habitat on site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat association	Nature of record	Presence on site
Fish						
<i>Epinephelus daemeli</i>	Black Cod	V	V	Adult Black Cod are usually found in caves, gutters and beneath bommies on rocky reefs. Smaller fish are found in coastal rock pools and around rocky estuaries.	Predicted to occur within 10km (DotE 2014)	Nil. No waterways on site.
<i>Nannoperca oxleyana</i>	Oxleyan Pygmy Perch		E		Predicted to occur within 10km (DotE 2014)	Nil. No waterways on site.

All information in this table is taken from NSW OEH and Commonwealth DoE Threatened Species profiles (OEH 2014, DoE 2014) unless otherwise stated. The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; EP – endangered population; CEEC – critically endangered ecological community; EEC – endangered ecological community, M- migratory, Ma – marine.

EPBC Act-listed migratory fauna known or predicted from the locality, habitat association and suitable habitat present at the subject site

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
Migratory Birds						
Wetland or Marine species						
<i>Apus pacificus</i>	Fork-tailed Swift	-	M	Recorded in all regions of NSW. Non-breeding, and almost exclusively aerial while in Australia. Occurs over urban and rural areas as well as areas of native vegetation.	Predicted to occur within 10km (DotE 2014)	Possible. Aerial species that may forage or fly over the study area.
<i>Ardea alba</i>	Great Egret	-	M	Occurs across NSW. Within NSW there are breeding colonies within the Darling Riverine Plains and Riverina regions, and minor colonies across its range including the north and north-east of the state. Reported from a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial).	Predicted to occur within 10km (DotE 2014)	Unlikely. No permanent or temporary water source at site.
<i>Ardea ibis</i>	Cattle Egret	-	M	Occurs across NSW. Principal breeding sites are the central east coast from Newcastle to Bundaberg. Also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Uses predominately shallow, open and freshwater wetlands with low emergent vegetation and abundant aquatic flora. Sometimes observed in swamps with tall emergent vegetation and commonly use areas of tall pasture in moist, low-lying areas.	Predicted to occur within 10km (DotE 2014)	Unlikely. No permanent or temporary water source at site.

Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of record	Presence on site
<i>Charadrius mongolus</i>	Lesser Sand Plover, Mongolian Plover	V	M	In Australia the species is found around the entire coast but is most common in the Gulf of Carpentaria, and along the east coast of Queensland and northern NSW. Individuals are rarely recorded south of the Shoalhaven estuary, and there are few inland records. It is almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms	Predicted to occur within 10km (DotE 2014)	Unlikely. Site is not coastal.
<i>Gallinago hardwickii</i>	Latham's Snipe		M	Occurs along the coast and west of the great dividing range. Non breeding visitor to Australia. Inhabit permanent and ephemeral wetlands up to 2000 m asl. Typically in open, freshwater wetlands with low, dense vegetation (incl. swamps, flooded grasslands and heathlands). Can also occur in saline/brackish habitats and in modified or artificial habitats close to human activity.	Predicted to occur within 10km (DotE 2014)	Unlikely. No permanent or temporary water source at site.
<i>Numenius phaeopus</i>	Whimbrel		M	Migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of Whimbrels in all regions. It is found in all states but is more common in the north. Often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas.	Predicted to occur within 10km (DotE 2014)	Unlikely. No permanent or temporary water source at site.
<i>Pluvialis fulva</i>	Pacific		M	Occurs along the east coast, especially along Queensland and New South Wales. Usually inhabits coastal habitats, though it	Predicted to occur within 10km	Unlikely. No permanent or temporary water

Scientific Name	Common Name	TSC/F M Act	EPBC Act	Habitat Association	Nature of record	Presence on site
	Golden Plover			occasionally occurs around inland wetlands. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass.	(DotE 2014)	source at site.
Terrestrial species						
<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle		M	Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).	Predicted to occur within 10km (DotE 2014)	Unlikely. No permanent or temporary water source at site.
<i>Hirundapus caudacutus</i>	White-throated Needletail		M	Recorded along NSW coast to the western slopes and occasionally from the inland plains. Breeds in northern hemisphere. Almost exclusively aerial while in Australia. Occur above most habitat types, but are more frequently recorded above more densely vegetated habitats (rainforest, open forest and heathland) than over woodland or treeless areas.	Predicted to occur within 10km (DotE 2014)	Possible Suitable habitat present at site.
<i>Merops ornatus</i>	Rainbow Bee-eater		M	Widespread across mainland Australia. Mainly inhabits open forests and woodlands and shrublands, often in proximity to permanent water. Also occurs in cleared/semi-cleared habitats including farmland and residential areas. Excavates a nest burrow in flat/sloping ground in banks of waterways, dams, roadside cuttings, gravel pits or cliff faces. Southern populations migrate north for winter after breeding.	Predicted to occur within 10km (DotE 2014)	Possible. May use site for foraging but limited nesting sites available.

