APPENDIX J

Biodiversity Assessment Reports and Offset Strategy

BIODIVERSITY ASSESSMENT REPORT

PREPARED FOR
THE REVISED MARTINS CREEK QUARRY EXTENSION PROJECT

MARTINS CREEK

MAY 2021
REF: 21037

BIODIVERSITY ASSESSMENT REPORT

PREPARED FOR
THE REVISED MARTINS CREEK QUARRY
EXTENSION PROJECT

MARTINS CREEK

MAY 2021

Conacher Consulting Pty Ltd

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PREFACE

Conacher Consulting has been engaged to prepare a Biodiversity Assessment Report for the proposed revised Martins Creek Quarry Extension Project as part of the Amended Development Application and Response to Submissions (ADA & RTS) for the Project.

The Martins Creek Quarry Extension Project is a State Significant Development under the *Environmental Planning and Assessment Act* (1979) (Application Number SSD 6612) and this Biodiversity Assessment Report has been prepared by *Conacher Consulting* to address the Secretary's Environmental Assessment Requirements in relation to Biodiversity.

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KEY ABBREVIATIONS AND TERMS

AGDoEE	Australian Government Department of the Environment and Energy (Now known as DAWE)
BC Act	*Biodiversity Conservation Act* 2016
CEEC	Critically endangered ecological community listed within the *BC Act* or the *EPBC Act*
DAWE	Australian Government Department of Agriculture, Water and the Environment
Development Footprint	The area of land that is directly impacted on by a proposed Major Project that is under the *EP&A Act*, including access roads, and areas used to store construction materials. Also referred to within this Report as the Proposed Disturbance Area.
Development Site	The area of land that is subject to a proposed Major Project that is under the *EP&A Act*. Also referred to within this Report as the Project Area.
DPIE	NSW Department of Planning, Industry and Environment
Ecosystem Credit	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site
EEC	Endangered ecological community listed within the *BC Act* or the *EPBC Act*
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act* 1979
EPBC Act	*Environment Protection and Biodiversity Conservation Act* 1999
FBA	Framework for Biodiversity Assessment (OEH 2014a)
OEH	NSW Office of Environment and Heritage (Now Known as DPIE)
SSD	State Significant Development
SEARS	Secretary's Environmental Assessment Requirements
TSC Act	*Threatened Species Conservation* Act 1995 (Now repealed by the *BC Act*)
VEC	Vulnerable ecological community listed within the *BC Act* or the *EPBC Act*.
PCT	Plant Community Type
Species Credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates.

Note: For additional definitions in relation to key assessment terms used please refer to the published FBA documentation (NSW OEH 2014a).

SECTION 1

INTRODUCTION

1.1 BACKGROUND AND STUDY AIMS

Conacher Consulting has been engaged to prepare a Biodiversity Assessment Report for the proposed revised Martins Creek Quarry Extension Project as part of the Amended Development Application and Response to Submissions (ADA & RTS) for the Project, to address the Secretary's Environmental Assessment Requirements (SEARS) in relation to Biodiversity. The proposed development is State Significant Development (SSD) under the *Environmental Planning and Assessment Act* 1979 (*EP&A Act*) (Application Number SSD 6612).

This Report supersedes the previous Biodiversity Assessment Report prepared by *Conacher Consulting* (2016) and has been prepared to provide additional information and an assessment of a reduced impact footprint. The format and content of this Report has been prepared to ensure compliance with Tables 20 and 21 of the Framework for Biodiversity Assessment (NSW OEH 2014a).

The biodiversity assessment requirements for the proposal are set out in the revised Secretary's Environmental Assessment Requirements dated 4 August 2016. This report has been prepared to:

1. Identify the flora and fauna characteristics of the site;
2. Provide biodiversity impact assessments in accordance with the NSW Framework for Biodiversity Assessment (NSW OEH 2014a) and the NSW Biodiversity Offsets Policy for Major Projects (NSW OEH 2014b), as required by the Secretary's Environmental Assessment Requirements (SEARs); and
3. Address the Guidelines for preparing Assessment Documentation relevant to the *Environment Protection and Biodiversity Conservation Act* 1999 (*EPBC Act*) provided by the Department of the Environment.

The proponent's Biodiversity Offset Strategy is provided as separate documentation to this Report (Conacher Consulting 2021).

The NSW Framework for Biodiversity Assessment is an accredited assessment process under the *EPBC Act* NSW Assessment Bilateral Agreement. This report also provides the information identified in the Guidelines for preparing Assessment Documentation relevant to the *EPBC Act*, provided as part of the SEARs.

1.2 PROPOSED DEVELOPMENT AND DEVELOPMENT FOOTPRINT

The development assessed in this report is the revised Martins Creek Quarry Extension Project. The proposal seeks approval for the extension of the existing quarry.

The EIS for the original Project was publicly exhibited in late 2016. Following detailed analysis of Agency and community feedback, the Proponent committed to key project design changes and additional mitigation and management measures to minimise the Project's environmental and social amenity impacts. This included reductions in proposed extraction limits, quarry operating hours and truck movements.

Following further community engagement and feedback during 2018 and 2019 and the changes to the quarry operations in September 2019, the Proponent has undertaken further

assessment of potential amendments to the Project, including a modification and reduction to the proposed disturbance area. As a result, the revised Project now includes a number of further amendments in terms of:

- Further reduction in road transportation volumes and peak hourly truck movements;
- Further reduction in operating hours;
- Reduced disturbance footprint, including a reduction in the extent of native vegetation clearing proposed; and
- Reduced proposed quarry operation approval term to 25 years from 30 years.

The Project Area and the Proposed Disturbance Area are mapped in Figure 1.1. Some of the key features of the revised Project include:

- Expanding the existing quarry to extract and process up to 1.1 million tonnes per annum (Mtpa) of hard rock material over 25 years;
- Transporting up to 500,000 tonnes per annum (tpa) of quarry product via public roads, with up to 600,000 tpa product transported via rail;
- Extension of the rail spur to facilitate longer trains to transport more Quarry product.;
- Construction and use of a new access road and bridge crossing from Dungog Road, over the North Coast rail line, to allow for all heavy vehicle movements via a new site access;
- Road improvements at the Dungog Road / Gresford Road intersection; and
- Operating hours from 7.00 am to 6.00 pm Monday to Saturday, apart from road haulage of Quarry product which will only occur Monday to Friday and rail haulage 24/7.

Further details of the proposal are provided in the ADA & RTS prepared for the proposal by Umwelt (2021a).

1.3 GENERAL DESCRIPTION OF THE PROJECT AREA

The development site is located in the Dungog local government area at Martins Creek. The development site contains an existing quarry. The planning and cadastral details of the development site are provided in Table 1.1.

TABLE 1.1
SITE DETAILS

Project Area Subject Allotments	Lots 2, 5 & 6 DP 242210 Lot 42 DP 815628 Lot 21 DP 773220 Lot 1 DP 1006375 Lot 1 DP 204377
Project Area	127.80ha
Proposed Disturbance Area	66.05 ha
Area of Native Vegetation within the Proposed Disturbance Area	21.13 ha
State	New South Wales
Local Government Area	Dungog
Major Catchment Area	Hunter – Central Rivers
Existing Land Use	Extractive industries

1.4 LEGISLATIVE CONTEXT

1.4.1 *Relevant Commonwealth Legislation*

i. *Environment Protection and Biodiversity Conservation Act* 1999

A referral has been submitted for the Project in accordance with the *EPBC Act* to the Australian Government Department of Agriculture, Water and the Environment (DAWE). Based on the initial project design and larger impact footprint, it was determined that the proposed development is a controlled action and requires assessment and approval under the *EPBC Act*.

For SSD, the Commonwealth assessment process is integrated with the NSW assessment process in accordance with the Assessment Bilateral Agreement between the Commonwealth of Australia and the State of New South Wales made under Section 45 of the *EPBC Act*.

The Framework for Biodiversity Assessment (NSW OEH 2014a) and NSW Biodiversity Offsets Policy for Major Projects (NSW OEH 2014b) are to be utilised for the assessment of the proposal in accordance with the Assessment Bilateral Agreement. The supplementary assessment requirements provided by DAWE in the SEARS are also addressed within this report.

1.4.2 *Relevant State Legislation*

i. *Environmental Planning and Assessment Act* 1979

The proposed development is classed as SSD under the *EP&A Act*.

The likely impacts of the proposed development on biodiversity are required to be addressed in accordance with the SEARs.

The SEARs have identified that the EIS must address the following specific matters in relation to Biodiversity:

- An assessment of the likely biodiversity impacts of the Project, having regard to OEH's (now Department of Planning, Industry and Environment (DPIE)) and the Commonwealth Department of the Environment's (DoE) (now Department of Agriculture, Water and the Environment (DAWE)) requirements (as per Attachment 2 of the revised SEARS dated 4 August 2016);
- An offset strategy prepared in accordance with OEH (now DPIE) and DoE (now DAWE) requirements.

This report provides a biodiversity impact assessment in accordance with the NSW Framework for Biodiversity Assessment (NSW OEH 2014a) (FBA). A Biodiversity Offset Strategy for the proposal has been provided as separate documentation to this report (Conacher Consulting 2021). The biodiversity offsets for the Project will be delivered in consultation with DPIE, BCD and the Biodiversity Conservation Trust (BCT). A formal credit equivalency assessment will be undertaken once the Project is approved, which will require an application to have the FBA credit requirement converted to BAM credits through an *Assessment of Reasonable Equivalence*. The following credit retirement options are available to satisfy the Project offset requirements under the Biodiversity Offsets Scheme:

- Securing (purchasing) credits from the establishment of Biodiversity Stewardship Site/s (and subsequent retirement of credits) or by retiring credits from already

established Stewardship Sites, in accordance the offset rules documented in section 6.3 and 6.4 of the *Biodiversity Conservation Regulation 2017*.
- Funding a *Biodiversity Conservation Action* in accordance with section 6.2 of the *Biodiversity Conservation Regulation 2017*, and/or
- Paying into to the Biodiversity Conservation Fund (BCF).

A comprehensive Biodiversity Offset Strategy (BOS) for the Project has been under development for several years as the Project was subject to environmental assessment. The work completed to date for the offset strategy has included desktop assessment, extensive field surveys (including targeted surveys and FBA Biometric plots) across five potential sites, application of the FBA Credit Calculator using FBA Biometric plots, GIS analysis of native vegetation extent and habitat connectivity (as per the FBA), GIS mapping and reporting. The five potential offset sites occur directly adjacent to the proposed Project Area and were found to support suitable PCTs and threatened species habitat required for the Project.

ii. *Biodiversity Conservation Act* 2016

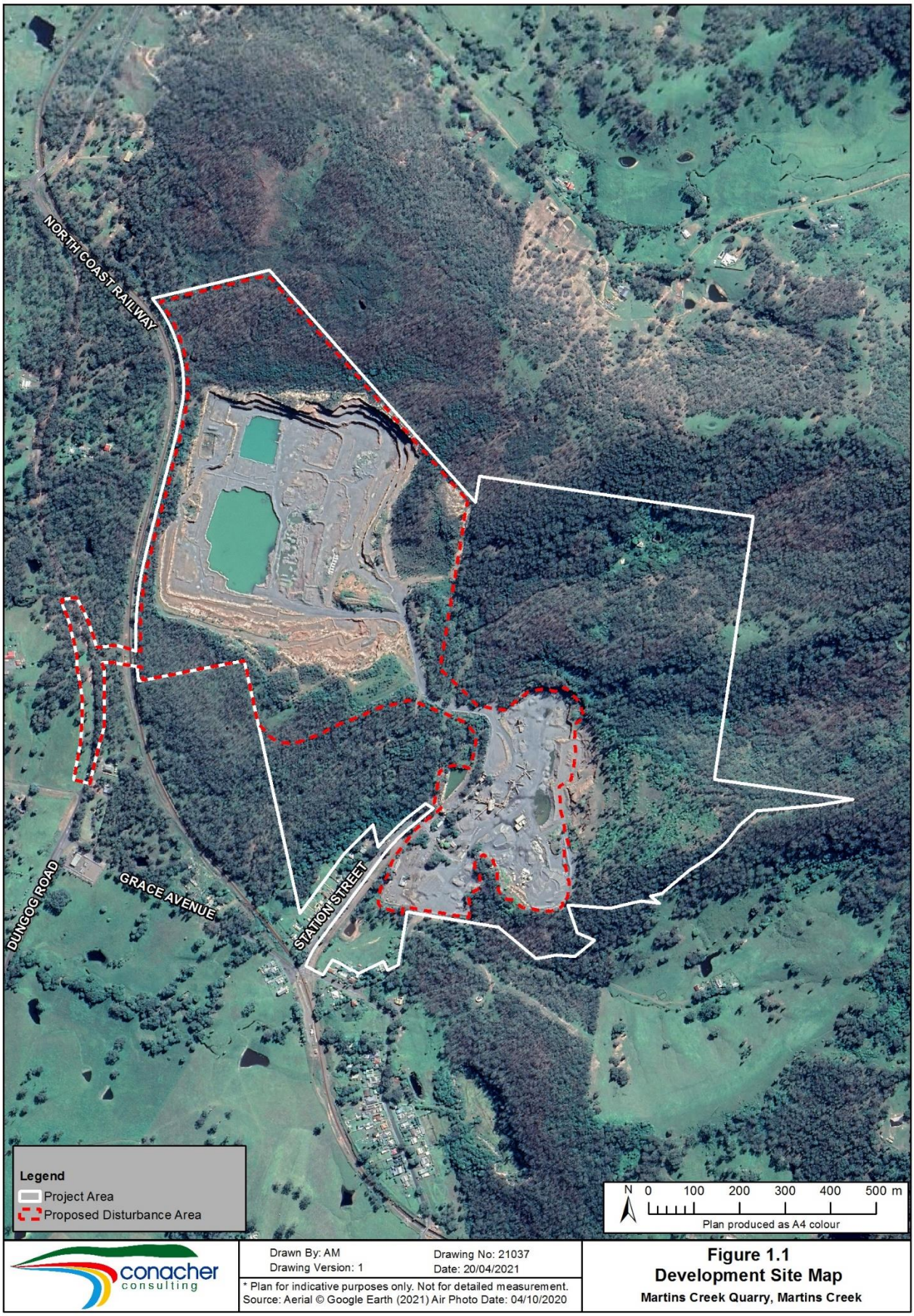
The *Biodiversity Conservation Act 2016* (BC Act) lists threatened species, threatened ecological communities and key threatening processes. This Act also provides for the declaration of areas of outstanding biodiversity value.

The proposal is being assessed in accordance with the provisions of the *Biodiversity Conservation (Savings and Transitional) Regulation* 2017.

1.5 SOURCES OF INFORMATION USED IN THIS ASSESSMENT

The reports and spatial data reviewed as part of this assessment are listed in the References Section of this Report. The following the ecological reports and vegetation mapping was specifically reviewed as part of the preparation of this Biodiversity Assessment Report:

- Ecotone Ecological Consultants 2010, Flora and Fauna Impact Assessment for Proposed New Sedimentation Structures at Martins Creek Quarry, Dungog LGA. Unpublished Draft Report prepared for R W Corkery & Co. Pty Ltd on behalf of Railcorp.
- Umwelt Environmental Consultants 2009, Ecological Constraints Analysis, Martins Creek Quarry. Unpublished Report prepared for Railcorp.
- Sivertsen, D., Roff, A., Somerville, M., Thonell, J., and Denholm, B. 2011, Greater Hunter Native Vegetation Mapping. Office of Environment and Heritage, Department of Premier and Cabinet, Sydney, Australia.


NORTH COAST RAILWAY
DUNGOG ROAD
GRACE AVENUE
STATION STREET
Legend
Project Area
Proposed Disturbance Area
N
0
100
200
300
400
500 m
Plan produced as A4 colour
conacher consulting
Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 1.1
Development Site Map
Martins Creek Quarry, Martins Creek

SECTION 2

LANDSCAPE FEATURES

2.1 IBRA BIOREGION & SUBREGION

The Project Area is located within the New South Wales North Coast IBRA Bioregion and within the Upper Hunter IBRA Subregion. The IBRA Subregion mapping relative to the Project Area is shown in Figures 2.1 and 2.2.

2.2 NSW LANDSCAPE REGION

The NSW Landscape Regions relative to the Project Area are mapped in Figures 2.3 and 2.4. The proposed disturbance area is predominantly located and has been assessed as within the Scone – Gloucester Foothills NSW Landscape Region. Part of the proposed disturbance area is also located within the Newcastle Coastal Ramp Landscape Region.

2.3 NATIVE VEGETATION EXTENT IN THE OUTER ASSESSMENT CIRCLE

The native vegetation extent within the proposed disturbance area is approximately 21.13 ha.

An inner and outer assessment circle combination of 200 ha and 2000 ha was assessed.

The native vegetation extent before development in the outer assessment circle has been mapped in Figure 2.5 as 1020.1 ha. The percentage of native vegetation cover within the outer assessment circle is 51 percent (51-55%).

The native vegetation extent before development in the inner assessment circle has been mapped in Figure 2.5 as 133.3 ha. The percentage of native vegetation cover within the inner assessment circle is 66.7 percent (66-70%).

2.4 CORRELATION OF AERIAL PHOTOGRAPH WITH MAPPED VEGETATION

Google Earth Imagery dated 4 October 2020 was utilised for the mapping of the native vegetation within the proposed disturbance area and assessment circles. No differences between the imagery used and the extent of vegetation were detected during site investigations.

2.5 RIVERS & STREAMS CLASSIFIED ACCORDING TO STREAM ORDER

The proposed disturbance area contains mapped first, second and third order streams classified according to Strahler (1952), these are shown in Figure 2.6 and Figure 2.7.

2.6 WETLANDS WITHIN, ADJACENT TO & DOWNSTREAM OF THE PROPOSED DISTURBANCE AREA

There are no important or local wetlands within or adjacent to the proposed disturbance area. There are no important or local wetlands located adjacent to or downstream of the proposed disturbance area within the outer assessment circle.

2.7 LANDSCAPE VALUE SCORE COMPONENTS

2.7.1 *Identification of Assessment Method Applied*

The site-based assessment method was applied for this Biodiversity Assessment Report.

2.7.2 *Percent Native Vegetation Cover in the Landscape*

The proposal will result in the clearing of approximately 21.13 ha of native vegetation which will reduce the native vegetation cover percentage from approximately 51% (51-55%) to 49.9% (46-50%) within the outer assessment circle and from approximately 66.7% (66-70%) to 56% (56-60%) within the inner assessment circle. The Percent Native Score is 1.75.

2.7.3 *Connectivity Value*

The proposed disturbance area does not contain any identified state or regional biodiversity linkages identified in Appendix 4, Table 10 of the FBA (NSW OEH 2014a). A site based assessment was completed in accordance with Steps 3-9 in Appendix 4 of the FBA (NSW OEH 2014a). There are two connecting linkages through the proposed disturbance area which will be impacted. These connecting links are mapped in Figure 2.8 as Connecting Linkages A and B. An assessment of the impacts to these connecting linkages is provided in Table 2.1. The score for connectivity value is 4.

TABLE 2.1
DETAILS OF CONNECTING LINKAGES

Connecting Linkages	Current Linkage Width Classes	Future Linkage Width Classes	Current Linkage Condition Classes	Future Linkage Condition Classes	Connectivity Value Score
Link A	0 – 5 Very Narrow (due to the existing haul road)	0 – 5 Very Narrow (no threshold classes crossed)	Overstorey: % foliage cover within benchmark Midstorey / Ground cover: % foliage cover within benchmark	Overstorey: % foliage cover within benchmark Midstorey / Ground cover: % foliage cover within benchmark (No threshold classes crossed)	**0**
Link B	>30-100m (55m) Moderate	0 – 5 Very Narrow (2 threshold classes crossed)	Overstorey: % foliage cover within benchmark Midstorey / Ground cover: % foliage cover within benchmark	Overstorey: % foliage cover within benchmark Midstorey / Ground cover: % foliage cover within benchmark (No threshold classes crossed)	**4**

2.7.4 *Patch Size Class*

The percentage vegetation cover cleared within the Scone – Gloucester Foothills Mitchell Landscape / NSW Landscape Region is 75%. The patch size class is extra large (>1000 ha) and the patch size score for the proposed development is 12.

2.7.5 *Area to Perimeter Ratio*

The proposal is not a linear type development or a multiple fragmentation impact development, therefore an assessment of the area to perimeter ratio is not required.

2.8 LANDSCAPE VALUE SCORE

The calculated Landscape Value Score for the proposed development is 17.4.

2.9 OTHER LANDSCAPE FEATURES IDENTIFIED IN THE SEARs

No other landscape features were identified for assessment in the SEARs.

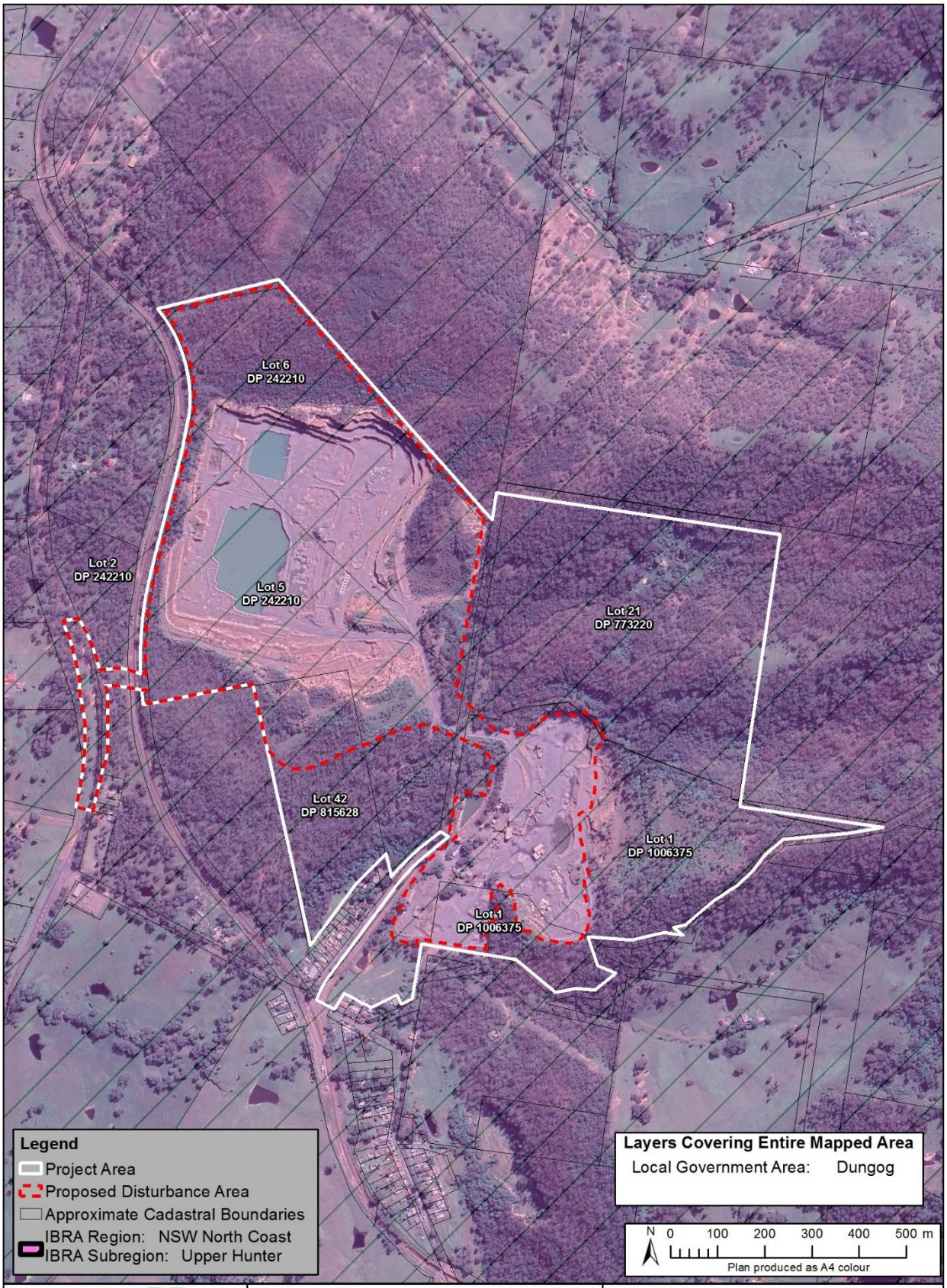
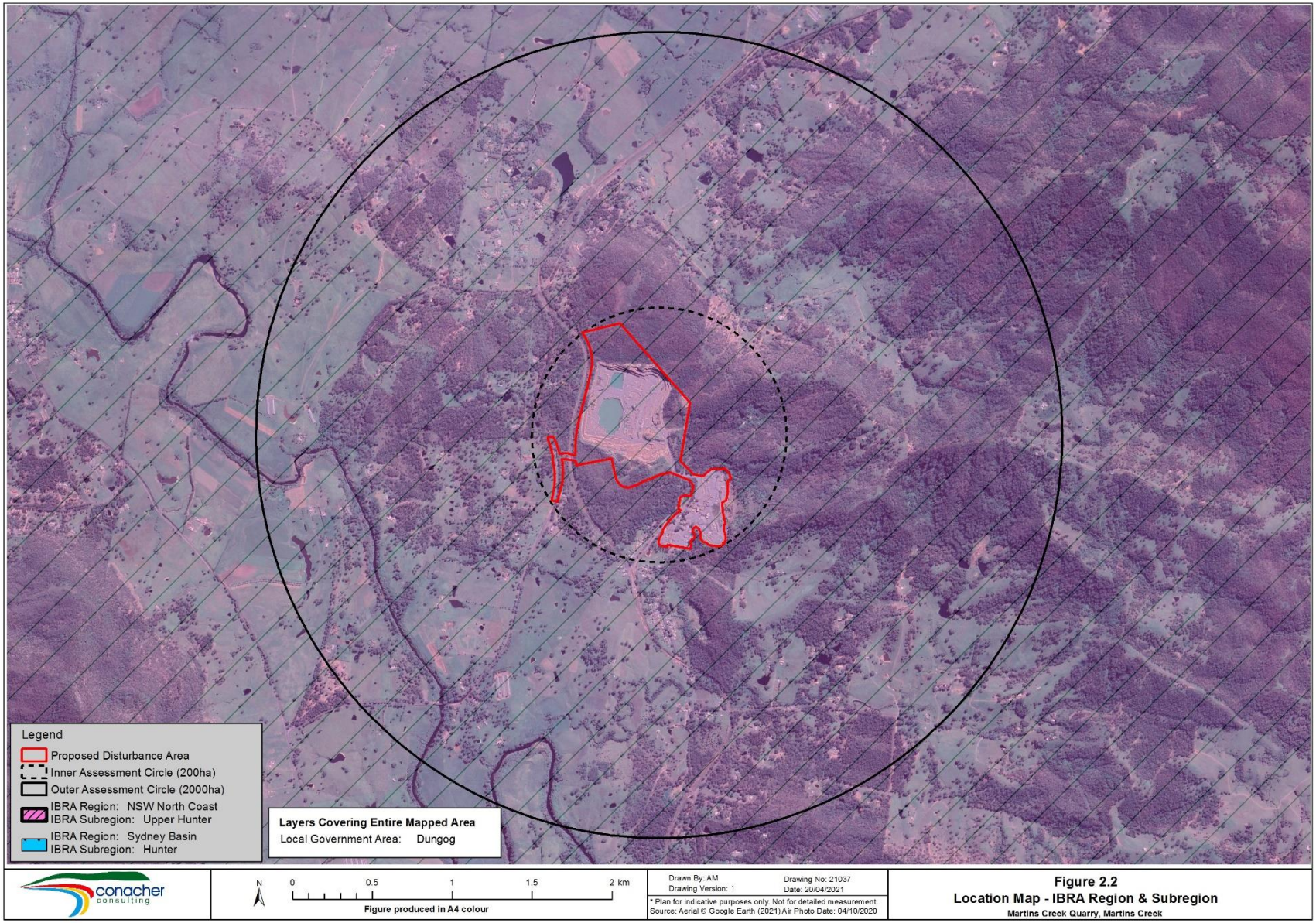