Scientific Name	Common Name	TSC/F M Act	EPBC Act	Habitat Association	Nature of record	Presence on site
<i>Monarcha melanopsis</i>	Black-faced Monarch		M	Summer breeding migrant to south-east. Occurs along the coast of NSW. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating (Birds Australia 2005).	Predicted to occur within 10km (DoE 2014)	Unlikely. Minimal suitable habitat present at site and 15 km from coast.
<i>Monarcha trivirgatus</i>	Spectacled Monarch		M	The Spectacled Monarch is found in coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. It is much less common in the south. It prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Predicted to occur within 10km (DoE 2014)	Unlikely. Minimal suitable habitat present at site and 15 km from coast.
<i>Myiagra cyanoleuca</i>	Satin Flycatcher		M	In NSW widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests.	Predicted to occur within 10km (DoE 2014)	Possible. May use site at times, however not near water source.
<i>Rhipidura rufifrons</i>	Rufous Fantail		M	Found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas (Birds Australia 2008).	Predicted to occur within 10km (DoE 2014)	Unlikely. Minimal suitable habitat present at site and 15 km from coast.

All information in this table is taken from NSW OEH and Commonwealth Department of the Environment Threatened Species profiles (OEH 2014a, DoE 2014a) unless otherwise stated. The codes used in this table are: CE – critically endangered; E – endangered; V – vulnerable; EP – endangered population; CEEC – critically endangered ecological community; EEC – endangered ecological community; VEC- vulnerable ecological community, M - migratory.

Appendix B – Field survey results

Table 17 Flora species recorded within study area

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
Adiantaceae		<i>Adiantum formosum</i>	Giant Maidenhair	P	
		<i>Cheilanthes sieberi</i>	Rock Fern		
Anthericaceae		<i>Laxmannia gracilis</i>	Slender Wire Lily		
		<i>Thysanotus tuberosus</i>	Common Fringe-lily		
Apocynaceae		<i>Parsonsia straminea</i>	Common Silkpod		
Areaceae		<i>Archontophoenix cunninghamiana</i>	Bangalow Palm	P	
		<i>Livistona australis</i>	Cabbage Palm	P	
Aspleniaceae		<i>Asplenium australasicum</i>	Bird's Nest Fern	P	
Asteraceae		<i>Chrysocephalum apiculatum</i>	Common Everlasting		
		<i>Euchiton sphaericus</i>	Star Cudweed		
		<i>Lagenophora gracilis</i>	Slender Lagenophora		
		<i>Senecio</i> sp.	Groundsel, Fireweed		
Bignoniaceae		<i>Pandorea pandorana</i>	Wonga Wonga Vine		
Casuarinaceae		<i>Allocasuarina littoralis</i>	Black She-Oak		
Commelinaceae		<i>Murdannia graminea</i>			
Convolvulaceae		<i>Dichondra repens</i>	Kidney Weed		
Cunoniaceae		<i>Ceratopetalum gummiferum</i>	Christmas Bush	P	
Cyperaceae		<i>Gahnia aspera</i>	Rough Saw-sedge		
		<i>Gahnia clarkei</i>	Tall Saw-sedge		
		<i>Lepidosperma laterale</i>	Variable Sword-sedge		
Dennstaedtiaceae		<i>Hypolepis muelleri</i>	Harsh Ground Fern		
		<i>Pteridium esculentum</i>	Bracken		
Dicksoniaceae		<i>Calochlaena dubia</i>	Rainbow Fern		
Dilleniaceae		<i>Hibbertia marginata</i>	Bordered Guinea Flower	V,P	V
		<i>Hibbertia scandens</i>	Climbing Guinea Flower		
Elaeocarpaceae		<i>Tetradlea</i> sp.			
Ericaceae		<i>Leucopogon lanceolatus</i>			
		<i>Melichrus procumbens</i>	Jam Tarts		
		<i>Monotoca scoparia</i>			
		<i>Trochocarpa laurina</i>	Tree Heath		
Euphorbiaceae		<i>Homalanthus populifolius</i>			
		<i>Mallotus philippensis</i>	Red Kamala		
Fabaceae (Faboideae)		<i>Daviesia ulicifolia</i>	Gorse Bitter Pea		
		<i>Desmodium varians</i>	Slender Tick-trefoil		
		<i>Glycine clandestina</i>	Twining glycine		
		<i>Platylobium formosum</i>			
Fabaceae (Mimosoideae)		<i>Acacia complanata</i>	Flat-stemmed Wattle		
		<i>Acacia disparrima</i> subsp. <i>disparrima</i>	Brush Ironbark Wattle		