Figure 2.1
Site Map - IBRA Bioregion & IBRA Subregions
Martins Creek Quarry, Martins Creek


Legend
Proposed Disturbance Area
Inner Assessment Circle (200ha)
Outer Assessment Circle (2000ha)
IBRA Region: NSW North Coast
IBRA Subregion: Upper Hunter
IBRA Region: Sydney Basin
IBRA Subregion: Hunter
Layers Covering Entire Mapped Area
Local Government Area: Dungog
conacher consulting
N
0
0.5
1
1.5
2 km
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Drawing Version: 1
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 2.2
Location Map - IBRA Region & Subregion
Martins Creek Quarry, Martins Creek

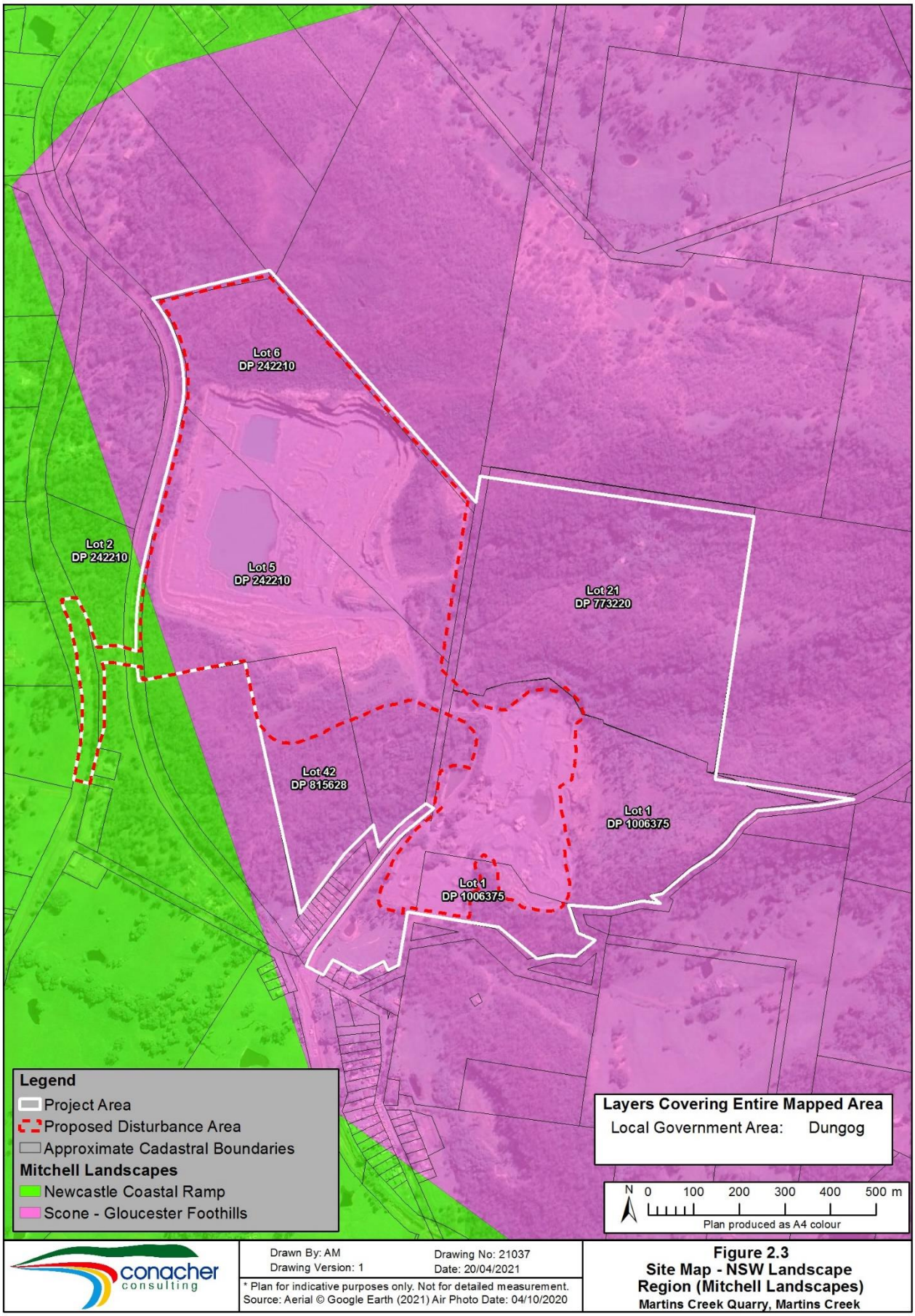
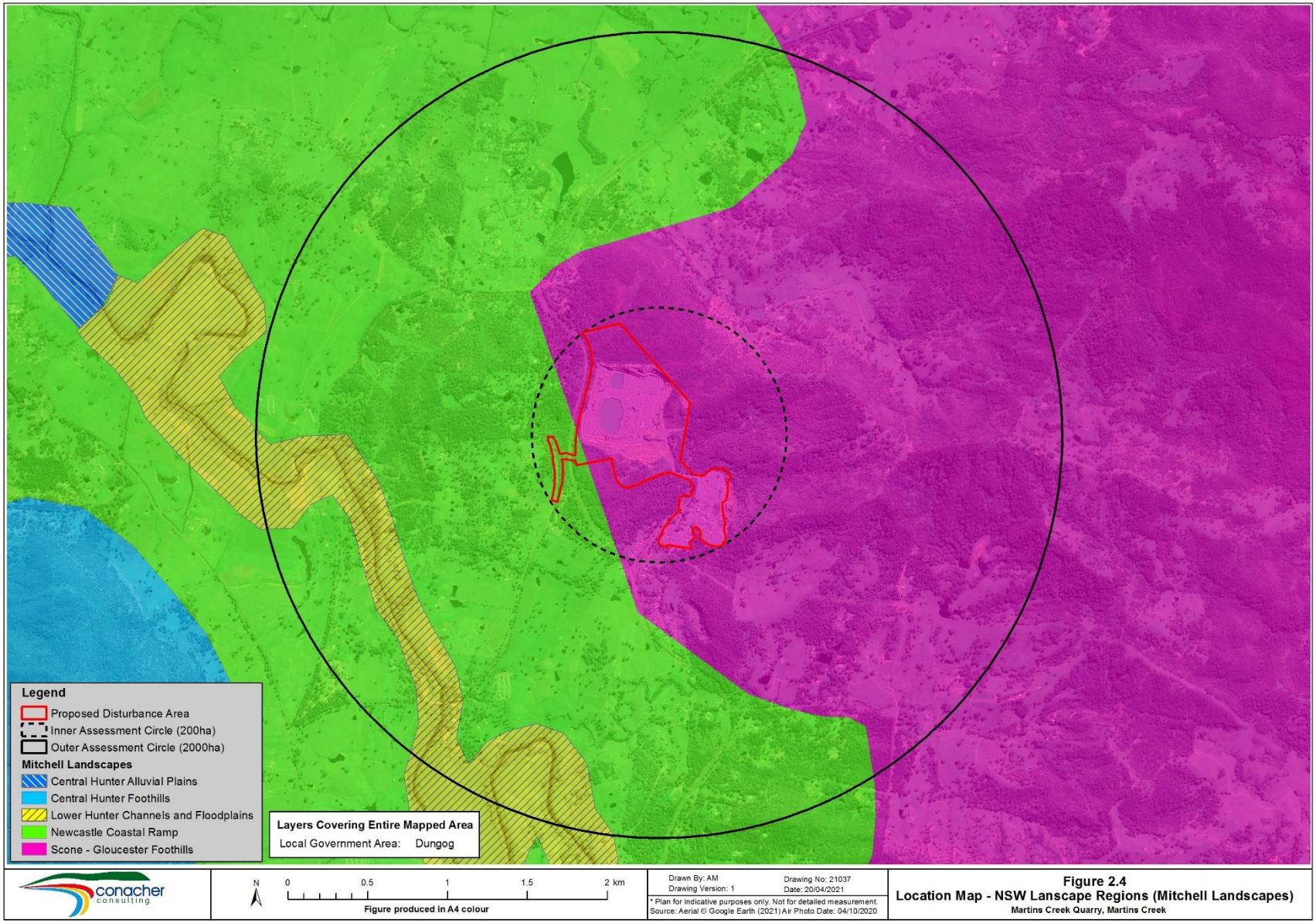


Figure 2.3
Site Map - NSW Landscape Region (Mitchell Landscapes)
Martins Creek Quarry, Martins Creek


Legend
Proposed Disturbance Area
Inner Assessment Circle (200ha)
Outer Assessment Circle (2000ha)
Mitchell Landscapes
Central Hunter Alluvial Plains
Central Hunter Foothills
Lower Hunter Channels and Floodplains
Newcastle Coastal Ramp
Scone - Gloucester Foothills
Layers Covering Entire Mapped Area
Local Government Area: Dungog
conacher consulting
N
0
0.5
1
1.5
2 km
Figure produced in A4 colour
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Drawing Version: 1
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 2.4
Location Map - NSW Lanscape Regions (Mitchell Landscapes)
Martins Creek Quarry, Martins Creek

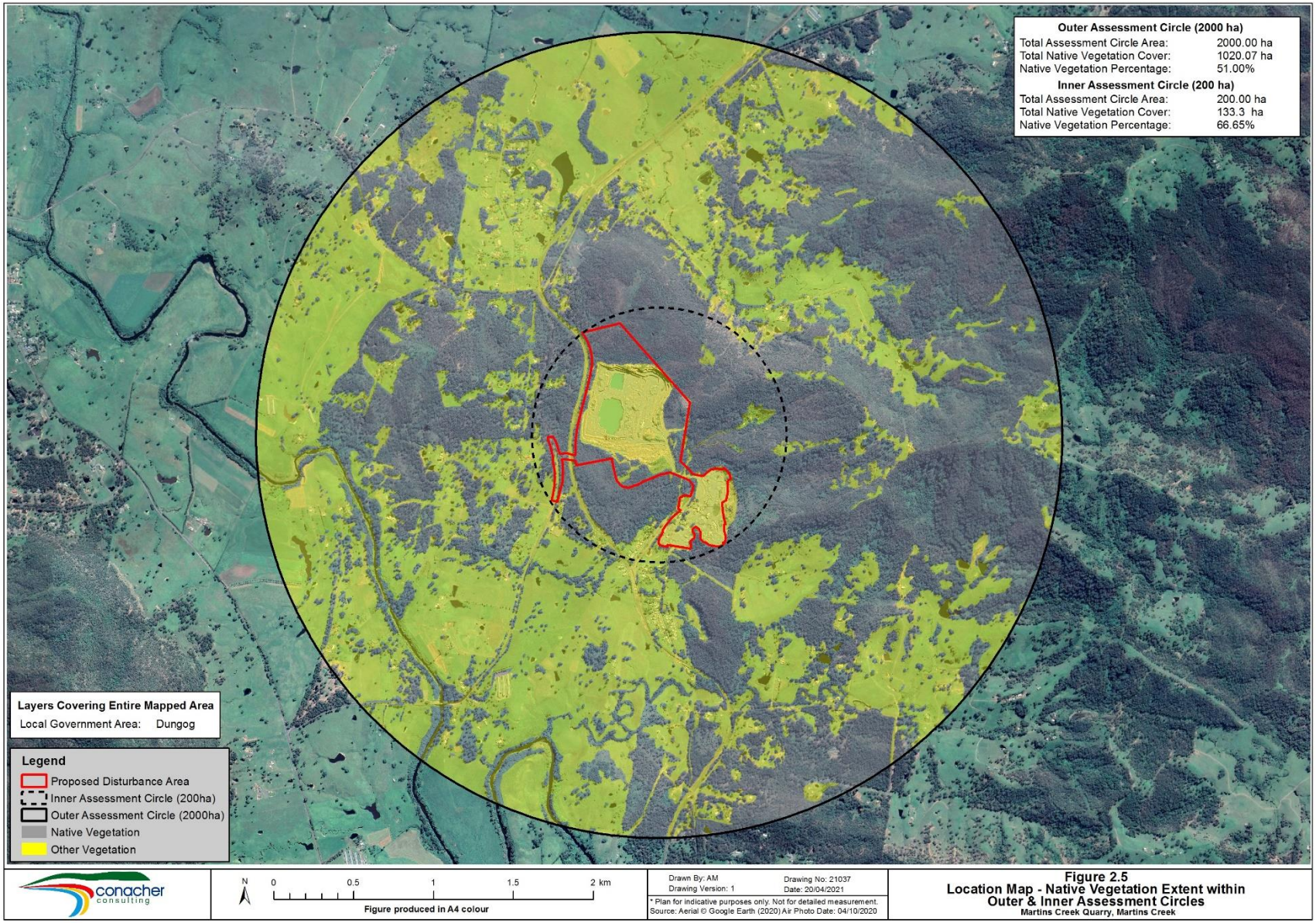
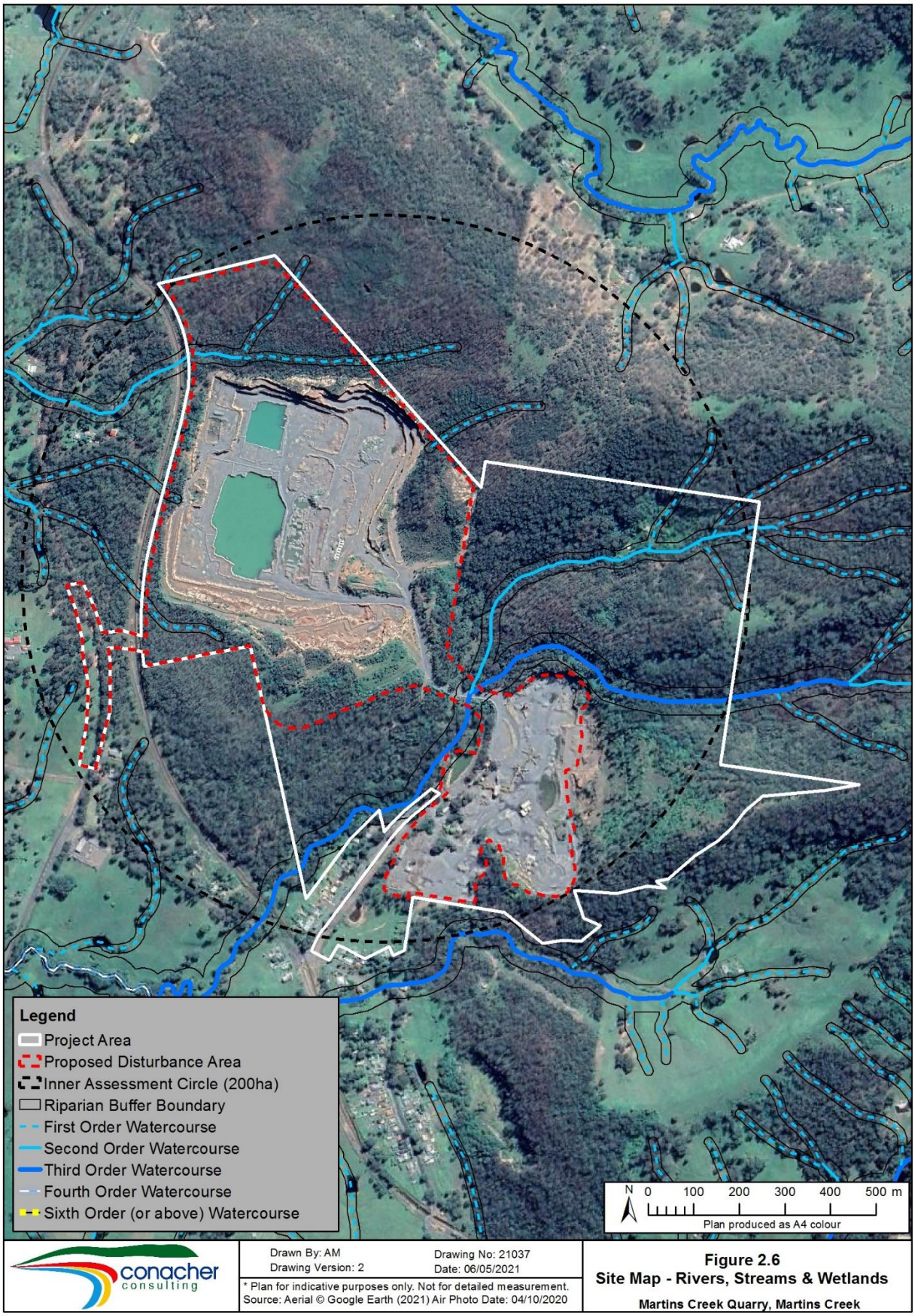


Figure 2.5
Location Map - Native Vegetation Extent within Outer & Inner Assessment Circles
Martins Creek Quarry, Martins Creek



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Drawing No: 21037
Date: 06/05/2021

* Plan for indicative purposes only. Not for detailed measurement.
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Figure 2.6
Site Map - Rivers, Streams & Wetlands
Martins Creek Quarry, Martins Creek

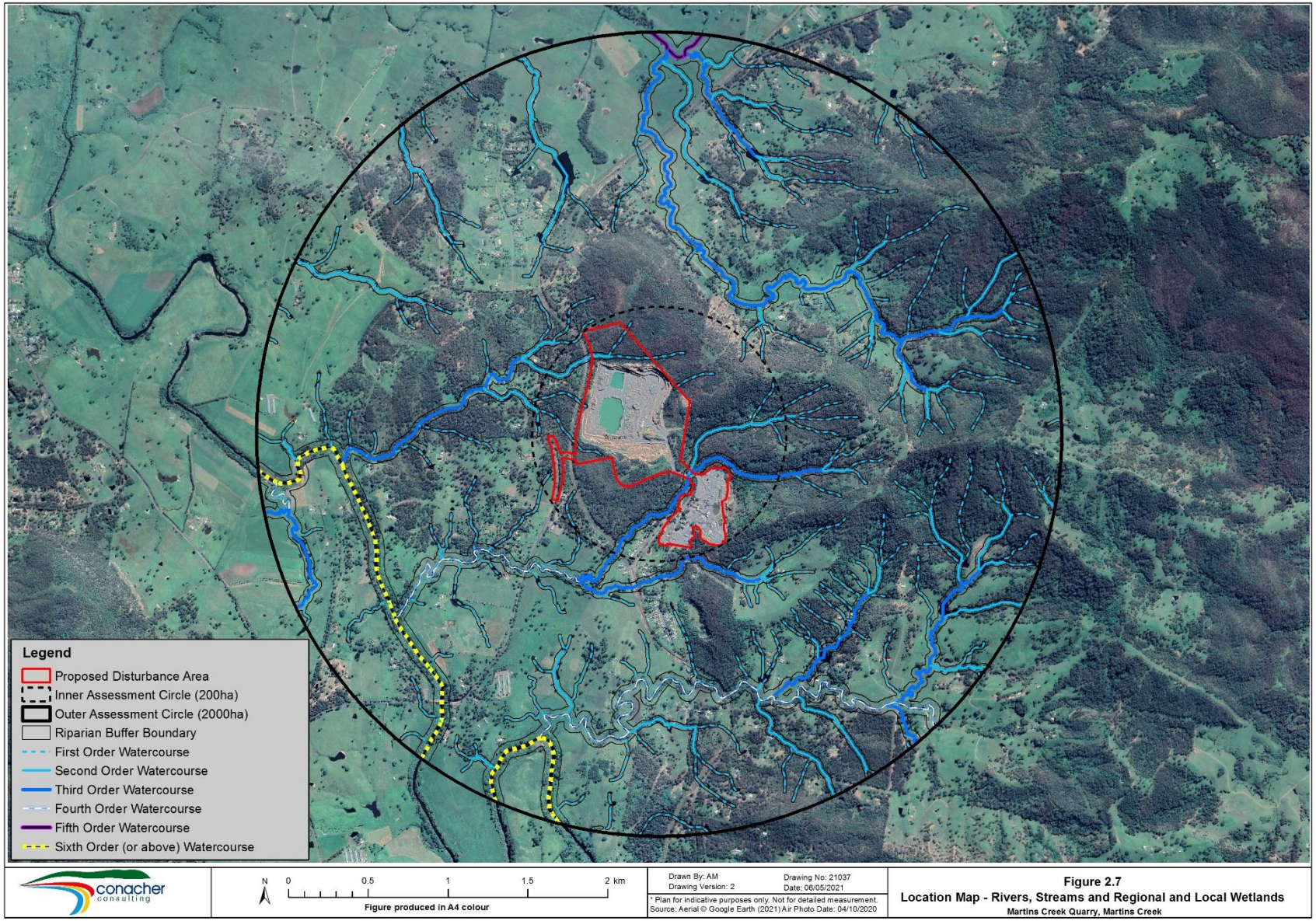
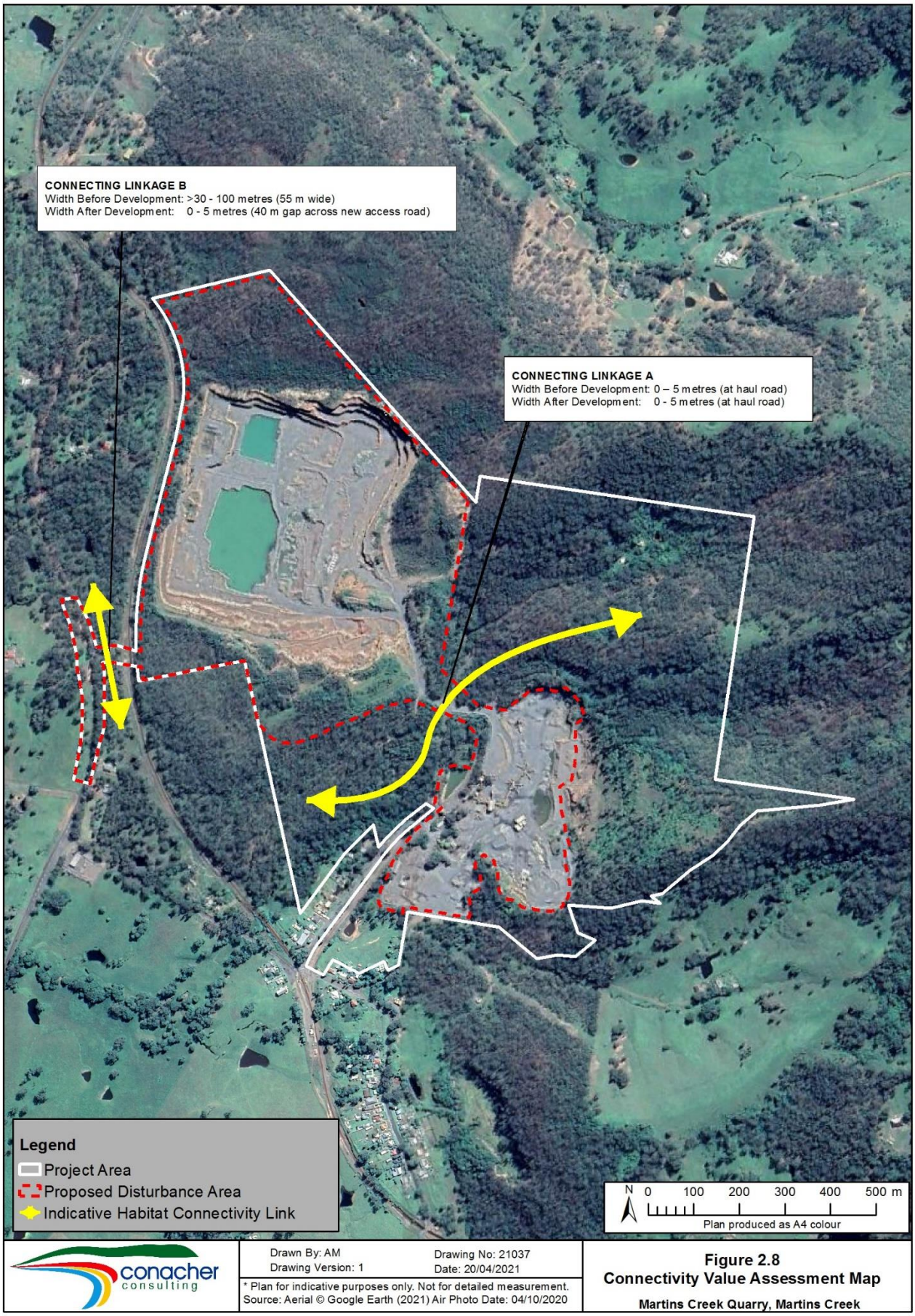