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
		<i>Acacia falcata</i>			
		<i>Acacia leiocalyx</i> subsp. <i>leiocalyx</i>	Curracabah		
		<i>Acacia</i> sp.	Wattle		
Lamiaceae		<i>Plectranthus graveolens</i>			
Lobeliaceae		<i>Lobelia dentata</i>			
		<i>Pratia purpurascens</i>	Whiteroot		
Lomandraceae		<i>Lomandra filiformis</i>	Wattle Matt-rush		
		<i>Lomandra longifolia</i>	Spiny-headed Mat-rush		
		<i>Lomandra multiflora</i> subsp. <i>multiflora</i>	Many-flow ered Mat-rush		
Luzuriagaceae		<i>Eustrephus latifolius</i>	Wombat Berry		
Menispermaceae		<i>Stephania japonica</i>	Snake vine		
Myrtaceae		<i>Acmena smithii</i>	Lilly Pilly		
		<i>Angophora paludosa</i>			
		<i>Angophora woodsiana</i>			
		<i>Corymbia gummifera</i>	Red Bloodw ood		
		<i>Corymbia henryi</i>	Large-leaved Spotted Gum		
		<i>Corymbia intermedia</i>	Pink Bloodw ood		
		<i>Eucalyptus acmenoides</i>	White Mahogany		
		<i>Eucalyptus carnea</i>	Thick-leaved Mahogany		
		<i>Eucalyptus microcorys</i>	Tallow w ood		
		<i>Eucalyptus pilularis</i>	Blackbutt		
		<i>Eucalyptus resinifera</i>	Red Mahogany		
		<i>Eucalyptus robusta</i>	Sw amp Mahogany		
		<i>Leptospermum polygalifolium</i>	Tantoon		
		<i>Leptospermum trinervium</i>	Slender Tea-tree		
		<i>Lophostemon suaveolens</i>	Sw amp Mahogany		
		<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark		
		<i>Syncarpia glomulifera</i>	Turpentine		
Oleaceae		<i>Jasminum volubile</i>			
Orchidaceae		<i>Dendrobium</i> sp.		P	
Oxalidaceae		<i>Oxalis perennans</i>			
Phormiaceae		<i>Dianella caerulea</i>	Blue Flax-lily		
		<i>Dianella caerulea</i> var. <i>producta</i>			
Phyllanthaceae		<i>Breynia oblongifolia</i>	Coffee Bush		
		<i>Glochidion ferdinandi</i>	Cheese Tree		
		<i>Poranthera microphylla</i>	Small Poranthera		
Pittosporaceae		<i>Bursaria spinosa</i>	Native Blackthorn		
		<i>Pittosporum multiflorum</i>	Orange Thorn		
Plantaginaceae		<i>Veronica cinerea</i>	Hairy Speedw ell		
Poaceae		<i>Austrostipa pubescens</i>			
		<i>Echinopogon ovatus</i>	Forest Hedgehog Grass		

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status
		<i>Entolasia marginata</i>	Bordered Panic		
		<i>Entolasia stricta</i>	Wiry Panic		
		<i>Imperata cylindrica</i>	Blady Grass		
		<i>Microlaena stipoides</i>	Weeping Grass		
		<i>Oplismenus aemulus</i>			
		<i>Oplismenus imbecillis</i>			
		<i>Panicum simile</i>	Two-colour Panic		
		<i>Themeda australis</i>	Kangaroo Grass		
Proteaceae		<i>Lomatia silaifolia</i>	Crinkle Bush	P	
		<i>Persoonia conjuncta</i>		P	
		<i>Persoonia levis</i>	Broad-leaved Geebung	P	
Rhamnaceae		<i>Alphitonia excelsa</i>	Red Ash		
Rosaceae		<i>Rubus moluccanus</i> var. <i>trilobus</i>	Molucca Bramble		
Rubiaceae		<i>Pomax umbellata</i>	Pomax		
Rutaceae		<i>Acronychia imperforata</i>	Logan Apple		
		<i>Zieria minutiflora</i> subsp. <i>minutiflora</i>			
Sapindaceae		<i>Dodonaea viscosa</i> subsp. <i>cuneata</i>	Wedge-leaf Hop-bush		
Smilacaceae		<i>Smilax australis</i>	Lawyer Vine		
		<i>Smilax glycyphylla</i>	Sweet Sarsaparilla		
Verbenaceae	*	<i>Lantana camara</i>	Lantana		
Violaceae		<i>Viola hederacea</i>	Ivy-leaved Violet		
Xanthorrhoeaceae		<i>Xanthorrhoea</i> sp.		P	

Key – P = protected species, V= vulnerable species

NB – The field survey results above relate to a previous reiteration of the development footprint (a larger area was originally proposed) and includes species not present in the current area of impact.

Table 18 Fauna species recorded within the study area

Class	Scientific Name	Common Name	NSW Status	EPBC Status
Aves	<i>Pardalotus striatus</i>	Striated Pardalote	P	
Aves	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P	
Aves	<i>Philemon corniculatus</i>	Noisy Friarbird	P	
Aves	<i>Entomyzon cyanotis</i>	Blue-faced Honeyeater	P	
Aves	<i>Rhipidura leucophrys</i>	Willie Wagtail	P	
Aves	<i>Pachycephala rufiventris</i>	Rufous Whistler	P	
Aves	<i>Oriolus sagittatus</i>	Olive-backed Oriole	P	
Aves	<i>Meliphaga lewinii</i>	Lewin's Honeyeater	P	
Aves	<i>Merops ornatus</i>	Rainbow Bee-eater	P	M
Aves	<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted Lorikeet	P	
Reptilia	<i>Varanus varius</i>	Lace Monitor	P	
Aves	<i>Alectura lathami</i>	Australian Brush-turkey	P	
Aves	<i>Rhipidura albiscapa</i>	Grey Fantail	P	
Aves	<i>Neochmia temporalis</i>	Red-browed Finch	P	
Aves	<i>Eopsaltria australis</i>	Eastern Yellow Robin	P	
Aves	<i>Myzomela sanguinolenta</i>	Scarlet Honeyeater	P	
Aves	<i>Coracina tenuirostris</i>	Cicadabird	P	
Aves	<i>Sericornis frontalis</i>	White-browed Scrubwren	P	
Aves	<i>Myiagra rubecula</i>	Leaden flycatcher	P	
Aves	<i>Colluricincla harmonica</i>	Grey Shrike-thrush	P	

Key- P= protected M= migratory

NB – The field survey results above relate to a previous reiteration of the development footprint (a larger area was originally proposed) and may include species not present in the current area of impact.

Development site plot/transect data

Vegetation Zone	Veg Type ID	Plot ID	Native plant species richness	Native over-storey cover	Native mid-storey cover	Native ground cover (grasses)	Native ground cover (shrubs)	Native ground cover (other)	Exotic plant cover	Number of trees with hollows	Overstorey regeneration	Total length of fallen logs	Easting	Northing	Zone
1	NR114	1	34	31	55	32	4	28	0	3	0.71	85	518775	6758077	56
		2	31	16	55.5	22	4	10	0	4	0.71	61	518849	6758109	56
		3	37	19	62.5	38	10	38	0	8	0.71	55	518718	6758157	56
2	NR123	4	32	27	45.5	52	4	14	0	6	1	28	518795	6758212	56
		5	40	31	51.5	58	30	60	0	5	1	30	518590	6758521	56
		6	39	35	56.5	54	18	18	0	7	1	23	518440	6758474	56
3	NR254	7	35	27	71	22	12	56	8	2	1	79	518405	6758385	56

Appendix C – EPBC Act Protected Matters Search



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 16/03/15 12:51:57

[Summary](#)

[Details](#)