Figure 2.7
Location Map - Rivers, Streams and Regional and Local Wetlands
Martins Creek Quarry, Martins Creek


CONNECTING LINKAGE B
Width Before Development: >30 - 100 metres (55 m wide)
Width After Development: 0 - 5 metres (40 m gap across new access road)
CONNECTING LINKAGE A
Width Before Development: 0 – 5 metres (at haul road)
Width After Development: 0 - 5 metres (at haul road)
Legend
Project Area
Proposed Disturbance Area
Indicative Habitat Connectivity Link
N
0 100 200 300 400 500 m
Plan produced as A4 colour
conacher consulting
Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 2.8
Connectivity Value Assessment Map
Martins Creek Quarry, Martins Creek

SECTION 3

NATIVE VEGETATION

3.1 NATIVE VEGETATION EXTENT WITHIN THE PROPOSED DISTURBANCE AREA

The extent of native vegetation within the proposed disturbance area was determined through field and GIS based assessment of the areas outside of the existing operational quarry footprint.

Google Earth Imagery dated 4 October 2020 was utilised for the mapping of the native vegetation within the proposed disturbance area. No differences between the imagery used and the extent of vegetation were detected during site investigations.

The extent of native vegetation present within the Project Area and proposed disturbance area are shown in Figure 3.1. The extent of native vegetation present is 21.13 ha within the proposed disturbance area.

3.2 PLANT COMMUNITY TYPES WITHIN THE PROPOSED DISTURBANCE AREA

The areas of native vegetation present within the proposed disturbance area were assessed and surveyed to determine the extent and condition of the Plant Community Types (PCTs) present.

An initial assessment of vegetation mapping by Sivertsen *et al*., (2011) and Somerville (2009) was undertaken to determine potential plant community types and extents within the study area and inform initial site traverses and provide a reference point for initial site investigations.

A foot traverse of the site was undertaken which focused on inspection of all topographically distinct areas and areas of potentially different vegetation types. During the initial site traverse a map of the vegetation types present was generated with the aid of a hand-held GPS device which showed in 'real-time' the location of the surveyor in relation to a current Google satellite photograph. The initial map was then further refined during subsequent site visits. Observations were made of the dominant flora species present and further refinement of the site vegetation map was completed with the aid of a hand-held GPS Device and through air photograph interpretation, particularly for the dry rainforest vegetation and the areas dominated by *E. glaucina*, due to visible changes in vegetation pattern in the aerial imagery.

The following four PCTs have been identified and mapped within the site in Figure 3.2:

- HU 816 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter;
- HU 619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast;
- HU 755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter; and
- HU 798 White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley.

These PCTs were subject to plot surveys in accordance with the FBA Methodology stratification requirements (NSW OEH 2014a). Five plots were completed within the subject allotments outside of the proposed disturbance area shown in Figure 3.2, as the proposed disturbance area was reduced following the completion of plot surveys.

The classification of these communities was undertaken through analysis of the vegetation plot data collected from the site and use of the NSW Bionet Vegetation Classification Tool.

The plant community types and plot and transect survey locations are mapped in Figure 3.2. The native condition class and vegetation condition mapping on which the vegetation zones were assessed is shown in Figure 3.3. Threatened Ecological Community locations are mapped in Figure 3.4.

Descriptions of the plant community types within the proposed disturbance area are provided in the following sub-sections 3.2.1 to 3.2.4. A list of flora species observed during surveys is provided in Appendix 1 and plot and transect field data sheets are provided in Appendix 2.

3.2.1 *HU 619 Slaty Red Gum Grassy Woodland on Hinterland Foothills of the Southern North Coast*

A description of HU 619 Slaty Red Gum Grassy Woodland on Hinterland Foothills of the Southern North Coast is provided in Table 3.1 and photographs of this plant community type are provided in Plates 1 to 4.

TABLE 3.1
DESCRIPTIVE DETAILS FOR
HU619 SLATY RED GUM GRASSY WOODLAND ON HINTERLAND FOOTHILLS OF THE SOUTHERN NORTH COAST

Plant Community Type / Vegetation Type	HU619 (PCT 1178) Slaty Red Gum Grassy Woodland on Hinterland Foothills of the Southern North Coast
Vegetation Class	Dry Sclerophyll Forest (shrub/grass sub formation) Hunter – Macleay Dry Sclerophyll Forests
Extent within Proposed Disturbance Area	13.43 ha
Extent within Project Area	33.07 ha
Species relied upon for identification and relative abundance	*Eucalyptus glaucina* (Plot 2=20, Plot 4=11, Plot 5 = 6) *Eucalyptus moluccana* (Plot 5 = 1) *Eucalyptus crebra* (Plot 2 = 9, Plot 4 = 22, Plot 5 = observed adjacent)
Justification of evidence used to identify PCT	The Bionet Vegetation Classification (NSW DPIE 2021a) was accessed and the descriptions of candidate PCTs were assessed to justify the selection of the chosen PCT. The following justification for the selection of the chosen PCT is provided. This PCT is the only PCT to contain the characteristic species *E. glaucina* as a dominant canopy tree. The candidate site vegetation corresponds with landscape position of Dungog-Paterson districts. The distribution of this PCT on the proposed disturbance area is mapped in Figure 3.2. *Other PCTs considered* **Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter** Does not contain *E. glaucina* as a characteristic species and is restricted to the lower Hunter Valley. **Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter** Does not contain *E. glaucina* as a characteristic species.

TABLE 3.1 DESCRIPTIVE DETAILS FOR HU619 SLATY RED GUM GRASSY WOODLAND ON HINTERLAND FOOTHILLS OF THE SOUTHERN NORTH COAST	
	Spotted gum – Narrow-leaved Ironbark shrub-grass open forest of the central and lower hunter Does not contain *E. glaucina* as a characteristic species.
Regional Mapping Classification	This PCT does not directly correspond with any of the regional map units described by Somerville (2009), however is most similar to MU 73 Spotted Gum / Narrow-leaved Ironbark shrub/grass open forest.
BC Act Status	Not Listed. Further discussion on TECs is provided in Section 3.3 of this Report.
EPBC Act Status	Not Listed. Further discussion on TECs is provided in Section 3.3 of this Report.
Estimate of percent cleared value	75%
Vegetation Zones	***Number of Zones for Plant Community Type*** One ***Zone Condition Class / Subcategory*** Moderate / Good ***Area of Zone within Proposed Disturbance Area*** 13.43 ha ***Patch Size*** >1000 ha ***Site Value Score for Zone*** 76.56 ***Survey Effort Required*** 3 Transects / Plots ***Survey Effort Undertaken*** 4 Transects / Plots (requirement met) Survey plots 2, 4, 5 and U2 were completed within this vegetation zone. Plates 1 to 4 show the photographs taken within these survey plots.

Plate 1 - Photograph of Plot 2

Plate 2 - Photograph of Plot 4

Plate 3 - Photograph of Plot 5

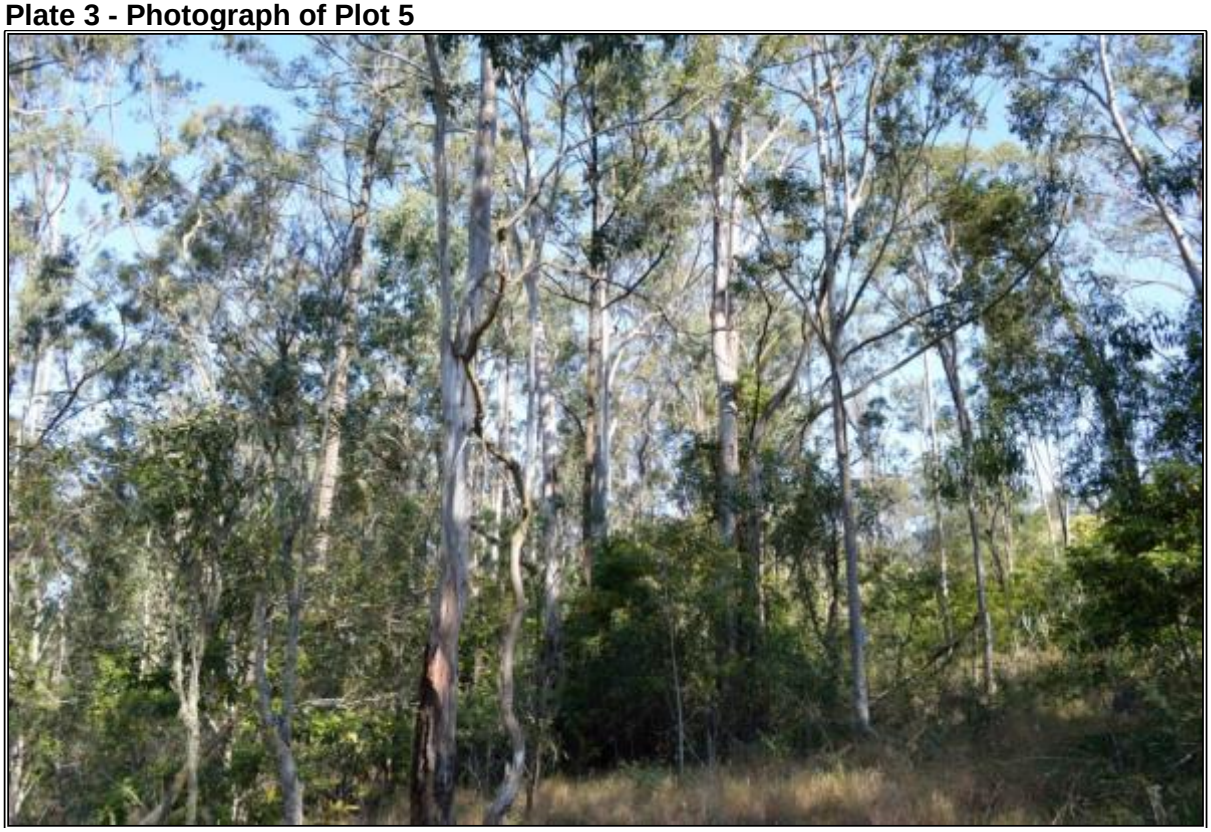


Plate 4 - Photograph of Plot U2

3.2.2 *HU 755 Whalebone Tree - Red Kamala Dry Subtropical Rainforest of the Lower Hunter*

A description of HU 755 Whalebone Tree - Red Kamala Dry Subtropical Rainforest of the Lower Hunter is provided in Table 3.2 and photographs of this plant community type are provided in Plates 5 to 7.

TABLE 3.2 DESCRIPTIVE DETAILS FOR HU755 WHALEBONE TREE - RED KAMALA DRY SUBTROPICAL RAINFOREST OF THE LOWER HUNTER	
Plant Community Type / Vegetation Type	HU755 (PCT 1541) Whalebone Tree - Red Kamala dry subtropical rainforest of the Lower Hunter
Vegetation Class	Dry Rainforest
Extent within Proposed Disturbance Area	2.22 ha
Extent within Project Area	5.93 ha
Species relied upon for identification and relative abundance	*Streblus brunonianus* (Plot 3 adjacent, Plot 7 adjacent, Plot 8 = 2) *Dendrocnide excelsa* (Plot 8 = 1) *Pittosporum multiflorum* (Plot 7 = 5) *Notelaea longifolia* (Plot 3 = 3, Plot 7 = 2, Plot 8 = 20) *Diospyros australis* (Plot 8 = 4) *Claoxylon australe* (Plot 3 = adjacent, Plot 8 = 1) *Clerodendrum tomentosum* (Plot 3 = 2) *Capparis arborea* (Plot 8 = 1) *Cissus antarctica* (Plot 7 = 2, Plot 8 = 2) *Dioscorea transversa* (Plot 3 = 200, Plot 7 = 200, Plot 8 = 50) *Pseuderanthemum variable* (Plot 3 = 20, Plot 7 = 20, Plot 8 = 20) *Gymnostachys anceps* (Plot 7 = adjacent, Plot 8 = 3)
Justification of evidence used to identify PCT	The Bionet Vegetation Classification (NSW DPIE 2021a) was accessed and the descriptions of candidate PCTs were assessed to justify the selection of the chosen PCT. The following justification for the selection of the chosen PCT is provided. 12 of the 21 characteristic species for this PCT were recorded in the three corresponding survey plots. The corresponding vegetation class or Dry Rainforest matches the candidate site vegetation. The vegetation on the site corresponds to the landscape position of valleys and sheltered sites on ranges of the Hunter Valley and lower North Coast escarpment at mid to low elevations. The vegetation mapped as this PCT corresponds to the diagnostic feature of a closed forest and *Streblus brunonianus* is a dominant species. The vegetation present has the structural diagnostic features of a mid storey composed of various small trees; shrubs and climbers with a ground layer typically sparse and composed of ferns, graminoids and forbs. The distribution of this PCT within the proposed disturbance area is mapped in Figure 3.2. ***Other Plant Community Types Considered*** **Giant Stinging Tree - Fig dry subtropical rainforest of the NSW North Coast Bioregion and Brigalow Belt South Bioregion**

TABLE 3.2 DESCRIPTIVE DETAILS FOR HU755 WHALEBONE TREE - RED KAMALA DRY SUBTROPICAL RAINFOREST OF THE LOWER HUNTER	
	11 of 22 characteristic species present / chosen PCT provides a slightly better floristic match / this PCT does not match vegetation class. **Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the NSW North Coast Bioregion and northern Sydney Basin Bioregion** 13 of 36 characteristic species present / chosen PCT provides a substantially better floristic match. **White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley** 14 of 18 characteristic species present / This PCT provides a closer floristic match than chosen PCT however the vegetation class does not correspond and the structure is of a closed canopy with only emergent eucalypts rather than an open forest dominated by Eucalypts. This PCT is present and has been mapped separately where the canopy is composed of an open forest structure dominated by Eucalypts.
BC Act Status	Listed as the Vulnerable Ecological Community Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions. Further discussion on TECs is provided in Section 3.3 of this Report.
EPBC Act Status	Not Listed
Estimate of percent cleared value	68%
Vegetation Zones	***Number of Zones for Plant Community Type*** One ***Zone Condition Class / Subcategory*** Moderate / good ***Area of Zone*** 2.22 ha ***Patch Size*** >1000ha ***Current Site Value Score for Zone*** 94 ***Survey Effort Required*** 2 Transects / Plots ***Survey Effort Undertaken*** 3 Transects / Plots (requirement met) Survey plots 3, 7 and 8 were completed within this vegetation type. Plots 7 & 8 were located outside of the proposed disturbance area, as the proposed disturbance area was reduced following the completion of the plot surveys. Plates 5 to 7 show the photographs taken within these survey plots.

Plate 5 - Photograph of Plot 3

Plate 6 - Photograph of Plot 7

Plate 7 - Photograph of Plot 8

3.2.3 *HU 798 White Mahogany – Spotted Gum – Grey Myrtle Semi Mesic Shrubby Open Forest of the Central and Lower Hunter Valley*

A description of HU 798 White Mahogany – Spotted Gum – Grey Myrtle Semi Mesic Shrubby Open Forest of the Central and Lower Hunter Valley is provided in Table 3.3 and photographs of this plant community type are provided in Plates 8 to 10.

TABLE 3.3 DESCRIPTIVE DETAILS FOR HU 798 WHITE MAHOGANY – SPOTTED GUM – GREY MYRTLE SEMI MESIC SHRUBBY OPEN FOREST OF THE CENTRAL AND LOWER HUNTER VALLEY	
Plant Community Type / Vegetation Type	HU 798 (PCT 1584) White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley
Vegetation Class	Northern Hinterland Wet Sclerophyll Forests
Extent within Proposed Disturbance Area	3.33 ha
Extent within Project Area	21.71 ha
Species Relied upon for identification and relative abundance	*Adiantum aethiopicum* (Plot 6 = 200, Plot 14 = 10) *Backhousia myrtifolia* (Plot 6 = 3, Plot 12 = 2, Plot 14 = 9) *Breynia oblongifolia* (Plot 6 = 20, Plot 12 = 3) *Cissus antarctica* (Plot 6 = 5) *Clerodendrum tomentosum* (Plot 12 = 2) *Corymbia maculata* (Plot 6 = 2, Plot 12 = 6, Plot 14 = 8) *Dichondra repens* (Plot 6 = 200, Plot 12 = 200) *Doodia aspera* (Plot 6 = 200) *Eucalyptus acmenoides* (Plot 12 = 16, Plot 14 = 2) *Microlaena stipoides* (Plot 6 = 2000, Plot 14 = 500) *Myrsine variabilis* (Plot 6 = 2) *Notelaea longifolia* (Plot 6 = 20, Plot 12 = 10, Plot 14 = 20)

TABLE 3.3 DESCRIPTIVE DETAILS FOR HU 798 WHITE MAHOGANY – SPOTTED GUM – GREY MYRTLE SEMI MESIC SHRUBBY OPEN FOREST OF THE CENTRAL AND LOWER HUNTER VALLEY	
	Oplismenus aemulus (Plot 6 = 50, Plot 12 = 10) *Pandorea pandorana* (Plot 6 = 20, Plot 12 = 3, Plot 14 = 5) *Pittosporum revolutum* (Plot 6 = 5, Plot 12 = 5, Plot 14 = 3) *Streblus brunonianus* (Plot 6 = 1)
Justification of evidence used to identify PCT	The Bionet Vegetation Classification (NSW DPIE 2021a) was accessed and the descriptions of candidate PCTs were assessed to justify the selection of the chosen PCT. The following justification for the selection of the chosen PCT is provided. 16 of the 18 characteristic species for this PCT corresponded to the species recorded in the corresponding survey plots. The vegetation present corresponds to the Northern Hinterland Wet Sclerophyll Forests vegetation class and occurs on mid-slopes and lower slopes as described for this PCT. As described for this PCT, the corresponding site vegetation has an open forest structure, is dominated by eucalypts, has a mid storey of mesic small trees, an open shrub layer and various climbers and the ground layer is predominately a mix of grasses and ferns and sparse graminoids and forbs. The distribution of this PCT within the proposed disturbance area is mapped in Figure 3.2. ***Other Plant Community Types Considered*** **Whalebone Tree - Red Kamala dry subtropical rainforest of the Lower Hunter** This vegetation type does not meet the diagnostic condition for this PCT of a closed canopy which is not dominated by Eucalypts. **White Mahogany – Turpentine Moist Shrubby Tall Open Forest** Excluded due to the dominance of *Corymbia maculata* on site and its absence from this PCT.
BC Act Status	Not listed. There are no potential TECs which correspond to this PCT.
EPBC Act Status	Not listed. There are no potential TECs which correspond to this PCT.
Estimate of percent cleared value	42%
Vegetation Zones	***Number of Zones for Plant Community Type*** One ***Zone No. 1 Condition Class / Subcategory*** Moderate / Good ***Area of Zone*** 3.33 ha ***Patch Size*** >1000ha ***Site Value Score for Zone*** 93.75 ***Survey Effort Required*** 2 Transects / Plots

TABLE 3.3 DESCRIPTIVE DETAILS FOR HU 798 WHITE MAHOGANY – SPOTTED GUM – GREY MYRTLE SEMI MESIC SHRUBBY OPEN FOREST OF THE CENTRAL AND LOWER HUNTER VALLEY	
	Survey Effort Undertaken 3 Transects / Plots (requirement met) Survey plots 6, 12 and 14 were completed within this PCT. Plots 6 & 12 were located outside of the proposed disturbance area, as the proposed disturbance area was reduced following plot surveys. Plates 8 to 10 show the photographs taken within these survey plots.

Plate 8 - Photograph of Plot 6

Plate 9 - Photograph of Plot 12

Plate 10 - Photograph of Plot 14

3.2.4 *HU816 Spotted Gum – Narrow-Leaved Ironbark Shrub-Grass Open Forest of the Central and Lower Hunter*

A description of HU816 Spotted Gum – Narrow-Leaved Ironbark Shrub-Grass Open Forest of the Central And Lower Hunter is provided in Table 3.4 and photographs of this plant community type are provided in Plates 11 to 12.