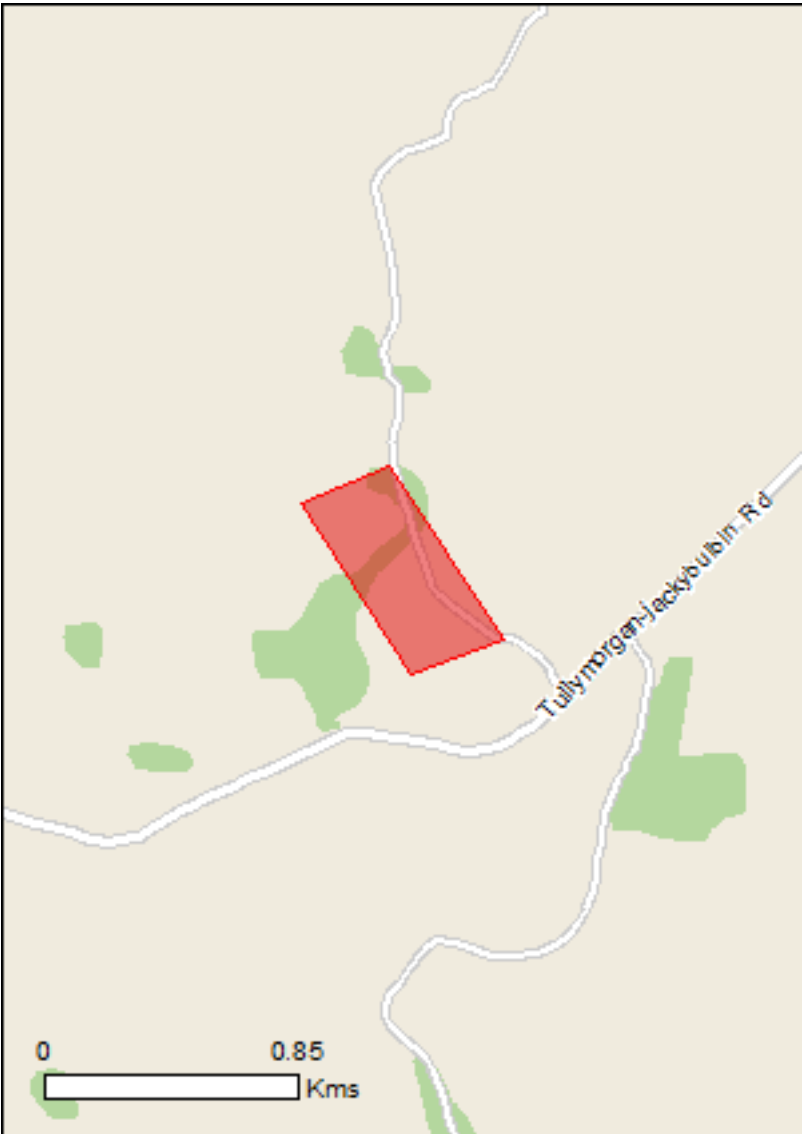
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

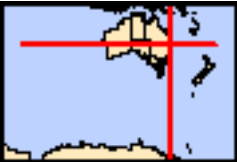
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Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	56
Listed Migratory Species:	38

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As [heritage values](#) of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	38
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	2
State and Territory Reserves:	6
Regional Forest Agreements:	1
Invasive Species:	39
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora epomophora Southern Royal Albatross [25996]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora sanfordi Northern Royal Albatross [82331]	Endangered	Species or species habitat may occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemeli Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Nannoperca oxleyana Oxleyan Pygmy Perch [64468]	Endangered	Species or species habitat likely to occur within area
Frogs		
Litoria olongburensis Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
Insects		
Phyllodes imperialis smithersi Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Allocasuarina defungens Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Cryptocarya foetida Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area
Gossia fragrantissima Sweet Myrtle, Small-leaved Myrtle [78867]	Endangered	Species or species habitat likely to occur within area
Hibbertia marginata [21970]	Vulnerable	Species or species habitat likely to occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat likely to occur within area
Melichrus sp. Gibberagee (Benwell 97239) Narrow-leaf Melichrus [86881]	Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat may occur within area
Paspalidium grandispiculatum a grass [10838]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Prostanthera palustris Swamp Mint-bush [66703]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat may occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

Places on the RNE		[Resource Information]
Note that not all Indigenous sites may be listed.		
Name	State	Status
Natural		
Lower Clarence River Area	NSW	Indicative Place
Jerusalem Creek Area	NSW	Registered

State and Territory Reserves		[Resource Information]
Name	State	
Bundjalung	NSW	
Bundjalung	NSW	
Chatsworth Hill	NSW	
FMA s in CASINO	NSW	
Mororo Creek	NSW	
UNE Special Management Zone No1	NSW	

Regional Forest Agreements		[Resource Information]
Note that all areas with completed RFAs have been included.		
Name	State	
North East NSW RFA	New South Wales	

Invasive Species		[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.		
Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur

Name	Status	Type of Presence
Vulpes vulpes Red Fox, Fox [18]		within area Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss,		Species or species

Name	Status	Type of Presence
Kariba Weed [13665]		habitat likely to occur within area
Senecio madagascariensis		
Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Bundjalung National Park	NSW

Coordinates

-29.30168 153.19264,-29.3062 153.19604,-29.30707 153.19321,-29.3026 153.18997,
-29.30168 153.1926,-29.30168 153.19264

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Department of Environment, Climate Change and Water, New South Wales](#)
- [Department of Sustainability and Environment, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment and Natural Resources, South Australia](#)
- [Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [Environmental and Resource Management, Queensland](#)
- [Department of Environment and Conservation, Western Australia](#)
- [Department of the Environment, Climate Change, Energy and Water](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [SA Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Atherton and Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [State Forests of NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

Appendix D – Biodiversity credit report

Biodiversity credit report



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

Date of report: 23/02/2015

Time: 11:21:26AM

Calculator version: v4.0

Major Project details

Proposal ID:	0082/2014/1471MP
Proposal name:	Sly's Quarry
Proposal address:	Tullymorgan-Jackbulbin Road Mororo NSW
Proponent name:	Newman Quarry
Proponent address:	
Proponent phone:	0265868714
Assessor name:	Daniel Williams
Assessor address:	Level 1, 62 Clarence Street Port Macquarie NSW 2444
Assessor phone:	6586 8714
Assessor accreditation:	0082

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion	4.23	283.00
Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion	6.27	485.00
Total	10.50	768

Credit profiles

1. Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion, (NR114)

Number of ecosystem credits created	283
IBRA sub-region	Clarence Sandstones

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion, (NR114) Blackbutt - bloodwood dry heathy open forest on sandstones of the northern NSW North Coast Bioregion, (NR115) Blackbutt - Spotted Gum shrubby open forest on sandstones of the lower Clarence Valley of the NSW North Coast Bioregion, (NR118) Pink Bloodwood - Red Mahogany - Smudgy Apple shrubby open forest on sandstone of northern NSW North Coast Bioregion, (NR218)	Clarence Sandstones and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion, (NR123)

Number of ecosystem credits created

485

IBRA sub-region

Clarence Sandstones

Offset options - Plant Community types	Offset options - IBRA sub-regions
Angophora paludosa shrubby forest and woodland on sandstone or sands of the NSW North Coast Bioregion, (NR101) Angophora robur shrubby forest and woodland on sandstones of the NSW North Coast Bioregion, (NR102) Bailey's Stringybark - Needlebark Stringybark heathy woodland on sandstones of the lower Clarence Valley of the NSW North Coast Bioregion, (NR104) Blackbutt - bloodwood dry heathy open forest on Quaternary sands of the northern NSW North Coast Bioregion, (NR114) Blackbutt - bloodwood dry heathy open forest on sandstones of the northern NSW North Coast Bioregion, (NR115) Blackbutt - Spotted Gum shrubby open forest on sandstones of the lower Clarence Valley of the NSW North Coast Bioregion, (NR118) Blackbutt - Turpentine dry heathy open forest on sandstones of the lower Clarence of the NSW North Coast Bioregion, (NR123) Needlebark Stringybark - Large-fruited Blackbutt heathy open forest on sandstones of the northern NSW North Coast Bioregion, (NR199) Needlebark Stringybark - Red Bloodwood heathy woodland on sandstones of the lower Clarence of the NSW North Coast Bioregion, (NR200) Needlebark Stringybark - Turpentine heathy open forest of the Clarence lowlands of the NSW North Coast Bioregion, (NR201) Pink Bloodwood - Red Mahogany - Smudgy Apple shrubby open forest on sandstone of northern NSW North Coast Bioregion, (NR218) Scribbly Gum - Red Bloodwood heathy open forest of the coastal lowlands of the NSW North Coast Bioregion, (NR228)	Clarence Sandstones and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Bordered Guinea Flower	Hibbertia marginata	1,190.00	16,660
Koala	Phascolarctos cinereus	10.50	273
Squirrel Glider	Petaurus norfolcensis	10.50	231
Common Planigale	Planigale maculata	10.50	273

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A Ayres	Dan Williams	<i>Dan Williams</i>	S Law er	<i>S Law er</i>	20/03/2015
1	A Ayres	Dan Williams		S Law er		01/05/2015

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