TABLE 3.4 DESCRIPTIVE DETAILS FOR HU816 SPOTTED GUM – NARROW-LEAVED IRONBARK SHRUB-GRASS OPEN FOREST OF THE CENTRAL AND LOWER HUNTER	
Plant Community Type / Vegetation Type	HU 816 (PCT 1602) Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
Vegetation Class	Hunter – Macleay Dry Sclerophyll Forests
Extent within Proposed Disturbance Area	2.15 ha
Extent within Project Area	13.64 ha
Species Relied upon for identification and relative abundance	*Corymbia maculata* (Plot 1 = 14, Plot 13 = 21) *Eucalyptus crebra* (Plot 1 = 7, Plot 13 = 10) *Breynia oblongifolia* (Plot 1 = 1, Plot 13 = 10) *Persoonia linearis* (Plot 1 = 2, Plot 13 = 1) *Notelaea longifolia* (Plot 1 = 2) *Pandorea pandorana* (Plot 1 = 5, Plot 13 = 4) *Cymbopogon refractus* (Plot 1 = 50, Plot 13 = 20) *Microlaena stipoides* (Plot 1 = 1000, Plot 13 = 50) *Themeda triandra* (Plot 1 = 500, Plot 13 = 50) *Oplismenus aemulus* (Plot 13 = 20) *Pratia purpurascens* (Plot 1 = 500, Plot 13 = 100) *Brunoniella australis* (Plot 1 = 20) *Lomandra multiflora* (Plot 1 = 20, Plot 13 = 5) *Cheilanthes sieberi* (Plot 1 = 50, Plot 13 = 50)
Justification of evidence used to identify PCT	The Bionet Vegetation Classification (NSW DPIE 2021a) was accessed and the descriptions of candidate PCTs were assessed. The following justification for the selection of the chosen PCT is provided. **Chosen PCT** 14 of the 15 species listed for this PCT corresponded to the species recorded in the survey plots. The site vegetation identified as this PCT corresponds with the PCT Vegetation Class. The site vegetation identified as this PCT corresponds with PCT landscape position of Central / Lower Hunter. The site vegetation identified as this PCT corresponds with the diagnostic structural features of an open forest with a canopy dominated by *C. maculata* and *Eucalyptus crebra*. The mid-storey consists of an open shrub layer. The ground layer is predominately grassy with various graminoids, forbs and small ferns. The distribution of this PCT within the proposed disturbance area is mapped in Figure 3.2. ***Other Plant Community Types Considered*** **White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley**

TABLE 3.4 DESCRIPTIVE DETAILS FOR HU816 SPOTTED GUM – NARROW-LEAVED IRONBARK SHRUB-GRASS OPEN FOREST OF THE CENTRAL AND LOWER HUNTER	
	This vegetation type does not correspond to landscape position of mid-slopes; lower slopes; Central and lower Hunter Valley in gullies and on lower slopes mainly on sandstone substrates and at mid to lower elevations. This vegetation type does not correspond with diagnostic features for this PCT as does not contain *Eucalyptus acmenoides*, a developed layer of mesic small trees and an open shrub layer. **Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest** Although several of the diagnostic features are present the site does not correspond with the landscape position of low ranges of the Lower Hunter Valley and Central Coast. **Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter** The landscape position for this PCT is restricted to Lower Hunter Valley, which is not consistent with the site location. **Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter** Both the landscape and diagnostic features are present however this PCT does not match as closely as PCT 1602. **Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter** The diagnostic feature of *Eucalyptus fibrosa* being a dominant tree is not met. **Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter** The diagnostic feature of *Eucalyptus fibrosa* being a dominant tree is not met. **Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass woodland of the Central and Lower Hunter** The diagnostic feature of a canopy dominated by *Eucalyptus crebra* and *Eucalyptus moluccana* is not met.
Regional Mapping Classification	This PCT displays similarities with MU 73 Spotted Gum / Narrow-leaved Ironbark shrub/grass open forest of Somerville (2009).
BC Act Status	Not Listed. Further discussion on TECs is provided in Section 3.3 of this Report.
EPBC Act Status	Not Listed. Further discussion on TECs is provided in Section 3.3 of this Report.
Estimate of percent cleared value	54%
Vegetation Zones	***Number of Zones for Plant Community Type*** One within proposed disturbance area / areas sampled by survey plots. ***Zone Condition Class / Subcategory*** Moderate / good ***Area of Zone within Proposed disturbance area*** 2.15 ha

TABLE 3.4 DESCRIPTIVE DETAILS FOR HU816 SPOTTED GUM – NARROW-LEAVED IRONBARK SHRUB-GRASS OPEN FOREST OF THE CENTRAL AND LOWER HUNTER	
	Patch Size >1000ha ***Current Site Value Score for Zone*** 96.88 ***Survey Effort Required*** 2 transects / plots ***Survey Effort Undertaken*** 2 transects / plots (Plot 1 & Plot 13) - requirement met Plates 11 to 12 show the photographs taken within these survey plots.

Plate 11 - Plot 1

Plate 13 - Plot 13

3.3 THREATENED ECOLOGICAL COMMUNTIES

The threatened ecological community listings within the *EPBC* Act and *BC Act* were reviewed to determine those with potential to occur within the site. The following threatened ecological communities were subject to detailed assessment to determine whether they occurred within the site:

- Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community as listed within the *EPBC Act*;
- Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions as listed within the *BC Act*;
- Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions as listed within the *BC Act*; and
- Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions as listed within the *BC Act*.

3.3.1 Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community

An assessment of the key diagnostic features listed in the Approved Conservation Advice (Australian Government Department of the Environment 2015) for this critically endangered ecological community (CEEC) was completed and is provided in Table 3.5. The assessment determined that this CEEC, as defined and listed under the *EPBC Act*, does not occur within the site.

TABLE 3.5 ASSESSMENT OF KEY DIAGNOSTIC FEATURES FOR CENTRAL HUNTER VALLEY EUCALYPT FOREST AND WOODLAND CRITICALLY ENDANGERED ECOLOGICAL COMMUNITY UNDER THE EPBC ACT	
Key Diagnostic Features	**Assessment**
It occurs in the Hunter River catchment (typically called the Hunter Valley region); AND	Yes, HU816 and HU619 correspond.
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks; AND	No, the site is located entirely on Carboniferous sediments.
It does not occur on alluvial flats, river terraces, aeolian sands, Triassic sediments, or escarpments; AND	HU816 and HU619 are not located within areas containing these landforms.
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height; AND	Yes, HU816 and HU619 correspond.
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. *E. maculata*) (spotted gum*), E. dawsonii* (slaty gum) and *E. moluccana* (grey box); OR a fifth species, *Allocasuarina luehmannii* (bulloak, buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species; AND	Yes, HU816 and HU619 correspond.
Allocasuarina torulosa (forest oak/ she-oak, rose she-oak/oak), *Eucalyptus acmenoides* (white mahogany) and *E. fibrosa* (red/broad-leaved ironbark) are largely absent from the canopy of a patch; AND	Yes, HU816 and HU619 correspond.
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.	Yes, HU816 and HU619 correspond.
Conclusion	The site does not contain this CEEC as the soil & geological characteristics required to support the occurrence of this CEEC are not met.

3.3.2 Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions

The following plant community types were assessed for the potential to correspond to this endangered ecological community:

- HU816/PCT1602 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter.
- HU619 Slaty Red Gum Grassy Woodland on Hinterland Foothills of the Southern North Coast

The Bionet NSW Vegetation Information System lists PCT 1602 as being associated with occurrences of this EEC.

These PCTs are considered to broadly correspond with Map Unit (MU) 73 Spotted Gum / Narrow-leaved Ironbark shrub/grass open forest of Somerville (2009).

In contrast the Final Determination (NSW Threatened Species Scientific Committee 2019) identifies that this EEC corresponds to MU 67 Spotted Gum/Red Ironbark/Large – fruited Grey

Gum shrub/grass open forest and MU 68 Red Ironbark/paperbark shrubby open forest) of Somerville (2009), which also aligns with MU 26 of Peake (2006).
The final determination for this EEC (NSW Threatened Species Scientific Committee 2019) identifies that Lower Hunter Spotted Gum Ironbark Forest is usually dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), with *E. punctata* (Grey Gum) occurring less frequently. *Corymbia maculata* was recorded in all plots within this plant community type. *Eucalyptus punctata* was not recorded on the site and *Eucalyptus fibrosa* was only recorded within Plot 1. All plots within this plant community type contained *Eucalyptus crebra*.

The final determination for this EEC (NSW Threatened Species Scientific Committee 2019) identifies that "*to the north of its distribution, and including areas at higher elevations and receiving higher rainfall, Lower Hunter Spotted Gum Ironbark Forest is replaced by Spotted Gum/ Narrow-leaved Ironbark shrub/grass open forest*". This community corresponds to MU 73 of Somerville (2009) and "*differs in the co-dominance of C. maculata, E. crebra and, less frequently, E. tereticornis, as well as the presence of a small tree stratum dominated by Allocasuarina torulosa and Brachychiton populneus"*.

The Final Determination (NSW Threatened Species Scientific Committee 2019) also identifies that "*other species occurring more frequently in MU 73 than Lower Hunter Spotted Gum Ironbark Forest include Acacia implexa, Aristida ramosa, Arthropodium species B, Breynia oblongifolia, Brunoniella australis, Cheilanthes distans, Cissus opaca, Clematis glycinoides, Clerodendrum tomentosum, Cymbopogon refractus, Desmodium brachypodum, D. rhytidophyllum, D. varians, Dianella caerulea, Dichondra repens, Entolasia marginata, Eustrephus latifolius, Gahnia aspera, Geitonoplesium cymosum, Notelaea longifolia, Oplismenus aemulus, Pandorea pandorana, Pittosporum undulatum and Solanum stelligerum*.

Many of the species listed above which are more common within Spotted Gum/ Narrow-leaved Ironbark shrub/grass open forest (MU73) of Somerville (2009), than Lower Hunter Spotted Gum Ironbark Forest, occur within thin the plots surveyed including:

- Plot 1 which contains *Arthropodium species B, Breynia oblongifolia, Brunoniella australis, Cymbopogon refractus, Desmodium rhytidophyllum, Dianella caerulea, Eustrephus latifolius, Geitonoplesium cymosum, Notelaea longifolia* and *Pandorea pandorana;* and
- Plot 13 which contains *Acacia implexa, Aristida ramosa, Breynia oblongifolia, Cheilanthes distans, Cymbopogon refractus, Desmodium rhytidophyllum, Desmodium varians, Dianella caerulea, Dichondra repens, Entolasia marginata, Gahnia aspera, Geitonoplesium cymosum, Oplismenus aemulus, Pandorea pandorana* and *Pittosporum undulatum.*

It is considered that while the vegetation present within the site occurs within the distribution of this EEC and corresponds with the geological characteristics associated with this EEC, the floristic characteristics of areas mapped as HU816/PCT1602 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter do not correspond with this EEC. It is therefore considered that the Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC is not present within the site.

3.3.3 Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions

The following plant community types were assessed for the potential to correspond to this endangered ecological community:

- HU816/PCT1602 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter; and
- HU619 Slaty Red Gum Grassy Woodland on Hinterland Foothills of the Southern North Coast.

The NSW Scientific Committee's (2010) Final Determination for this EEC identifies that this EEC corresponds to Map Unit (MU) 27 of Peake (2006). Peake's (2006) MU 27 is part of a continuum of several related but separate spotted gum – ironbark aligned communities which occur within the Hunter Valley (NSW Threatened Species Scientific Committee 2019).

An analysis of the vegetation descriptions of Peake (2006) has identified that MU 27 is similar to Peake's (2006) MU 25 and MU 26 which do not form part of this EEC. The presence of MU 26 Lower Hunter Spotted Gum Ironbark forest has been ruled out under Section 3.3.2 of this Report.

An analysis of the flora species observed for HU619 and HU816 within the site and the flora species which are unique between MU25 and MU27 of Peake (2006) is provided in Table 3.6. For HU619 this analysis has identified the presence of 19 unique species from MU25 compared to only 5 species unique to MU27 and for HU816 the presence of 19 species unique to MU25 compared to only 4 species unique to MU27. Based on this analysis it is considered that HU619 and HU816 correspond to MU 25 Barrington Footslopes Dry Spotted Gum Forest and not MU 27 Central Hunter Ironbark – Spotted Gum – Grey Box Forest of Peake (2006).

TABLE 3.6
COMPARISON OF PRESENCE OF UNIQUE FLORA SPECIES BETWEEN PEAKE'S (2006) MU25 AND MU27 WITHIN PLANT COMMUNITY TYPES HU619 AND HU816

Flora Species Present which are unique between MU25 and MU27 of Peake (2006)	HU619		HU816	
	Species Unique to MU25	Species Unique to MU27	Species Unique to MU25	Species Unique to MU27
Acacia falcata		1		1
Acacia implexa	1		1	
Acacia ulicifolia	1		1	
Backhousia myrtifolia				
Billardiera scandens	1		1	
Daviesia ulicifolia		1		
Desmodium rhytidophyllum	1		1	
Eragrostis brownii		1		1
Eucalyptus acmenoides			1	
Eucalyptus fibrosa				1
Eucalyptus globoidea	1		1	
Eucalyptus siderophloia	1			
Eustrephus latifolius	1		1	
Exocarpos cupressiformis	1		1	
Gahnia aspera	1		1	

TABLE 3.6 COMPARISON OF PRESENCE OF UNIQUE FLORA SPECIES BETWEEN PEAKE'S (2006) MU25 AND MU27 WITHIN PLANT COMMUNITY TYPES HU619 AND HU816				
Flora Species Present which are unique between MU25 and MU27 of Peake (2006)	**HU619**		**HU816**	
	Species Unique to MU25	**Species Unique to MU27**	**Species Unique to MU25**	**Species Unique to MU27**
Geitonoplesium cymosum	1		1	
Imperata cylindrica			1	
Jacksonia scoparia			1	
Lagenophora stipitata	1			
Lomandra filiformis subsp. *filiformis*		1		
Notelaea longifolia	1		1	
Oplismenus aemulus	1		1	
Oplismenus imbecillis	1			
Pandorea pandorana			1	
Panicum simile	1			
Phyllanthus hirtellus		1		1
Pittosporum revolutum	1		1	
Pittosporum undulatum	1		1	
Plectranthus parviflorus			1	
Poranthera microphylla	1			
Scleria mackaviensis	1			
Sporobolus creber			1	
Totals	**19**	**5**	**19**	**4**

Locational differences can also be utilised to separate MU25 and MU27 of Peake (2006), with MU25 occurring in locations more often on Carboniferous sandstones and conglomerates, whereas MU 27 occurs mostly on Permian sediments. The NSW Scientific Committee (2010) also identify that the Central Hunter Ironbark-Spotted Gum-Grey Box Forest EEC generally occurs on Permian sediments in the Hunter Valley. The proposed disturbance area is located entirely on Carboniferous sediments and therefore does not correspond to the locational requirements of the EEC.

It is therefore considered that the vegetation within the site mapped as HU619 and HU816, is not part of the Central Hunter Ironbark-Spotted Gum-Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC listed under the *BC Act*.

3.3.4 Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions

Plant community type HU755 (PCT 1541) Whalebone Tree - Red Kamala dry subtropical rainforest of the Lower Hunter corresponds to the vulnerable ecological community (VEC), Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions as listed within the *BC Act*.

It is considered that this plant community type conforms to the structural, floristic, geological and locational characteristics identified in the Final Determination for this VEC (NSW Scientific Committee 2011).

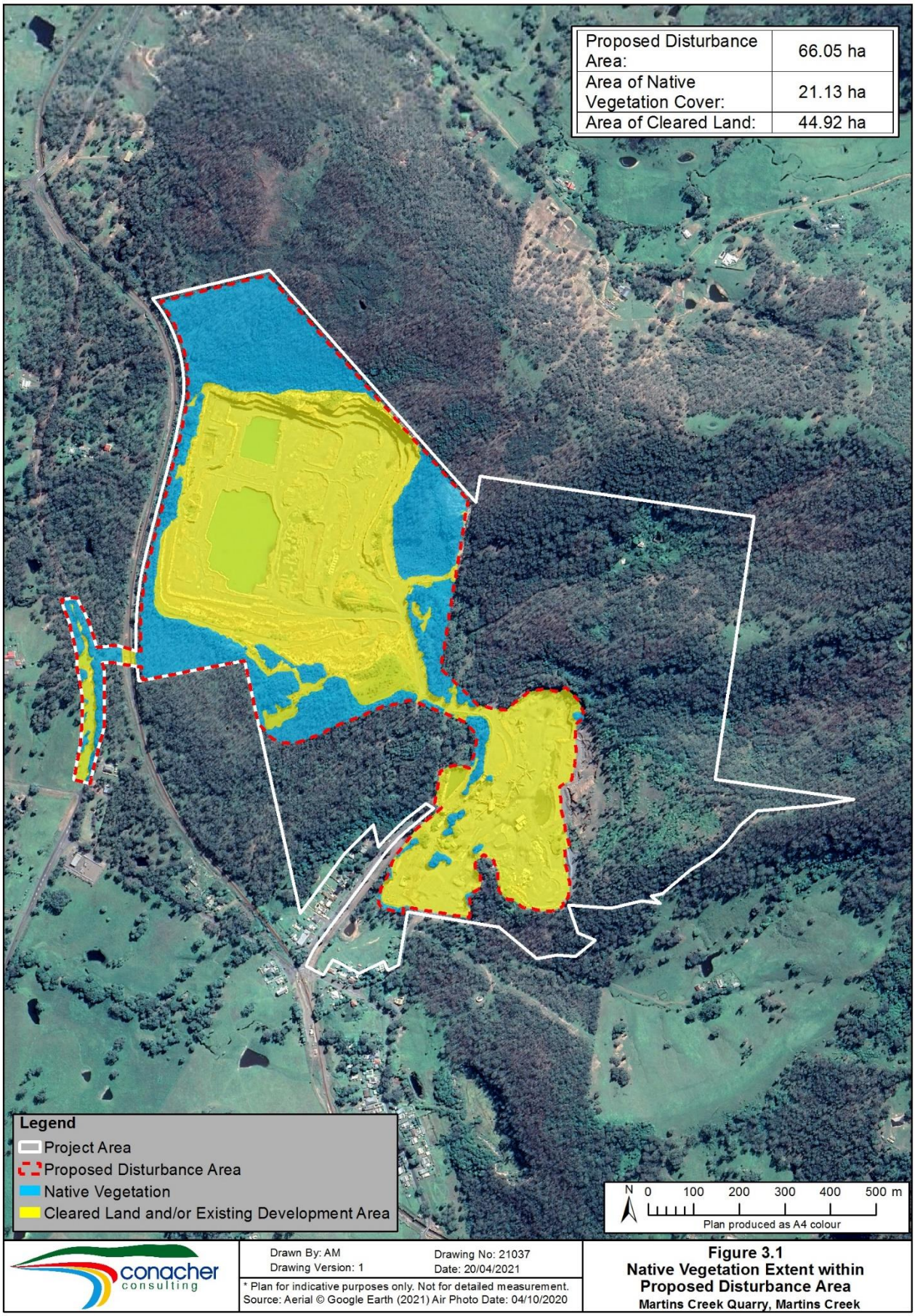
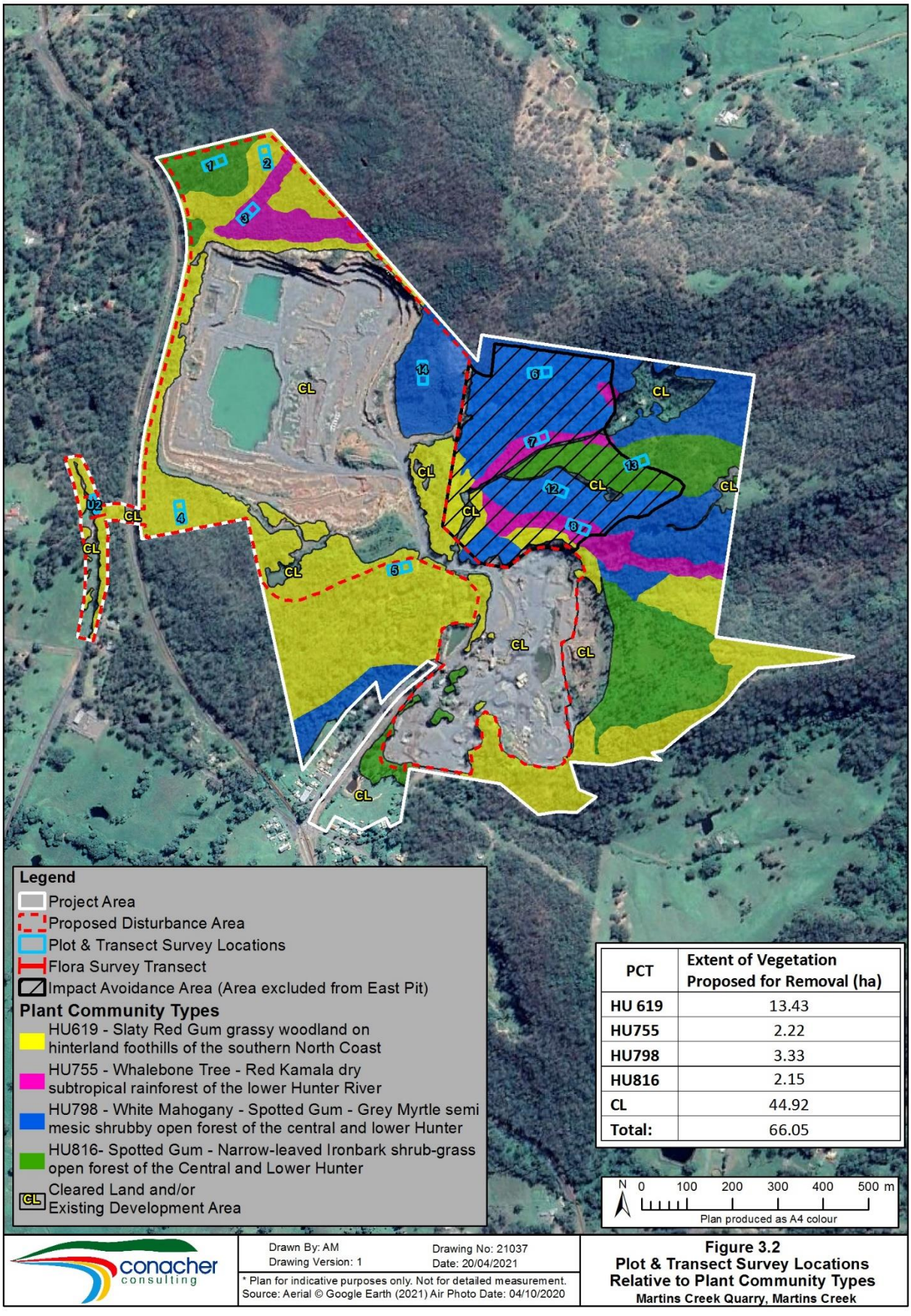


Figure 3.1
Native Vegetation Extent within Proposed Disturbance Area
Martins Creek Quarry, Martins Creek



PCT	Extent of Vegetation Proposed for Removal (ha)
HU 619	13.43
HU755	2.22
HU798	3.33
HU816	2.15
CL	44.92
Total:	66.05

Figure 3.2
Plot & Transect Survey Locations Relative to Plant Community Types
Martins Creek Quarry, Martins Creek

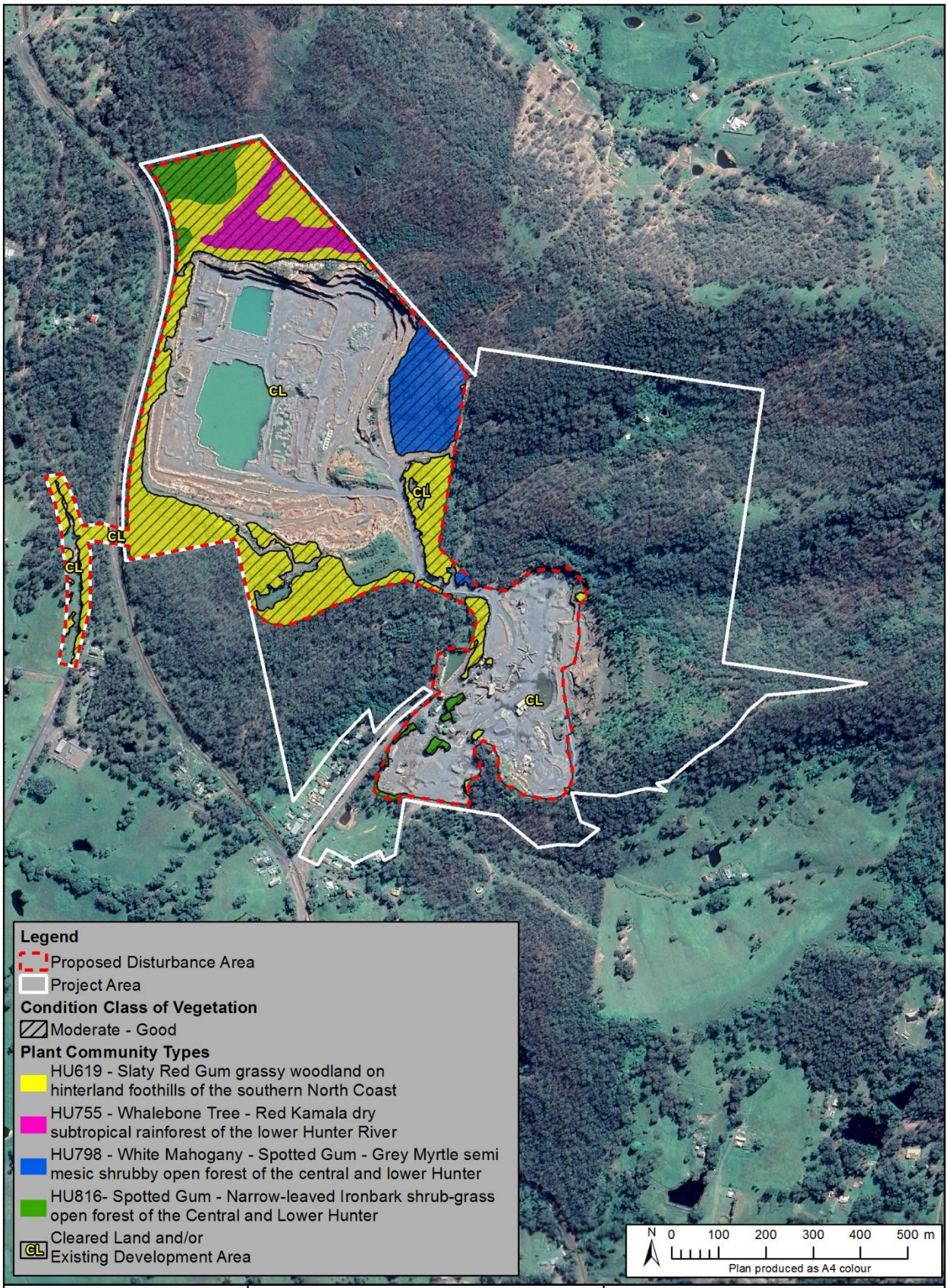


Figure 3.3
Condition Class of Vegetation within Proposed Disturbance Area
Martins Creek Quarry, Martins Creek

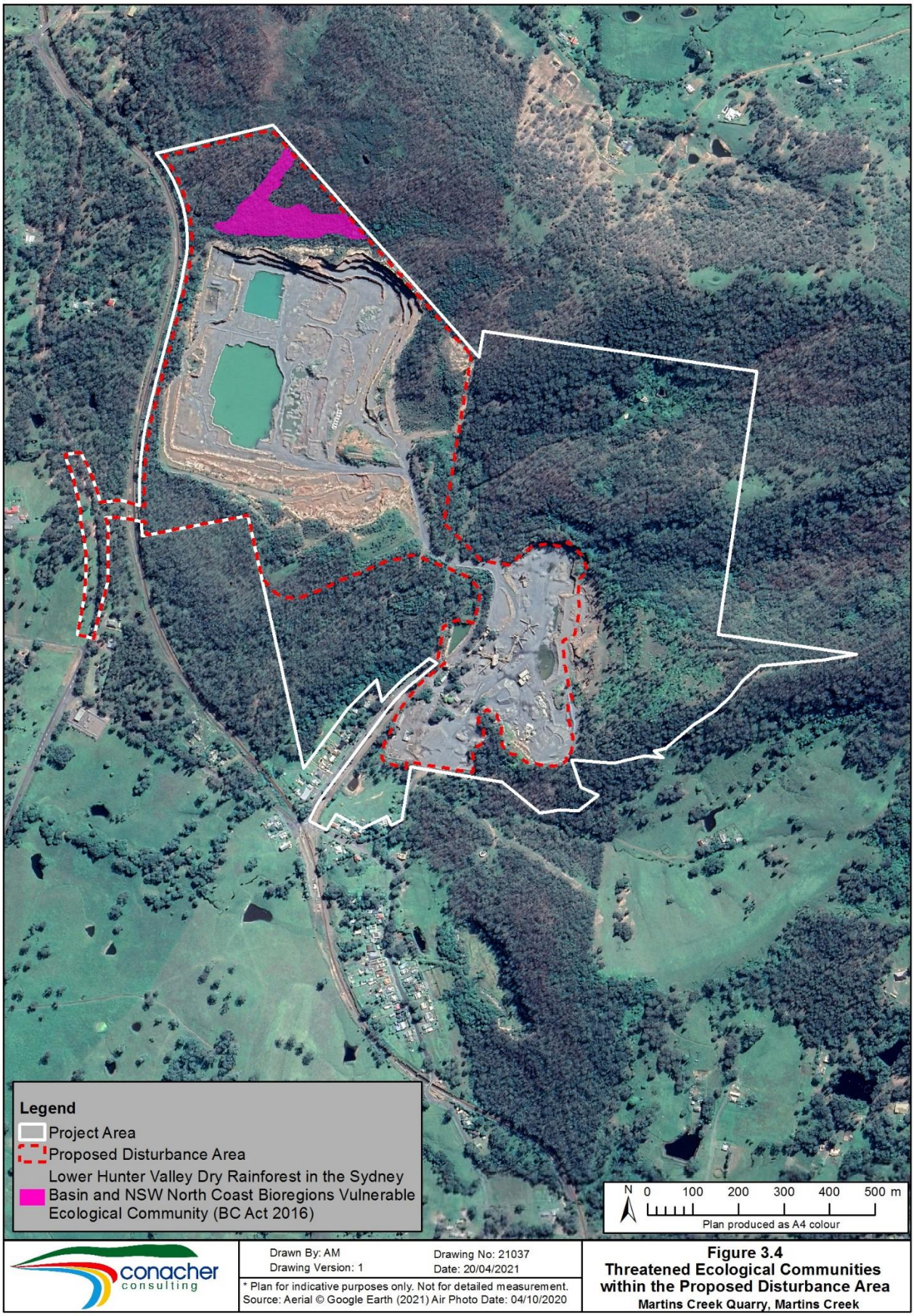


Figure 3.4
Threatened Ecological Communities within the Proposed Disturbance Area
Martins Creek Quarry, Martins Creek

SECTION 4

THREATENED SPECIES

4.1 HABITAT FEATURES PRESENT

The proposed disturbance area contains disturbed habitats for fauna species. Details of the micro habitat features observed are provided in Table 4.1. Mapping of hollow bearing-tree locations is provided in Figure 4.1.

TABLE 4.1
FAUNA HABITATS PRESENT

HABITAT TYPE	PRESENCE	COMMENTS
Hollow bearing trees	Yes	Several hollow bearing trees are present within the site
Mature trees	Yes	Several present
Culverts	Yes	A twin pipe culvert is present under the existing haul road and a single pipe culvert is present at the point of discharge near station street.
Rock Shelters / Caves / Crevices	Yes	Crevices are present
Acacia shrubs	Yes	Acacias are present within the proposed disturbance area including *A. binervata, A. falcata, A. implexa, A. irrorata* and *A. ulicifolia*.
Banksia shrubs	No	None observed
Native Grasses	Yes	Yes, native understorey grasses present within PCTs 1178,1584 and 1602.
Man-made features	Yes	One disued corrugated iron clad shed was observed on the site, no signs of microbat usage were observed during inspections.
The native vegetation types present	Yes	See Section 3
Areas of cleared land and exotic vegetation	Yes	See Section 3
Any exposed areas of bush rock including outcrops	Yes	Surface rock is present throughout the site, particularly within the developed drainage line areas
Natural burrows	No	None observed
Large trees with basal cavities	Yes	Trees with basal cavities are present
Logs	Yes	Fallen logs are present.
Wetlands, streams, and waterbodies etc.	Yes	Two small dams are present in the northern section of the site. Sediment basins are present and the western quarry pit area holds water. Drainage lines are present. The drainage lines do not hold water for extended periods after rainfall events.
Nests and roosts	Yes	A Wedge-tailed Eagles nest was recorded to the north-east of the proposed disturbance area. A roost location for the Powerful Owl was also detected adjacent to the proposed

TABLE 4.1 FAUNA HABITATS PRESENT		
HABITAT TYPE	**PRESENCE**	**COMMENTS**
		disturbance area, to the north of the east quarry pit.
Wombat burrows	No	None observed
Dens used by Petaurus gliders	Yes	One Squirrel Glider den tree was observed during surveys.
Petaurus glider sap feed trees	Yes	Suitable sap feed tree species are present, no sap feed scars observed.
Distinctive scats	No	None observed
Latrine and den sites pf the Spotted-tailed Quoll	No	None observed
Allocasuarina spp. trees	Yes	Low densities of *Allocasuarina* were observed.
Flying-fox camps	No	None observed
Micro chiropteran bat subterranean roosts (culverts, tunnels and disused mineshafts	No	None observed
Regent Honeyeater feed or nest trees;	No site use observed	Suitable feed trees present
Swift Parrot feed trees;	No site use observed	Suitable feed trees present
Winter-flowering eucalypts	Yes	*Corymbia maculata*, *Eucalyptus tereticornis* and various Ironbark species are present.
Mistletoes	No	None observed although possible low densities present.
Permanent soaks and seepages	No	None observed
Areas that can act as corridors for plant and animal species / Connectivity value of the site.	Yes	See connectivity assessment in Section 2.

4.2 IDENTIFICATION OF ECOSYSTEM CREDIT SPECIES

The threatened species for which the likelihood of occurrence or elements of habitat can be predicted by vegetation surrogates and landscape features, or for which targeted surveys are likely to have a low probability for detection, are identified as 'Ecosystem Credit' species. Targeted survey is not required for these species and they are listed in Table 4.2, where they have been predicted by the Credit Calculator to occur. In accordance with the FBA the list of predicted ecosystem credit species can be refined based on assessment of the presence of habitat components. For this assessment no predicted ecosystem species were excluded from the list. Additional ecosystem credit threatened species not predicted to occur, but observed during surveys are identified in Section 4.6.3 of this Report.

TABLE 4.2 PREDICTED THREATENED SPECIES (ECOSYSTEM CREDITS)			
Species Name	**TS Offset Multiplier**	**NSW Listing Status**	**National Listing Status**
Barking Owl *Ninox connivens*	3.0	Vulnerable	-
Brown Treecreeper (eastern subspecies) *Climacteris picumnus subsp. victoriae*	2.0	Vulnerable	-

TABLE 4.2 PREDICTED THREATENED SPECIES (ECOSYSTEM CREDITS)			
Species Name	**TS Offset Multiplier**	**NSW Listing Status**	**National Listing Status**
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	2.2	Vulnerable	-
Eastern Coastal Free-tailed Bat *Micronomus norfolkensis*	2.2	Vulnerable	-
Flame Robin *Petroica phoenicea*	1.3	Vulnerable	-
Gang-gang Cockatoo *Callocephalon fimbriatum*	2.0	Vulnerable	-
Greater Broad-nosed Bat *Scoteanax rueppellii*	2.2	Vulnerable	-
Hooded Robin (south-eastern form) *Melanodryas cucullata subsp. cucullata*	1.7	Vulnerable	-
Little Eagle *Hieraaetus morphnoides*	1.4	Vulnerable	-
Little Lorikeet *Glossopsitta pusilla*	1.8	Vulnerable	-
Powerful Owl *Ninox strenua*	3.0	Vulnerable	-
Red-legged Pademelon *Thylogale stigmatica*	2.6	Vulnerable	-
Scarlet Robin *Petroica boodang*	1.3	Vulnerable	-
Sooty Owl *Tyto tenebricosa*	3.0	Vulnerable	-
Speckled Warbler *Chthonicola sagittata*	2.6	Vulnerable	-
Spotted-tailed Quoll *Dasyurus maculatus*	2.6	Vulnerable	Endangered
Turquoise Parrot *Neophema pulchella*	1.8	Vulnerable	-
Varied Sittella *Daphoenositta chrysoptera*	1.3	Vulnerable	-
Wompoo Fruit-dove *Ptilinopus magnificus*	1.3	Vulnerable	-
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	2.2	Vulnerable	-

4.3 SPECIES CREDIT SPECIES

An assessment of the species credit type threatened species to determine the candidate threatened species for targeted surveys is provided in Table 4.3. The species listed include those predicted by the Credit Calculator and any threatened species credit species previously identified from the site, if known from previous reports or recorded on the Bionet Atlas (NSW DPIE 2021b). The details of preferred habitat and habitat constraints have been provided based on information obtained from the Biobanking Threatened Species Profile Database, the Bionet Threatened Species Profile Database, the NSW Bionet Atlas (NSW DPIE 2021b) and additional relevant references where listed.

TABLE 4.3
CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)

List of Candidate Species Credit Species	Preferred Habitat & Habitat Constraints	Is the proposed disturbance area within species known or likely habitat distribution	Justification of Inclusion or exclusion	Observation Status & Species Polygon Area or Extent (if relevant)	Able to Withstand Loss	NSW Listing Status	National Listing Status
Cymbidium canaliculatum – population in the Hunter Catchment	**Preferred Habitat:** Found most commonly in *Eucalyptus albens* dominated woodland and less commonly on *Eucalyptus dawsonii, Eucalyptus crebra, Eucalyptus moluccana, Angophora floribunda, Acacia salicina*.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	No	Endangered Population	Not Listed
White-flowered Wax Plant *Cynanchum elegans*	**Preferred Habitat:** Grows in dry rainforest, littoral rainforest, coastal scrub, *Eucalyptus tereticornis* aligned open forest and woodland; *Corymbia maculata* aligned open forest and woodland and *Melaleuca armillaris* scrub.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	No	Endangered	Endangered

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Diuris pedunculata Snake Orchid	**Preferred Habitat:** Grassy slopes and flats often on peaty soils and also shale and fine granite soils. It is noted that the taxonomic status of this species is under review with current populations found above 800m being *Diuris pallens*. *Diuris pedunculata* has historically been found on lowlands around Richmond and Windsor with a record for the Paterson area. It is uncertain if any extant populations of this species exist.	Yes (based on historical range records)	Species included / subject to targeted surveys	Not observed during targeted surveys	No	Vulnerable	Not Listed
Slaty Red Gum *Eucalyptus glaucina*	**Preferred Habitat:** This species grows in grassy woodland and dry eucalypt forest.	Yes	Species included / subject to targeted surveys	Observed during surveys Estimated 2887 individuals within proposed disturbance area	Yes	Vulnerable	Vulnerable

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Small-flower Grevillea *Grevillea parviflora* subsp. *parviflora*	**Preferred Habitat:** This species grows in sandy or light clay soils usually over thin shales often with lateritic ironstone gravels and nodules. It occurs in a range of vegetation types from open forest and heath to shrubby woodland.	No	Site does not contain suitable habitat.	Not likely to occur Not observed during targeted surveys	No	Vulnerable	Vulnerable
Tall Rusty Hood *Pterostylis chaetophora*	**Preferred Habitat:** Occurs in seasonally moist, dry sclerophyll forest with a grass and shrub understorey.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	-	Vulnerable	Not Listed
Rainforest Cassia *Senna acclinis*	**Preferred Habitat:** Occurs within and adjacent to subtropical and dry rainforest.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	No	Endangered	Not Listed

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Scrub Turpentine *Rhodamnia rubescens*	**Preferred Habitat:** Rainforest and moist sclerophyll forest.	Yes	Species included / subject to targeted surveys	Not observed within the proposed disturbance area. 109 individuals observed at three locations within the impact avoidance area associated with the east pit. The plants observed are not likely to be impacted by the proposal.	-	Critically Endangered	Critically Endangered
Regent Honeyeater *Anthochaera phrygia*	**Preferred Habitat:** Inhabits temperate woodlands on the inland slopes of the south-east Australia. It is also recorded in the Hunter Valley and in drier coastal woodlands and swamp forests in some years.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	Yes	Critically Endangered	Critically Endangered

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Eastern Pygmy Possum *Cercartetus nanus*	**Preferred Habitat:** In New South Wales the species is found in coastal areas and inland areas at higher elevation. Pygmy-Possums feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. In most areas woodlands and heath appear to be preferred, except in Northern NSW where they are more frequently encountered in Rainforest.	Species has a wide and patchy distribution. No known records within 10km of the site. Nearest record on the Bionet Atlas of NSW Wildlife (NSW DPIE 2021b) is approximately 22km to the south-east of the site.	Site does not contain Banksias, Grevilleas or Callistemon. Surveys undertaken, species considered not likely to occur.	Not observed during targeted surveys	-	Vulnerable	-
White-bellied Sea-Eagle *Haliaeetus leucogaster* Breeding Habitat	**Habitat Constraints:** Mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest within 1.5 km of a coastline, estuary, river, fresh or saline lake, lagoon, wetland, or water reservoir.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	No	Vulnerable	Not Listed

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Pale-headed Snake *Hoplocephalus bitorquatus*	**Preferred Habitat:** Inhabits dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. Shelters in trees. **Habitat constraints:** land containing hollow-bearing trees, loose bark and/or fallen timber	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	Yes	Vulnerable	Not Listed
Golden-tipped Bat *Kerivoula papuensis*	**Preferred Habitat:** Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	Yes	Vulnerable	-

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Green and Golden Bell Frog *Litorea aurea*	**Preferred Habitat:** Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. **Habitat constraints:** Land within 100m of emergent aquatic or riparian vegetation	Marginally	Species included / subject to targeted surveys	Not observed during targeted surveys	Yes	Endangered	Vulnerable
Parma Wallaby *Macropus parma*	**Preferred Habitat:** Inhabits moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. **Habitat Constraints:** Forests with thick, shrubby understorey associated with grassy patches	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	Yes	Vulnerable	Not Listed

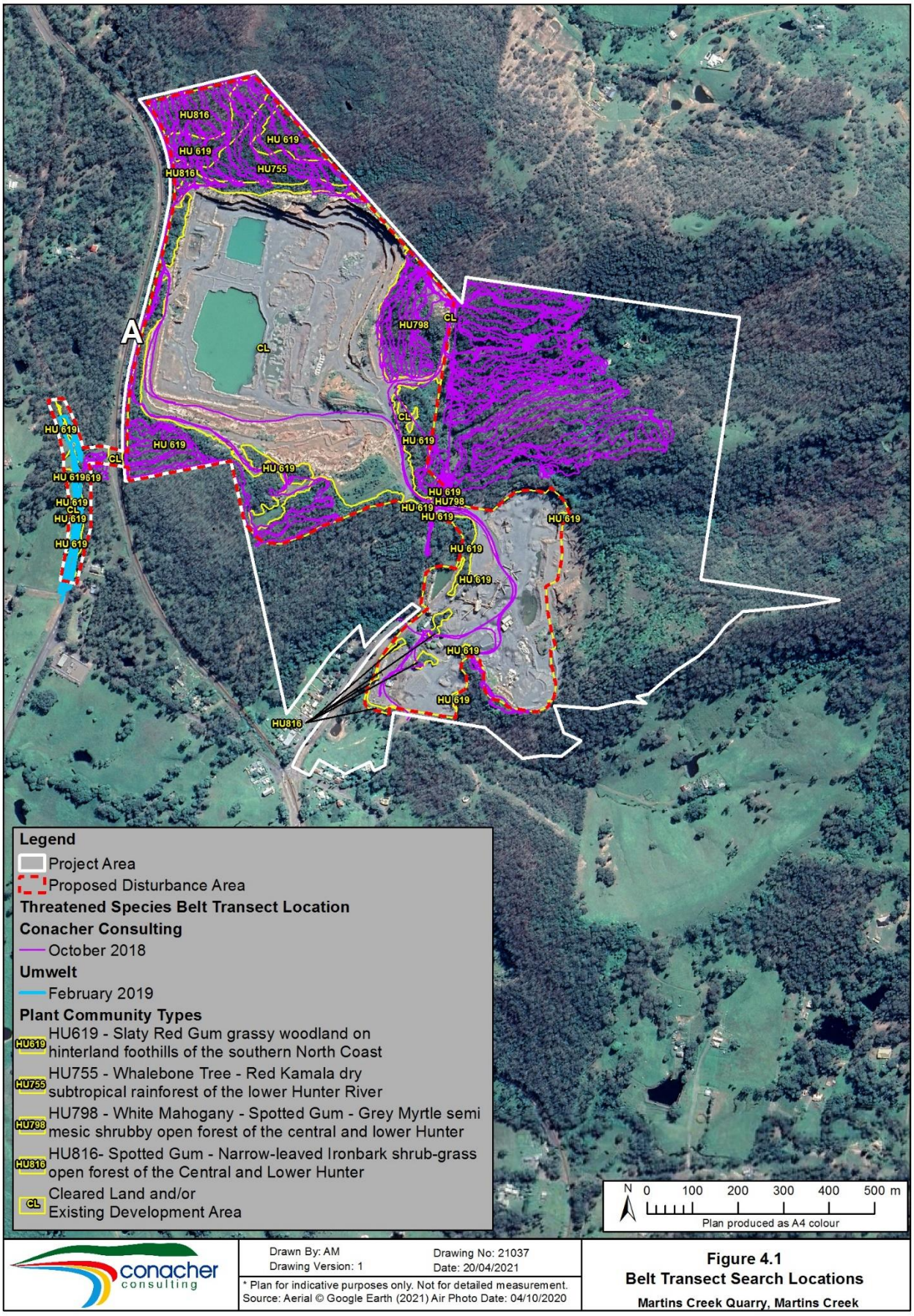
TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Little Bent-winged Bat *Miniopterus australis* Breeding Habitat	**Habitat Constraints:** Land containing caves or similar structures for breeding	Yes	Species excluded, no suitable breeding habitat present.	Not observed during targeted surveys	No	Vulnerable	Not Listed
Large Bent-winged Bat *Miniopterus orianae oceanensis* Breeding Habitat	**Habitat Constraints:** Land containing caves or similar structures for breeding	Yes	Species excluded, no suitable breeding habitat present.	Not observed during targeted surveys	Yes	Vulnerable	Not Listed
Southern Myotis *Myotis macropus*	**Preferred Habitat:** Forages over streams and pools and roosts in caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage close to foraging habitats. **Habitat Constraints:** Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone	Yes	Species included / subject to targeted surveys	Observed Polygon = 13.80 ha	Yes	Vulnerable	Not Listed

TABLE 4.3 CANDIDATE THREATENED SPECIES (SPECIES CREDIT SPECIES)							
List of Candidate Species Credit Species	**Preferred Habitat & Habitat Constraints**	**Is the proposed disturbance area within species known or likely habitat distribution**	**Justification of Inclusion or exclusion**	**Observation Status & Species Polygon Area or Extent (if relevant)**	**Able to Withstand Loss**	**NSW Listing Status**	**National Listing Status**
Brush-tailed Phascogale *Phascogale tapoatafa*	**Preferred Habitat:** Dry sclerophyll open forest with hollow bearing trees.	Yes	Species included / subject to targeted surveys	Observed Polygon = 21.13 ha	Yes	Vulnerable	Not Listed
Koala *Phascolarctos cinereus*	**Preferred Habitat:** Inhabit eucalypt woodlands and forests with suitable feed trees.	Yes	Species included / subject to targeted surveys	Observed Polygon = 21.13 ha	Yes	Vulnerable	Vulnerable
Grey-headed Flying-fox *Pteropus poliocephalus* (Breeding Habitat)	**Preferred Habitat:** Survey camp sites	Yes	Species included / subject to targeted surveys for camp sites	No camp sites observed during targeted surveys	No	Vulnerable	Vulnerable
Red-backed Button Quail *Turnix maculosus*	**Preferred Habitat:** Grassland, heath and crops in NSW, particularly close to water.	Yes	Species included / subject to targeted surveys	Not observed during targeted surveys	No	Vulnerable	

4.4 DETAILS OF TARGETED FLORA SURVEYS

The targeted belt transects and meander search locations for threatened flora species are mapped in Figure 4.1 and Figure 4.2. Figure 4.1 shows the locations of targeted belt transect searches completed during October 2018 and February 2019 by Umwelt. Figure 4.2 shows the locations of additional threatened flora searches completed by *Conacher Consulting* and Umwelt shows the locations of threatened flora search surveys completed by Umwelt.

Descriptions of the surveys completed for the candidate threatened flora species are provided in the following sub-sections 4.4.1 to 4.4.8 of this Report.


HU816
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HU 619619
HU 619
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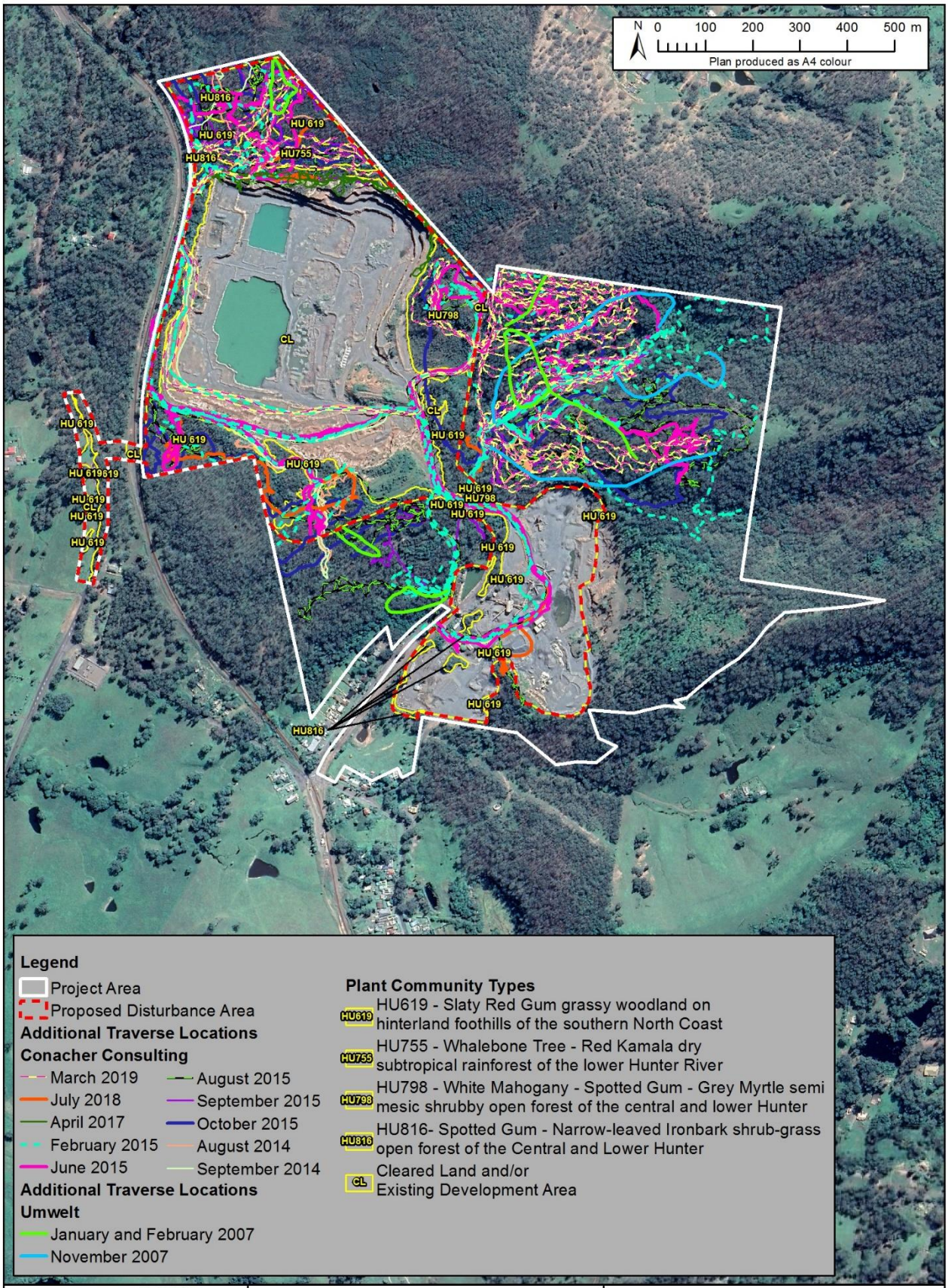
HU 619
HU 619
HU 619
HU798
HU 619
HU 619
HU 619
HU 619
HU 619
HU 619
HU816
Legend
Project Area
Proposed Disturbance Area
Threatened Species Belt Transect Location
Conacher Consulting
October 2018
Umwelt
February 2019
Plant Community Types
HU619 - Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast
HU755 - Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River
HU798 - White Mahogany - Spotted Gum - Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter
HU816- Spotted Gum - Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
Cleared Land and/or Existing Development Area
N
0
100
200
300
400
500 m
Plan produced as A4 colour
conacher consulting
Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 4.1
Belt Transect Search Locations
Martins Creek Quarry, Martins Creek


N 0 100 200 300 400 500 m
Plan produced as A4 colour
HU816
HU 619
HU755
HU798
CL
Legend
Project Area
Proposed Disturbance Area
Additional Traverse Locations
Conacher Consulting
March 2019
July 2018
April 2017
February 2015
June 2015
August 2015
September 2015
October 2015
August 2014
September 2014
Additional Traverse Locations
Umwelt
January and February 2007
November 2007
Plant Community Types
HU619 - Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast
HU755 - Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River
HU798 - White Mahogany - Spotted Gum - Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter
HU816- Spotted Gum - Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
Cleared Land and/or Existing Development Area
conacher consulting
Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 4.2
Additional Site Traverse Locations
Martins Creek Quarry, Martins Creek

4.4.1 *Cymbidium canaliculatum* – population in the Hunter Catchment

Approximately 10m spaced belt transect searches for this species were undertaken in areas of suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)
- 19 February 2019 (1 person)

The locations of the searches completed during 2018 and 2019 are mapped in Figure 4.1.

Additional belt transect and meander searches (traverses) were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 20 August 2014 (1hr)
- 21 August 2014 (7hrs)
- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 18 February 2015 (10hrs)
- 19 February 2015 (12hrs)
- 20 February 2015 (2hrs)
- 10 June 2015 (5hrs)
- 11 June 2015 (5hrs)
- 17 August 2015 (8hrs)
- 18 August 2015 (8hrs)
- 19 August 2015 (8hrs)
- 20 August 2015 (8hrs)
- 21 August 2015 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)

Where available, the locations of the additional traverse surveys as recorded with a hand-held GPS device have been plotted in Figure 4.2.

4.4.2 White-flowered Wax Plant (*Cynanchum elegans*)

There are no seasonal survey requirements for this species.

Approximately 10m spaced belt transect searches for this species were undertaken in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)
- 19 February 2019 (1 person)

The locations of the searches completed during 2018 and 2019 are mapped in Figure 4.1.

Additional belt transect and meander searches (traverses) were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 20 August 2014 (1hr)
- 21 August 2014 (7hrs)
- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 18 February 2015 (10hrs)
- 19 February 2015 (12hrs)
- 20 February 2015 (2hrs)
- 10 June 2015 (5hrs)
- 11 June 2015 (5hrs)
- 17 August 2015 (8hrs)
- 18 August 2015 (8hrs)
- 19 August 2015 (8hrs)
- 20 August 2015 (8hrs)
- 21 August 2015 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)

Where available, the locations of the additional traverse surveys as recorded with a hand-held GPS device have been plotted in Figure 4.2.

4.4.3 Snake Orchid (*Diuris pedunculata*)

Surveys for this species are required between September and October.

Approximately 10m spaced belt transect searches for this species were undertaken in areas of suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- 3 October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)

The locations of the searches completed during 2018 and 2019 are mapped in Figure 4.1.

Additional belt transect and meander searches (traverses) were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)

Where available, the locations of the additional traverse surveys as recorded with a hand-held GPS device have been plotted in Figure 4.2.

4.4.4 Slaty Red Gum *(Eucalyptus glaucina)*

The presence of *Eucalyptus glaucina* within the site was determined during initial site investigations and the presence of previous site records for this species was documented in the Preliminary Environmental Assessment provided with the request for the SEARs.

Field surveys consisted of initial systematic searches throughout the site to determine the area of occupancy followed by quadrat counts and extrapolation to enable determination of the number of individuals likely to be removed within the impact areas. A detailed description of the methods utilised is provided as follows.

Determination of Distribution
Field traverses were undertaken systematically across the vegetated areas of the proposed disturbance area to determine the locations and approximate distribution of *E. glaucina*. Aerial photographs and a hand-held GPS device was used to identify and record the distribution of this species within the site during surveys.

Initial searches for this species were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 20 August 2014 (1hr)
- 21 August 2014 (7hrs)
- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 18 February 2015 (10hrs)
- 19 February 2015 (12hrs)
- 20 February 2015 (2hrs)
- 10 June 2015 (5hrs)
- 11 June 2015 (5hrs)
- 17 August 2015 (8hrs)
- 18 August 2015 (8hrs)
- 19 August 2015 (8hrs)
- 20 August 2015 (8hrs)
- 21 August 2015 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)
- 26 July 2018 (voucher sampling by 2 persons over 3.5hrs)
- 3 October 2018 (additional distribution searches by 2 persons over 7hrs)
- 9 October 2018 (additional distribution searches by 3 persons over 7.5hrs)

Where available, the locations of these surveys as recorded with a hand-held GPS device, and have been plotted in Figure 4.2.

The distribution of this species was further refined during 10m spaced belt transect searches completed in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) mapped in Figure 4.1.

Determination of Abundance
A total of eight (8) quadrats of 20x50m (1000m^2) size were surveyed within areas containing *E. glaucina* in the proposed impact area.

The quadrat locations are shown in Figure 4.3, the quadrat locations were chosen and marked on an aerial photograph prior to the counting survey to ensure representativeness and adequate sampling across the site. The quadrat surveys for *E. glaucina* were undertaken on the 16th and 17th of September 2015 and on 25-27 October 2016.

Each quadrat was set out in the field with a compass and measuring tape and marked in the field with coloured flagging tape during the survey. GPS coordinates were recorded for each quadrat to enable mapping of survey quadrat locations on a map of the site. The total number of all *E. glaucina* trees and saplings present within the quadrats were counted. Each *E. glaucina* individual within the quadrats was marked within spray paint to ensure none were missed or double counted.

The total number of *E. glaucina* individuals present was determined for each quadrat. The results from the quadrats within the proposed disturbance area were used to determine the mean density. The mean density was utilised to extrapolate an estimate of the quantity of *E. glaucina* individuals within the areas containing this species which are to be impacted. The results for the survey are presented in Section 4.6.1.

Compliance with OEH Guidelines

The field surveys and abundance estimates for *E. glaucina* were completed in accordance with the requirements of the NSW Guide to Surveying Threatened Plants (NSW OEH 2016). Specifically the guideline identifies that:

'Where the unit of measure is abundance, the number of individuals can be counted, or sampling and extrapolation may need to provide an estimate of abundance.

Small groups of individuals (<50 plants) can be counted with reasonable confidence. However, larger populations (>50 plants or >0.1 hectare area of occupancy) can't be counted without noticeable error (Cropper 1993, Keith 2000). In this case it is best to extrapolate the density by sampling over the area of occupancy. *Samples can be stratified according to areas of differing density, and counts made within quadrats'.*

The extent of *E. glaucina* within the site falls within the category of >50 plants over an area of >0.1 hectares. Therefore, in accordance with NSW OEH (2016), the quadrat-extrapolation method utilised by *Conacher Consulting* is identified as the best method for assessing the likely impacts to this species for this Project.

Confirmation of Identification

A total of 7 samples from Red Gum trees within the site were collected and sent to the NSW Royal Botanic Gardens for formal identification, the locations of the sample sites are shown in Figure 4.3. Samples 1 to 6 were collected during July 2018 and sample 7 was collected during March 2016.

A total of six of the samples sent were confirmed to be *Eucalyptus glaucina* (definite or probable identification level / sample locations 1-4 6 & 7) and one of the samples was identified as *Eucalyptus tereticornis* (sample location 5). Despite the presence of *E. tereticornis* at sample location 5, surrounding *E. glaucina* trees were observed at this location. The sample locations are shown in Figure 4.3. The identification results provided by the NSW Royal Botanic Gardens are provided in Appendix 6.

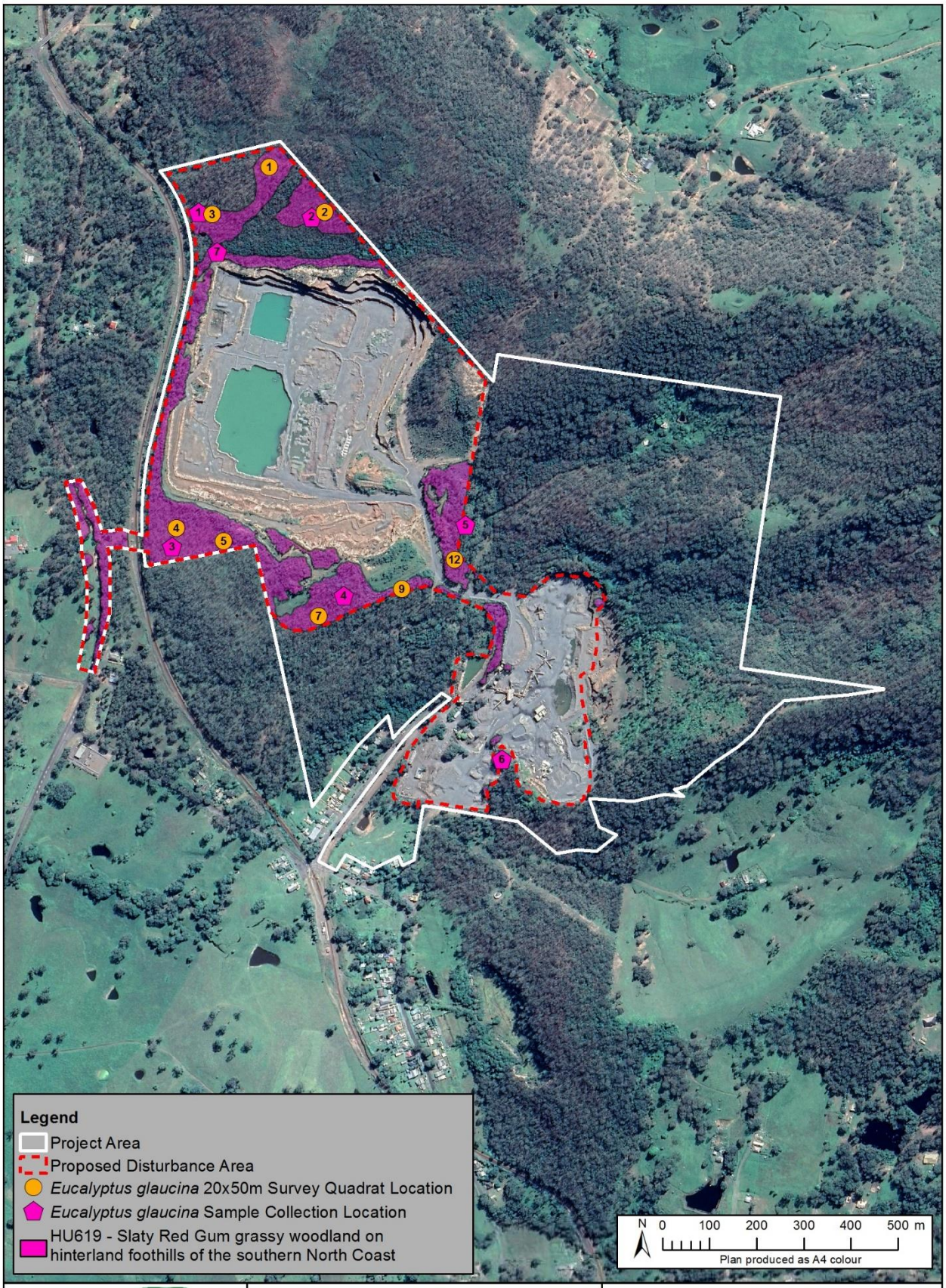


Figure 4.3
***Eucalyptus glaucina* Survey Quadrat Locations**
Martins Creek Quarry, Martins Creek

4.4.5 Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)

Approximately 10m spaced belt transect searches for this species were undertaken in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- 3 October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)
- 19 February 2019 (1 person)

The locations of the searches completed during 2018 and 2019 are mapped in Figure 4.1.

Additional belt transect and meander searches (traverses) were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 20 August 2014 (1hr)
- 21 August 2014 (7hrs)
- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 18 February 2015 (10hrs)
- 19 February 2015 (12hrs)
- 20 February 2015 (2hrs)
- 10 June 2015 (5hrs)
- 11 June 2015 (5hrs)
- 17 August 2015 (8hrs)
- 18 August 2015 (8hrs)
- 19 August 2015 (8hrs)
- 20 August 2015 (8hrs)
- 21 August 2015 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)

Where available, the locations of the additional traverse surveys as recorded with a hand-held GPS device have been plotted in Figure 4.2.

4.4.6 Rainforest Cassia (*Senna acclinis*)

Approximately 10m spaced belt transect searches for this species were undertaken in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- 3 October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)
- 19 February 2019 (1 person)

The locations of the searches completed during 2018 and 2019 are mapped in Figure 4.1.

Additional belt transect and meander searches (traverses) were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 20 August 2014 (1hr)
- 21 August 2014 (7hrs)
- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 18 February 2015 (10hrs)
- 19 February 2015 (12hrs)
- 20 February 2015 (2hrs)
- 10 June 2015 (5hrs)
- 11 June 2015 (5hrs)
- 17 August 2015 (8hrs)
- 18 August 2015 (8hrs)
- 19 August 2015 (8hrs)
- 20 August 2015 (8hrs)
- 21 August 2015 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)

Where available, the locations of the additional traverse surveys as recorded with a hand-held GPS device have been plotted in Figure 4.2.

4.4.7 Tall Rusty Hood (*Pterostylis chaetophora*)

The NSW OEH have identified that surveys for this species are to be completed between late September (i.e. last week) to early October (first two weeks).

Approximately 10m spaced belt transect searches for this species were undertaken in areas of suitable habitat in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- 3 October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)

The locations of the searches completed during 2018 are mapped in Figure 4.1.

Additional belt transect and meander searches (traverses) were undertaken during the completion of plot surveys and several site traverses on the following dates:

- 5 September 2014 (3hrs)
- 30 September 2014 (2hrs)
- 15 September 2015 (5hrs)
- 16 September 2015 (8hrs)
- 17 September 2015 (9hrs)
- 18 September 2015 (2hrs)
- 14 October 2015 (4.5hrs)

Where available, the locations of the additional traverse surveys as recorded with a hand-held GPS device have been plotted in Figure 4.2.

4.4.8 Scrub Turpentine (*Rhodamnia rubescens*)

Approximately 10m spaced belt transect searches for this species were undertaken in accordance with the NSW Guide to Surveying Threatened Plants (NSW OEH 2016) on the following dates:

- 3 October 2018 (2 persons over 7hrs)
- 9 October 2018 (3 persons over 7.5hrs)
- 19 February 2019 (1 person)

The locations of the searches completed during 2018 and 2019 are mapped in Figure 4.1.

An additional targeted search and counting survey for this species was completed on 13 March 2019 by two persons over 7 hours. The areas where this species was observed has subsequently been removed from the proposed disturbance area. All specimens observed were counted and their locations were recorded with a hand-held GPS device. Direct counts of this species were able to be conducted due to the limited distribution of the individuals observed.

4.5 DETAILS OF TARGETED FAUNA SURVEYS

The dates and times of all fauna surveys completed are listed in Appendix 3. The targeted surveys completed for candidate 'species credit' threatened fauna were undertaken in accordance with the following survey guidelines:

- Field Survey methods – Field survey methods for environmental consultants and surveyors when assessing proposed development or their activities on site containing threatened species (NSW DEC 2004a)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (NSW DEC 2004b)
- Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (NSW DECC 2009)

Where survey methods were employed which are not listed within these guidelines, additional consultation was undertaken with the NSW DPIE.

The details of the specific surveys undertaken for each of the target species are provided as follows.

4.5.1 Regent Honeyeater (*Anthochaera phrygia*) Surveys

The Threatened Species Profile Database identifies that surveys for this species can be undertaken in any month. Searches for the Regent Honeyeater were undertaken throughout the year, including during August 2014 and August – September 2015 when Spotted Gum (*Corymbia maculata*) and Slaty Red Gum (*Eucalyptus glaucina*) trees were flowering. Sporadic flowering of ironbark species was also observed throughout the survey period.

Details of the targeted surveys completed for the Regent Honeyeater are provided in Table 4.4a and survey locations are shown in Figure 4.4a. This species was not observed within the site during targeted surveys.

TABLE 4.4a DETAILS OF TARGETED SURVEYS COMPLETED FOR THE REGENT HONEYEATER			
Survey Technique	**Survey Effort & Timing**	**Weather Conditions**	**Survey Completed By**
Diurnal Search	**20 August 2014** 1hr x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2014** 7hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**5 September 2014** 3hrs 20 min x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**30 September 2014** 2.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 February 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 February 2015** 12 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**20 February 2015** 2hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**10 June 2015** 5.25hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**11 June 2015** 5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**17 August 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 August 2015** 8.25 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 August 2015** **8.5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**20 August 2015** **8.75hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2015** **2.75hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**15 September 2015** **5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**16 September 2015** **9hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**17 September 2015** **8hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**18 September 2015** **2.5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**14 October 2015** 4.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**25 July 2018** 5.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search / Opportunistic	**3 October 2018** 2 persons x 7hrs	See Appendix 4	Conacher Consulting
Diurnal Search / Opportunistic	**9 October 2018** 3 persons x 7.5hrs	See Appendix 4	Conacher Consulting

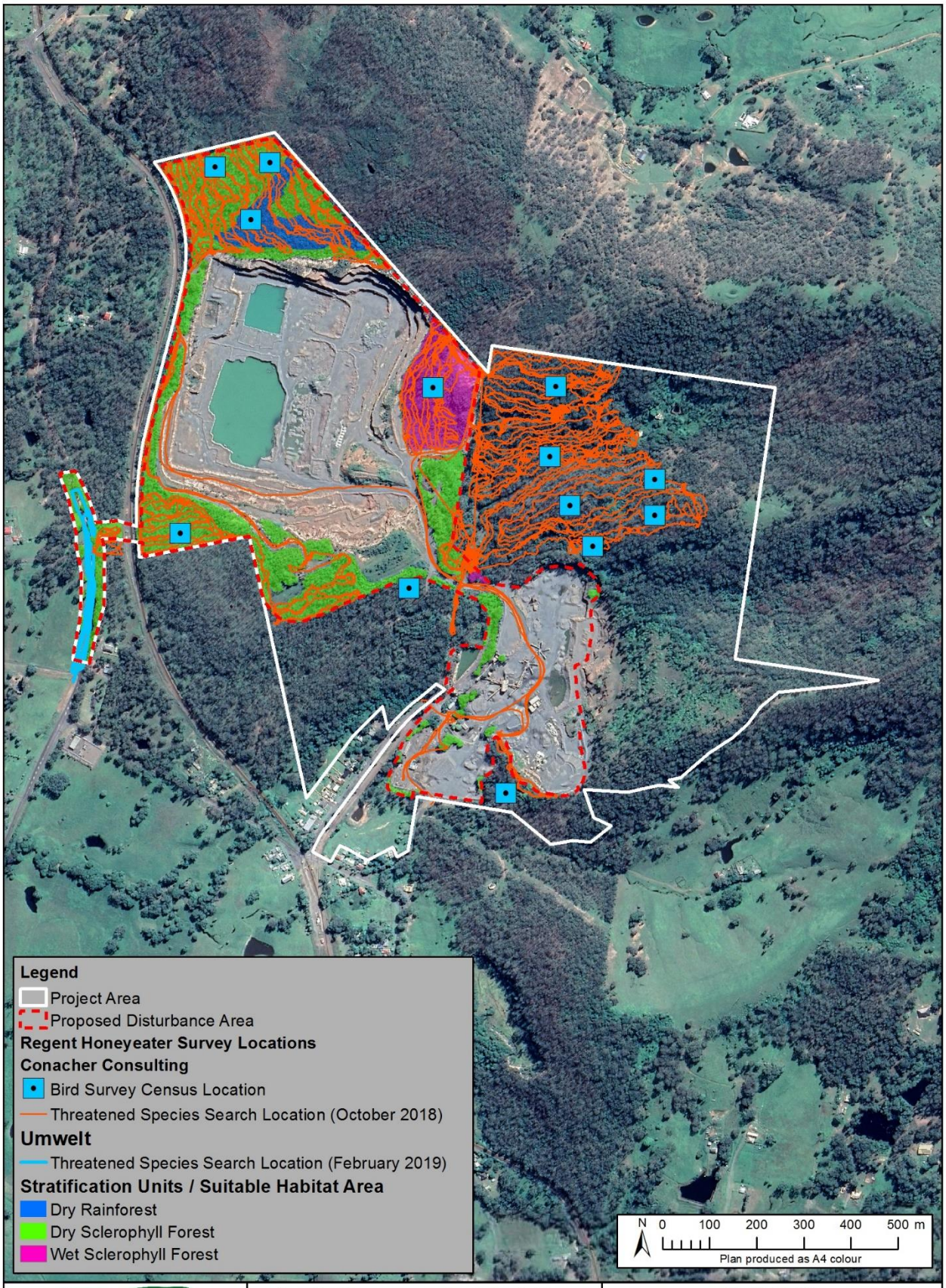


Figure 4.4A
Regent Honeyeater Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.2 Eastern Pygmy Possum (*Cercartetus nanus*) Surveys

The OEH have identified that surveys for this species can be undertaken during mid-spring to mid-autumn The weather conditions during surveys were suitably warm for survey purposes, particularly the Elliot trapping surveys completed. There are no records of a population of this species within over 20km of the site (NSW OEH 2021b).

Details of the targeted surveys completed for the Eastern Pygmy-possum are provided in Table 4.4b and survey locations are shown in Figure 4.4b. Habitat assessments were completed during threatened species searches.

This species was not observed within the site and it is considered that the proposed disturbance area does not contain optimal habitat for this species due to a lack of preferred foraging habitat components including Banksia, Grevillea and Callistemon species.

TABLE 4.4b
DETAILS OF TARGETED SURVEYS COMPLETED FOR THE EASTERN PYGMY-POSSUM

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Spotlighting (walking)	**January 2007** 4 person hours	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (walking)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (driving)	**January 2007** 1 person hour	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (driving)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (Walking)	**20 & 21 August 2014** 8 persons hrs	Mild temperature, no rainfall	Conacher Consulting
Spotlighting (Walking)	**18 & 19 February 2015** 8 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Spotlighting (Walking)	**17 & 19 August 2015** 4 person hours	Mild, no rainfall during survey	Conacher Consulting
Spotlighting (Walking)	**17 September 2015** 2 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Arboreal Elliot B Traps (Rolled oats & peanut butter bait / trap tree sprayed with honey and water mixture)	**January 2007** 70 trap nights	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Arboreal Elliot A Traps (rolled oats, honey & peanut butter bait / trap tree sprayed with honey/water mix)	**15 September – 17 September 2015** 162 trap nights (9 transects of 6 traps x 3 nights)	Variable – see Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (rolled oats, honey, peanut butter bait & insectivore mix / bait tree sprayed with honey/water mix) *supplementary survey method only	**21 August – 4 September 2014** 56 Trap nights -2 arboreal cameras x 14 nights -2 terrestrial cameras x 14 nights	Variable – see Appendix 4	Conacher Consulting

TABLE 4.4b DETAILS OF TARGETED SURVEYS COMPLETED FOR THE EASTERN PYGMY-POSSUM			
Survey Technique	**Survey Effort & Timing**	**Weather Conditions**	**Survey Completed By**
Baited Infra-red Camera Survey (rolled oats, honey, peanut butter & insectivore mix bait / bait tree sprayed with honey/water mix) *supplementary survey method only	**11 June – 21 August 2015** 568 trap nights -8 arboreal cameras x 71 nights	Variable – see Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (Peanut butter, honey and oats / bait tree sprayed with honey/water mix) *supplementary survey method only	**1 June – 1 July 2020** 1080 trap nights -36 cameras x 30 nights (Rebaited 16th June)	Variable – see Appendix 4	Umwelt

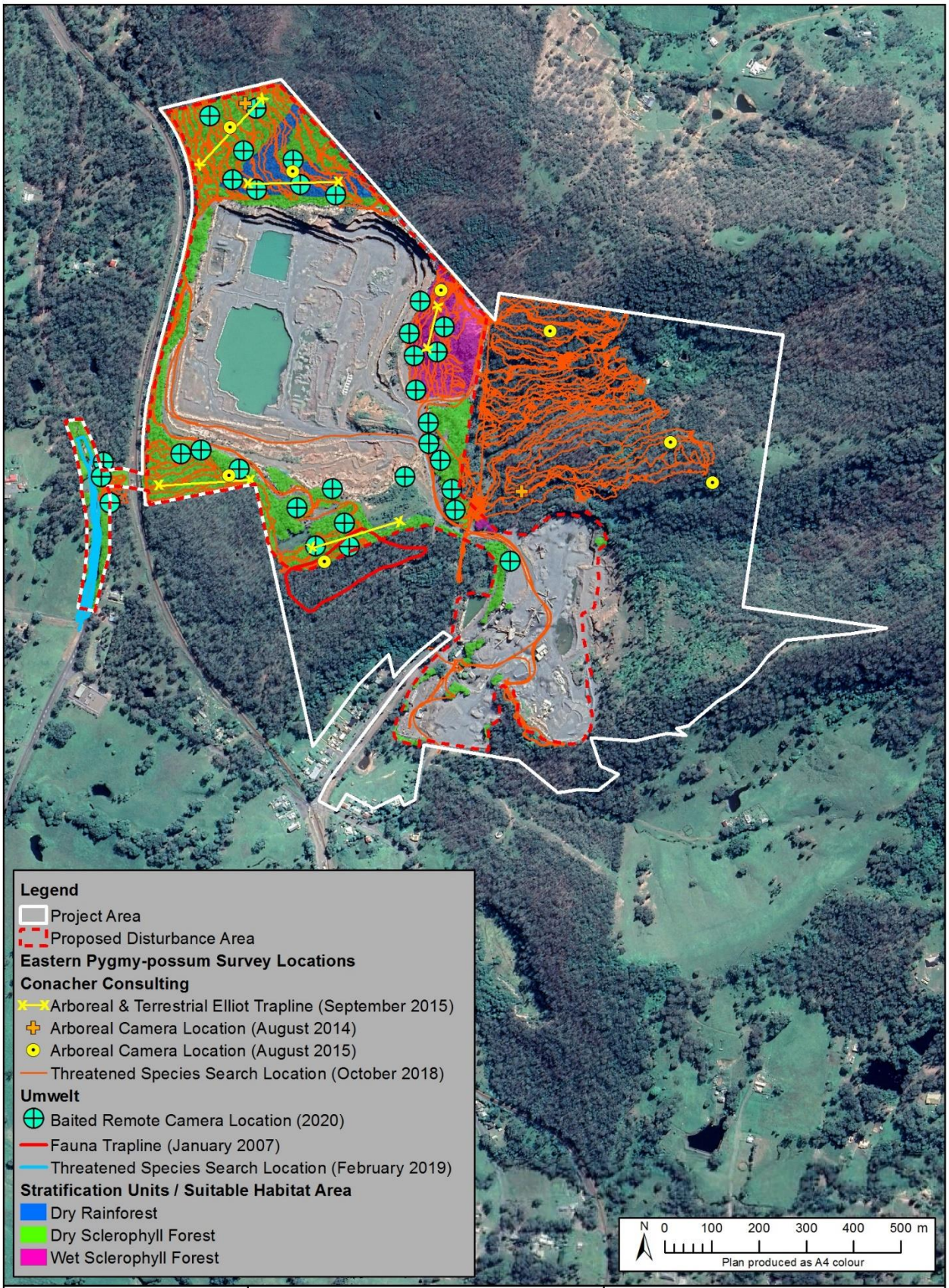


Figure 4.4B
Eastern Pygmy Possum Targeted Survey Locations
Martins Creek Quarry, Martins Creek

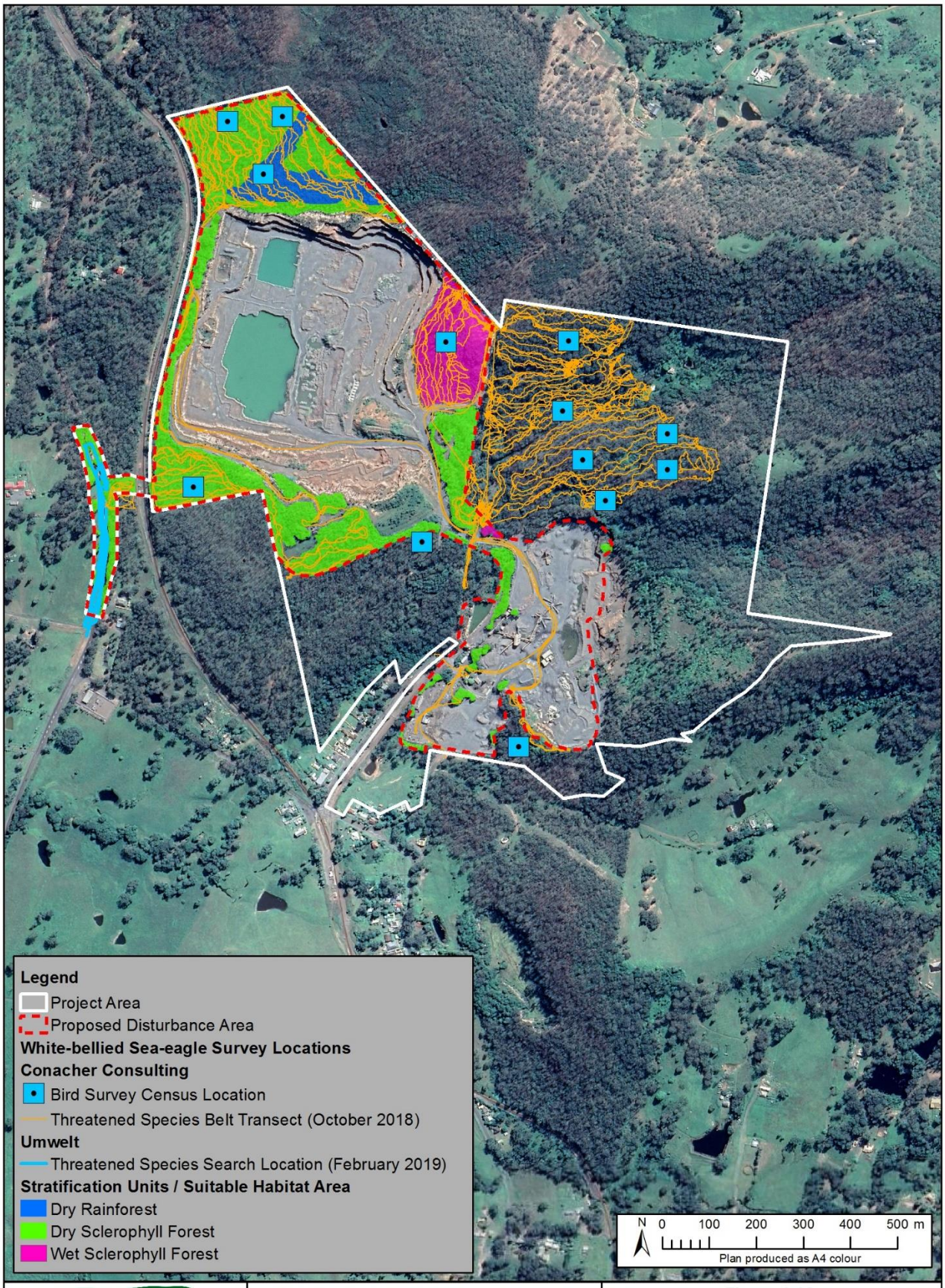
4.5.3 White-bellied Sea-Eagle (*Haliaeetus leucogaster*) Breeding Habitat Surveys

The Threatened Biodiversity Data Collection identifies that surveys for this species can be undertaken between July to December.

Details of the targeted surveys completed for White-bellied Sea-Eagle are provided in Table 4.4c and survey locations are shown in Figure 4.4c. This species was not observed within the site during targeted surveys.

TABLE 4.4c
DETAILS OF TARGETED SURVEYS COMPLETED FOR THE WHITE-BELLIED SEA-EAGLE

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Diurnal Search	**5 September 2014** 3hrs 20 min x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**30 September 2014** 2.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 February 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 February 2015** 12 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**20 February 2015** 2hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**17 August 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 August 2015** 8.25 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 August 2015** **8.5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**20 August 2015** **8.75hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2015** **2.75hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**15 September 2015** **5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**16 September 2015** **9hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**17 September 2015** **8hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**18 September 2015** **2.5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**14 October 2015** 4.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**25 July 2018** 5.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Opportunistic Search	**3 October 2018** 2 persons x 7hrs	See Appendix 4	Conacher Consulting
Opportunistic Search	**9 October 2018** 3 persons x 7.5hrs	See Appendix 4	Conacher Consulting



conacher consulting

Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021

* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020

Figure 4.4C
White-bellied Sea-eagle Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.4 Pale-headed Snake (*Hoplocephalus bitorquatus*) Surveys

The Threatened Biodiversity Data Collection identifies that surveys for this species can be undertaken between November to March.

Targeted nocturnal searches were undertaken during January 2007 (2 nights), November 2007 (2 nights) and February 2015 (2 nights). Details of the targeted surveys completed for this species are provided in Table 4.4d and survey locations are shown in Figure 4.4d. This species was not observed within the site during targeted surveys.

TABLE 4.4d
DETAILS OF TARGETED SURVEYS COMPLETED FOR PALE-HEADED SNAKE

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Nocturnal Habitat Search	**January 2007** 2 person hours (30min search x 2 persons x 2 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Nocturnal Habitat Search	**November 2007** 2 person hours (30min search x 2 persons x 2 nights)	Mild	Umwelt (2009)
Spotlighting (Walking & Driving)	**18 February 2015** 4 person hours (2 persons x 2 hrs)	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Spotlighting (Walking & Driving)	**19 February 2015** 4 person hours (2 persons x 2 hrs)	Warm, no rainfall during survey (rainfall prior to survey)	Conacher Consulting

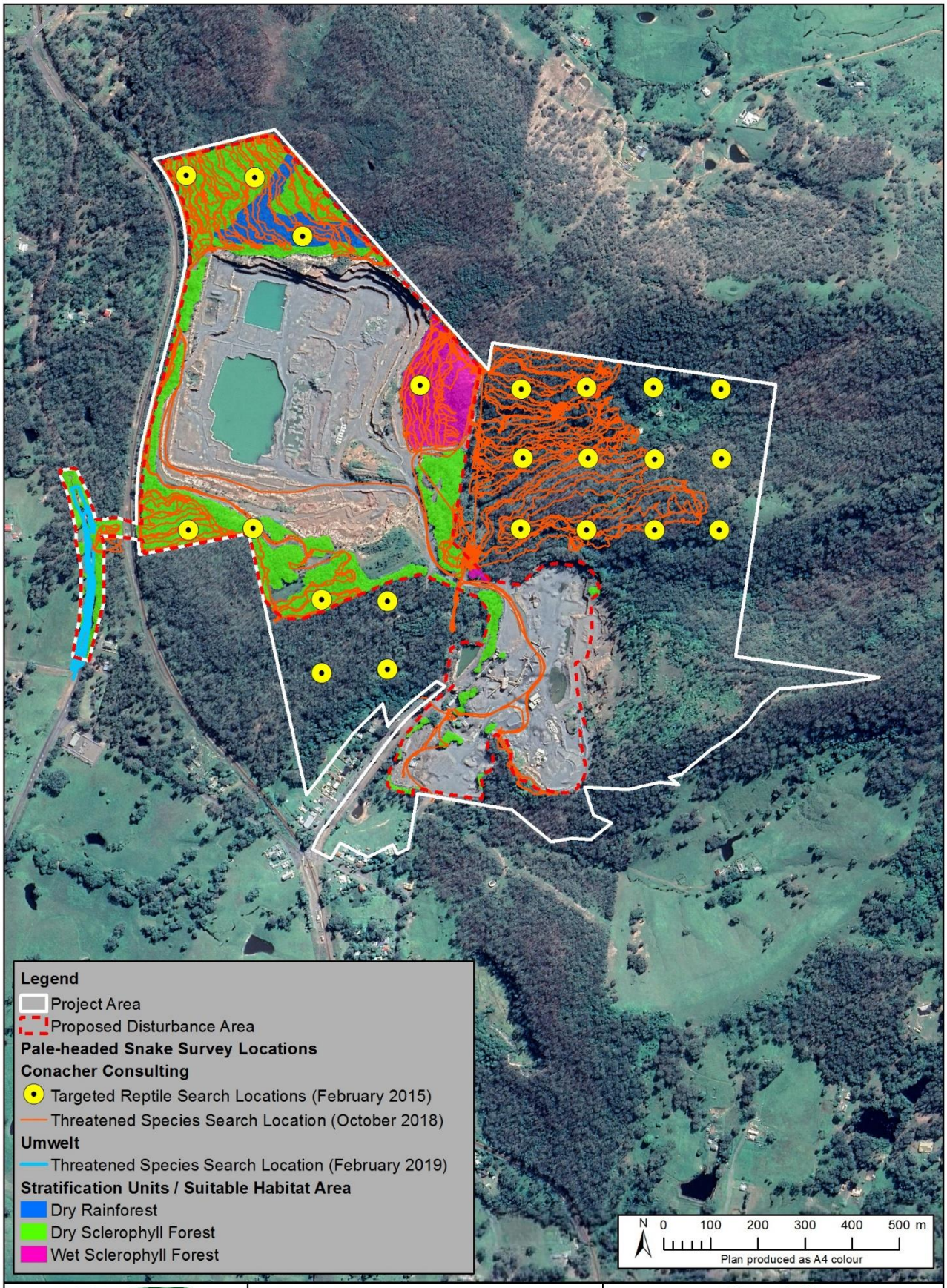


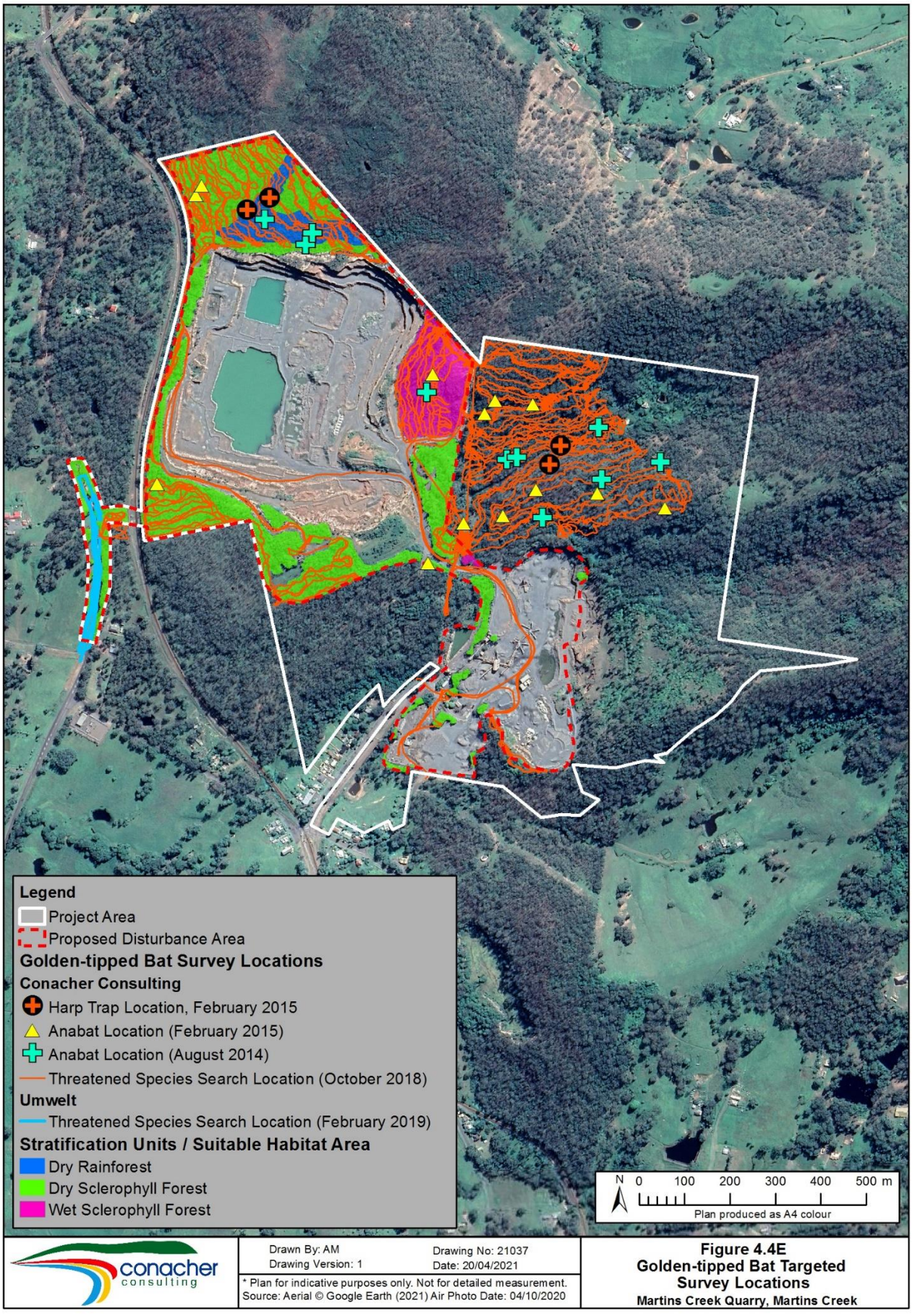
Figure 4.4D
Pale-headed Snake Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.5 Golden-tipped Bat (*Kerivoula papuensis*) Surveys

Details of the targeted surveys completed for this species are provided in Table 4.4e and survey locations are shown in Figure 4.4e. This species was not observed within the site during targeted surveys.

TABLE 4.4e
DETAILS OF TARGETED SURVEYS COMPLETED FOR GOLDEN-TIPPED BAT

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Harp Trapping	**January 2007** **6** trap nights (2 traps x 3 consecutive nights) One trap in Dry Sclerophyll Forest habitat One trap in Dry Rainforest habitat	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Harp Trapping	**18 & 19 February 2015** 4 harp trap nights - 2 harp traps x 2 consecutive nights in dry rainforest habitat	Variable / suitable survey conditions – see Appendix 4	Conacher Consulting
Ultrasonic Call Recording	**January 2007** 6 recording nights -3 recording nights in Dry Sclerophyll Forest -3 recording nights in Dry Rainforest	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Ultrasonic Call Recording	**November 2007** 9 recording nights -3 recorders x 3 nights	Mild temperature, patchy rainfall	Umwelt (2009)
Ultrasonic Call Recording	**18-19 February 2015** 4 recording nights **-**2 Anabat recorders x 2 nights	Variable / suitable survey conditions – see Appendix 4	Conacher Consulting
Ultrasonic Call Recording	**15-17 September 2015** 6 recording nights -2 Anabat recorders x 3 nights	Variable / suitable survey conditions – see Appendix 4	Conacher Consulting
Ultrasonic Call Recording (supplementary recordings out of survey season)	**20-21 August 2014** **4 recording nights** -2 Anabat recorders x 2 nights **17-20 August 2015** **8 recording nights** -2 Anabat recorders x 4 nights	Variable – see Appendix 4	Conacher Consulting
Opportunistic Search for Gerygone Nests for potential Golden-tipped Bat Roost Sites	Completed in conjunction with flora belt transect searches	Not applicable	Conacher Consulting


Legend
Project Area
Proposed Disturbance Area
Golden-tipped Bat Survey Locations
Conacher Consulting
Harp Trap Location, February 2015
Anabat Location (February 2015)
Anabat Location (August 2014)
Threatened Species Search Location (October 2018)
Umwelt
Threatened Species Search Location (February 2019)
Stratification Units / Suitable Habitat Area
Dry Rainforest
Dry Sclerophyll Forest
Wet Sclerophyll Forest
N
0 100 200 300 400 500 m
Plan produced as A4 colour
conacher consulting
Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 4.4E
Golden-tipped Bat Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.6 *Green and Golden Bell Frog* (*Litoria aurea*) Surveys

The Threatened Biodiversity Data Collection identifies that surveys for this species can be undertaken between November to March. Targeted survey methods utilised include tadpole surveys, call surveys and active searches in accordance with the requirements of the NSW Department of Environment and Climate Change (2009).

Surveys for this species were targeted to the watercourses and dams present and included surveys during summer after periods of rain. The watercourses present within the proposed disturbance area were found to be generally dry with only very minor ephemeral pools of water present following heavy rain events. The surveys involved day habitat searches for frogs and tadpoles, night spotlight searches around dams and along watercourses and call playback at all water source locations during February 2015 (2 nights) and September 2015 (1 night).

Details of the targeted surveys completed for this species are provided in Table 4.4f and survey locations are shown in Figure 4.4f. This species was not observed within the site during targeted surveys.

TABLE 4.4f
DETAILS OF TARGETED SURVEYS COMPLETED FOR GREEN AND GOLDEN BELL FROG

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Diurnal Habitat Search & Opportunistic Observation	**5 September 2014** 2 person hrs (1hr x 2 persons)	See Appendix 4	Conacher Consulting
Diurnal Habitat Search & Opportunistic Observation	**30 September 2014** 5 person hrs (2.5hrs x 2 persons)	See Appendix 4	Conacher Consulting
Diurnal Habitat Search & Opportunistic Observation	**18 – 20 February 2015** 44 person hrs (2 persons x 22 hrs)	See Appendix 4	Conacher Consulting
Diurnal Habitat Search & Opportunistic Observation	**15-18 September 2015** 52 person hrs (2 persons x 26hrs)	See Appendix 4	Conacher Consulting
Diurnal Habitat Search & Opportunistic Observation	**14 October 2015** 9 person hrs (2 persons x 4.5hrs)	See Appendix 4	Conacher Consulting
Spotlighting (walking)	**January 2007** 4 person hours	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (walking)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (driving)	**January 2007** 1 person hour	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (driving)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Nocturnal Call Playback **Spotlighting (Walking & Driving)** **Nocturnal Watercourse Search**	**18 February 2015** 4 person hours (2 persons x 2 hrs)	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Nocturnal Call Playback	**19 February 2015** 4 person hours (2 persons x 2 hrs)	Warm, no rainfall during survey (rainfall prior to survey)	Conacher Consulting

TABLE 4.4f DETAILS OF TARGETED SURVEYS COMPLETED FOR GREEN AND GOLDEN BELL FROG			
Survey Technique	**Survey Effort & Timing**	**Weather Conditions**	**Survey Completed By**
Spotlighting (Walking & Driving) **Nocturnal Watercourse Search**			
Nocturnal Call Playback **Spotlighting (Walking & Driving)** **Nocturnal Watercourse Search**	**17 September 2015** 2 person hours (1hr x 2 persons)	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting

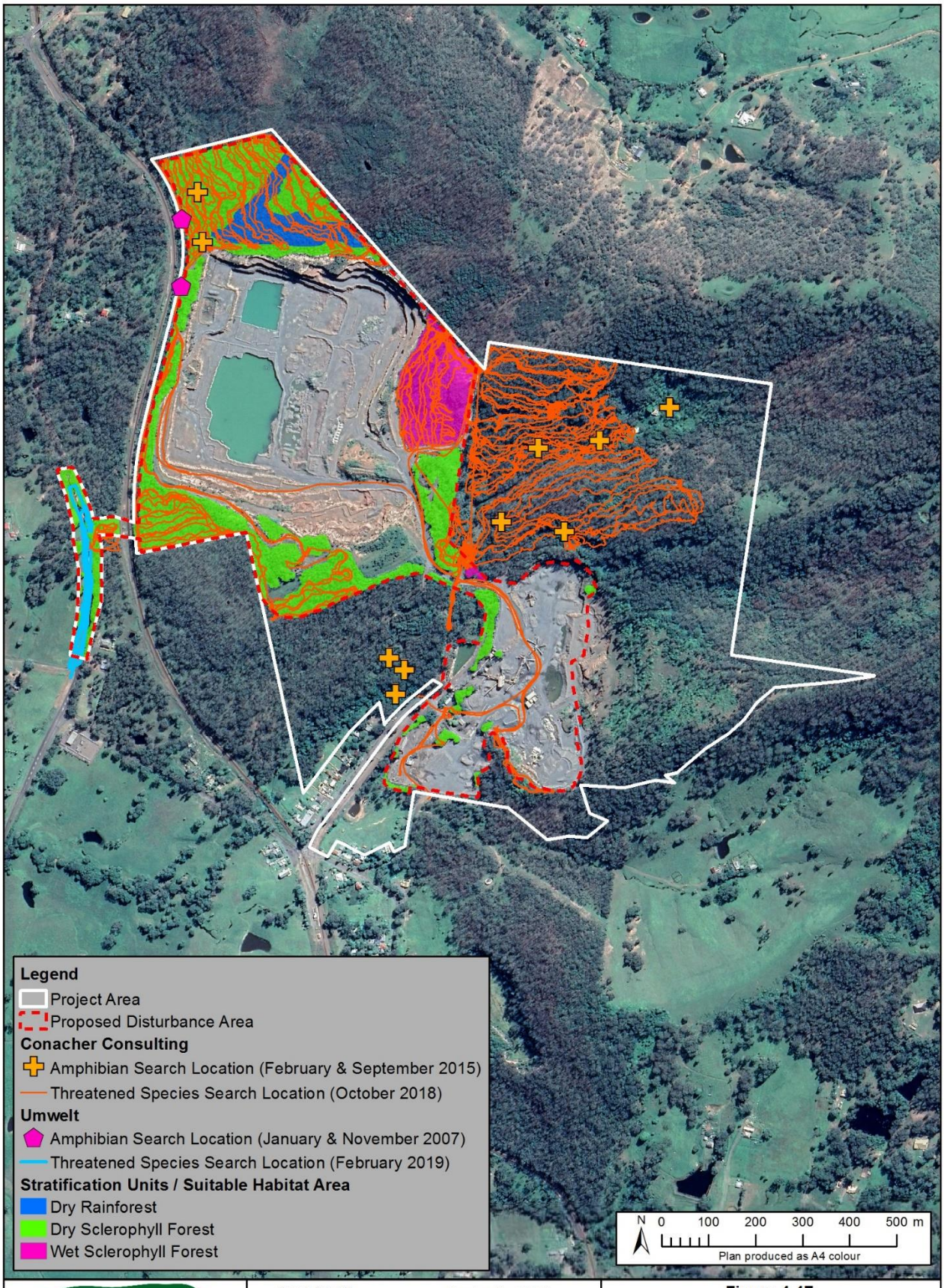


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Figure 4.4F
Green & Golden Bell Frog Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.7 Parma Wallaby (*Macropus parma*) Surveys

The Threatened Biodiversity Data Collection identifies that surveys for this species can be undertaken in any month.

Details of the targeted surveys completed for the Parma Wallaby are provided in Table 4.4g and survey locations are shown in Figure 4.4g. This species was not observed within the site during targeted surveys.

TABLE 4.4g
DETAILS OF TARGETED SURVEYS COMPLETED FOR PARMA WALLABY

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Diurnal Search	**20 August 2014** 1hr x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2014** 7hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**5 September 2014** 3hrs 20 min x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**30 September 2014** 2.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**18 February 2015** 8hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**19 February 2015** 12 hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**20 February 2015** 2hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**10 June 2015** 5.25hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**11 June 2015** 5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**17 August 2015** 8hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**18 August 2015** 8.25 hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**19 August 2015** 8.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**20 August 2015** 8.75hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2015** 2.75hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**15 September 2015** 5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**16 September 2015** 9hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**17 September 2015** 8hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**18 September 2015** 2.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**14 October 2015** 4.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**25 July 2018** 5.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**3 October 2018** 2 persons x 7hrs	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**9 October 2018** 3 persons x 7.5hrs	Variable – see Appendix 4	Conacher Consulting

TABLE 4.4g DETAILS OF TARGETED SURVEYS COMPLETED FOR PARMA WALLABY			
Survey Technique	**Survey Effort & Timing**	**Weather Conditions**	**Survey Completed By**
Spotlighting (walking)	**January 2007** 4 person hours	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (walking)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (driving)	**January 2007** 1 person hour	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (driving)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (Walking)	**20 & 21 August 2014** 8 persons hrs	Mild temperature, no rainfall	Conacher Consulting
Spotlighting (Walking)	**18 & 19 February 2015** 8 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Spotlighting (Walking)	**17 & 19 August 2015** 4 person hours	Mild, no rainfall during survey	Conacher Consulting
Spotlighting (Walking)	**17 September 2015** 2 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Terrestrial Hair Funnels / Tubes (Rolled oats & peanut butter bait)	**January 2007** 850 trap nights (50 x 17 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Terrestrial Hair Tubes (Rolled oats, peanut butter & honey bait)	**21 August – 4 September 2014** 140 trap nights (10 x 14 nights)	Variable – see Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (rolled oats, honey, peanut butter bait & insectivore mix)	**21 August – 4 September 2014** 28 Trap nights -2 terrestrial cameras x 14 nights	Variable – see Appendix 4	Conacher Consulting

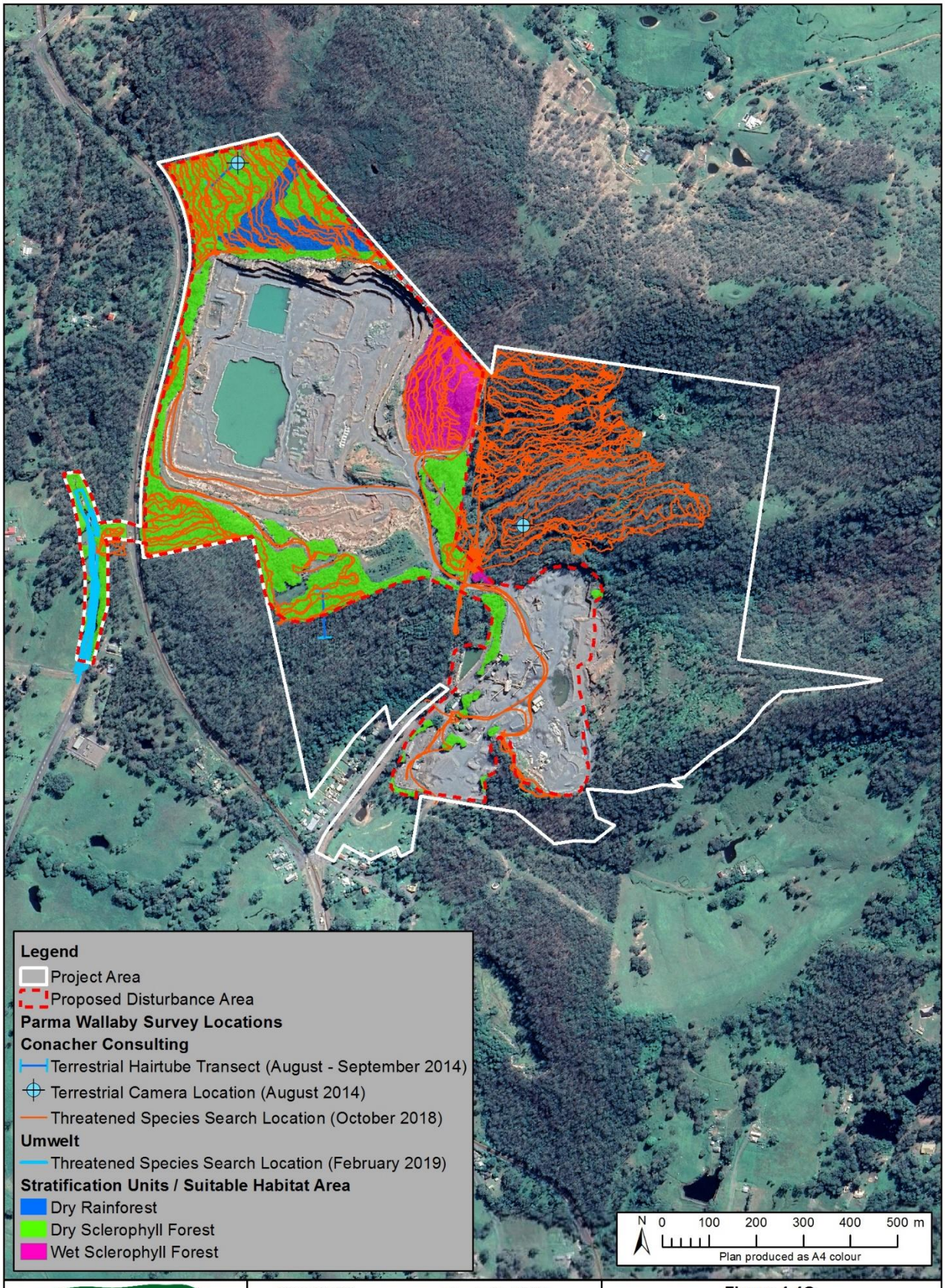

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Figure 4.4G
Parma Wallaby Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.8 *Southern Myotis* (*Myotis macropus*) *Surveys*

The Threatened Biodiversity Data Collection identifies that surveys for this species can be undertaken between October and March.

Details of the targeted surveys completed for this species are provided in Table 4.4h and survey locations are shown in Figure 4.4h. This species was observed within the site during targeted surveys.

TABLE 4.4h
DETAILS OF TARGETED SURVEYS COMPLETED FOR SOUTHERN MYOTIS

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Harp Trapping	**January 2007** **6** trap nights (2 traps x 3 consecutive nights) One trap in Dry Sclerophyll Forest habitat One trap in Dry Rainforest habitat	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Harp Trapping	**18 & 19 February 2015** 4 harp trap nights - 2 harp traps x 2 consecutive nights in dry rainforest habitat	Variable / suitable survey conditions – see Appendix 4	Conacher Consulting
Ultrasonic Call Recording	**January 2007** 6 recording nights -3 recording nights in Dry Sclerophyll Forest -3 recording nights in Dry Rainforest	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Ultrasonic Call Recording	**November 2007** 9 recording nights -3 recorders x 3 nights	Mild temperature, patchy rainfall	Umwelt (2009)
Ultrasonic Call Recording	**18-19 February 2015** 4 recording nights **-**2 Anabat recorders x 2 nights	Variable / suitable survey conditions – see Appendix 4	Conacher Consulting
Ultrasonic Call Recording	**15-17 September 2015** 6 recording nights -2 Anabat recorders x 3 nights	Variable / suitable survey conditions – see Appendix 4	Conacher Consulting
Ultrasonic Call Recording (supplementary recordings out of survey season)	**20-21 August 2014** **4 recording nights** -2 Anabat recorders x 2 nights **17-20 August 2015** **8 recording nights** -2 Anabat recorders x 4 nights	Variable – see Appendix 4	Conacher Consulting
Opportunistic Search for Gerygone Nests for potential Golden-tipped Bat Roost Sites	Completed in conjunction with flora belt transect searches	Not applicable	Conacher Consulting

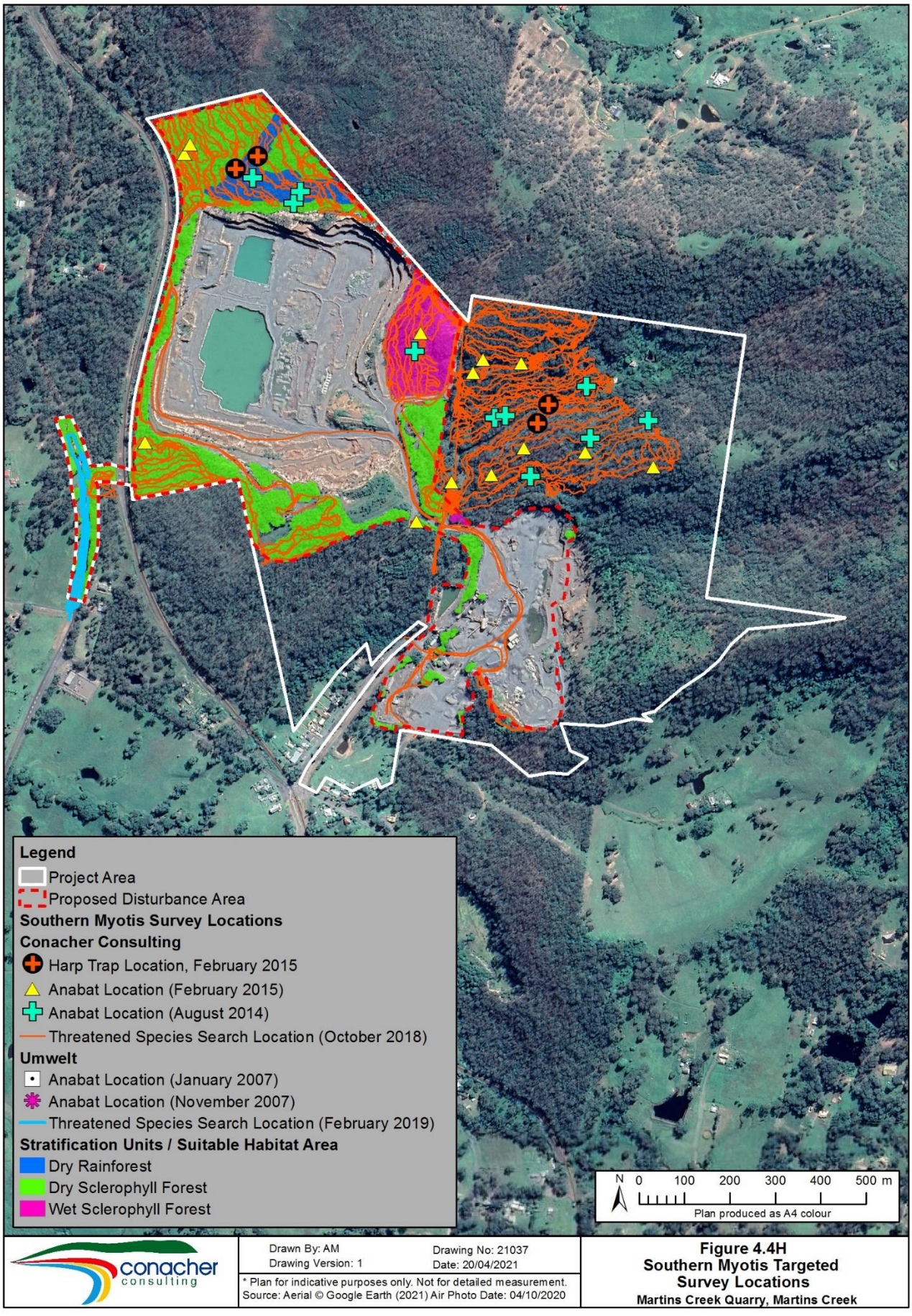

Figure 4.4H
Southern Myotis Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.9 *Brush-tailed Phascogale* (*Phascogale tapoatafa*) *Surveys*

Details of the targeted surveys completed for the Brush-tailed Phascogale are provided in Table 4.4i and survey locations are shown in Figure 4.4i.

Initial surveys were completed for this species by Umwelt (2009) and *Conacher Consulting*. Due to a change in the survey requirements on the Threatened Biodiversity Data Collection, an updated survey for this species was completed by Umwelt ecologists between 1 June and 1 July 2020. The survey program was confirmed as acceptable with Biodiversity Conservation Division (BCD) and met the survey requirements of the Threatened Biodiversity Data Collection. This species was observed within the site during targeted surveys.

TABLE 4.4i
DETAILS OF TARGETED SURVEYS COMPLETED FOR BRUSH-TAILED PHASCOGALE

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Spotlighting (walking)	**January 2007** 4 person hours	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (walking)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (driving)	**January 2007** 1 person hour	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (driving)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (Walking)	**20 & 21 August 2014** 8 persons hrs	Mild temperature, no rainfall	Conacher Consulting
Spotlighting (Walking)	**18 & 19 February 2015** 8 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Spotlighting (Walking)	**17 & 19 August 2015** 4 person hours	Mild, no rainfall during survey	Conacher Consulting
Spotlighting (Walking)	**17 September 2015** 2 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Terrestrial Elliot B Traps (Rolled oats and peanut butter bait)	**January 2007** 200 trap nights (50 traps x 4 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Terrestrial Elliot A Traps (Rolled oats and peanut butter bait)	**January 2007** 200 trap nights (50 traps x 4 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Arboreal Elliot B Traps (Rolled oats and peanut butter bait / trap tree sprayed with honey and water mixture)	**January 2007** 70 trap nights	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Arboreal Elliot A Trapping (rolled oats, honey & peanut butter bait / trap tree sprayed with honey/water mix)	**15 September – 17 September 2015** 162 trap nights -9 transects of 6 traps x 3 nights (54 trap nights per stratification unit)	Variable – see Appendix 4	Conacher Consulting

TABLE 4.4i DETAILS OF TARGETED SURVEYS COMPLETED FOR BRUSH-TAILED PHASCOGALE			
Survey Technique	**Survey Effort & Timing**	**Weather Conditions**	**Survey Completed By**
Terrestrial Elliot A Trapping (rolled oats, honey & peanut butter bait)	**17 August – 20 August 2015** 360 trap nights -9 transects of 10 traps x 4 nights (120 trap nights per stratification unit)	Variable – see Appendix 4	Conacher Consulting
Cage Traps (baited with chicken necks)	**January 2007** 36 trap nights (12 traps x 3 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Terrestrial Hair Funnels / Tubes (meat bait)	**January 2007** 850 trap nights (50 x 17 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Terrestrial Hair Funnels / Tubes (Rolled oats & peanut butter bait)	**January 2007** 850 trap nights (50 x 17 nights)	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Terrestrial Hair Tubes (Rolled oats, peanut butter & honey bait)	**21 August – 4 September 2014** 140 trap nights (10x 14 nights)	Variable – see Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (rolled oats, honey, peanut butter bait & insectivore mix / bait tree sprayed with honey/water mix)	**21 August – 4 September 2014** 56 Trap nights -2 arboreal cameras x 14 nights -2 terrestrial cameras x 14 nights	Variable – see Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (rolled oats, honey, peanut butter bait & insectivore mix / bait tree sprayed with honey/water mix)	**11 June – 21 August 2015** 568 trap nights -8 arboreal cameras x 71 nights	Variable – see Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (Peanut butter, honey and oats / bait tree sprayed with honey/water mix) *supplementary survey method only	**1 June – 1 July 2020** 1080 trap nights -36 cameras x 30 nights (Rebaited 16th June)	Variable – see Appendix 4	Umwelt

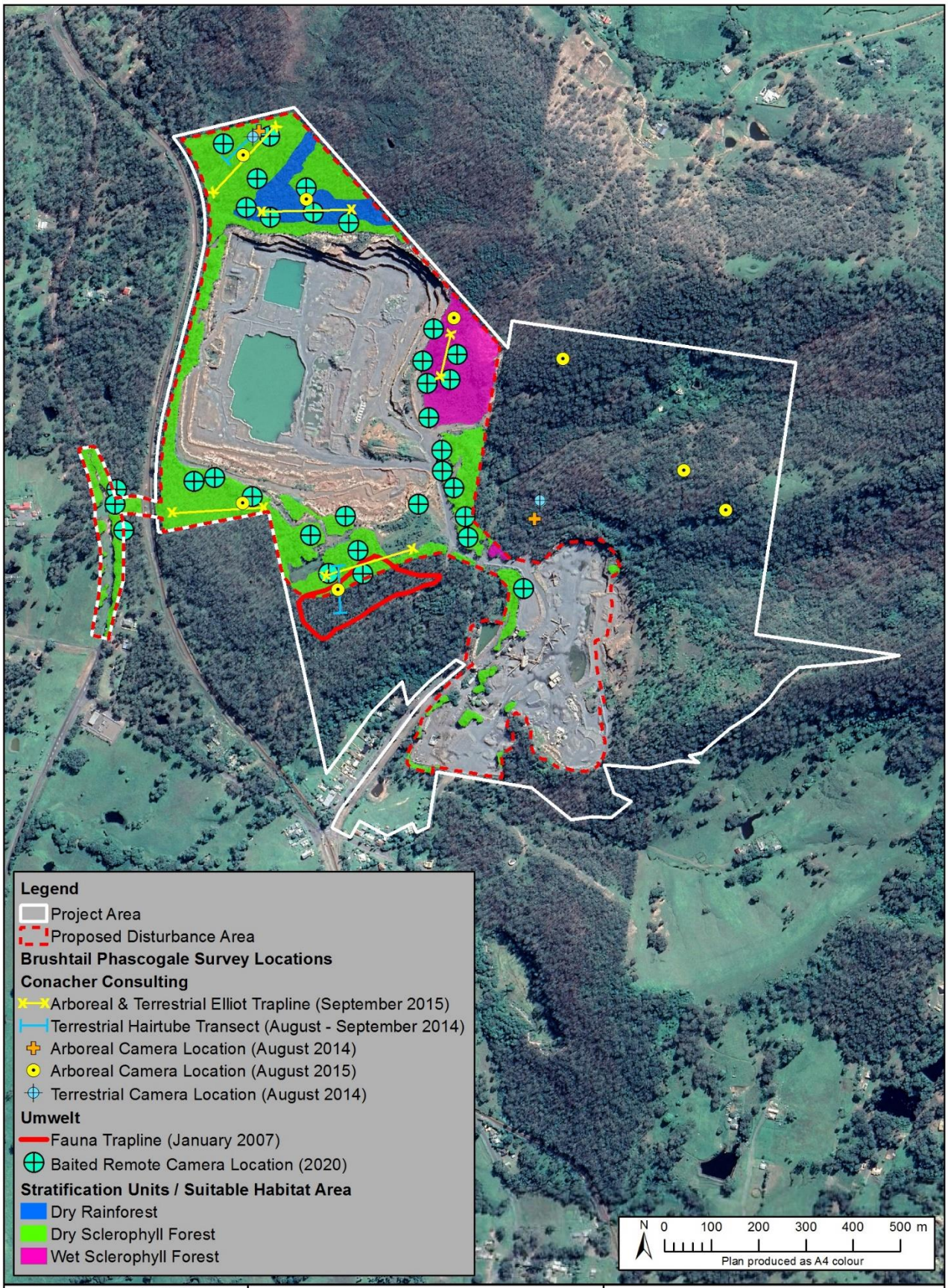

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Figure 4.4l
Brush-tailed Phascogale Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.10 *Koala* (*Phascolarctos cinereus*) *Surveys*

The Threatened Species Profile Database identifies that surveys for this species can be undertaken in any month.

Koalas were targeted during diurnal searches and nocturnal spotlighting surveys. Passive sound recordings were undertaken for Koala calls using a Songmeter and baited remote cameras were used to record Koalas.

A targeted scat search undertaken generally in accordance with the Spot Assessment Technique (SAT) (Phillips and Callaghan 2011). A scale grid of 150m spacing was placed over an aerial photograph of the site. At each grid intersect point (or the nearest suitable location), a scat search utilising the SAT Technique and a diurnal search of trees was conducted for Koalas. Scats collected were formally identified by Scats About P/L, a specialised hair and scat identification business.

Details of the targeted surveys completed for the Koala are provided in Table 4.4j and survey locations are shown in Figure 4.4j. This species was observed within the site during targeted surveys.

TABLE 4.4j
DETAILS OF TARGETED SURVEYS COMPLETED FOR KOALA

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Diurnal Search	**20 August 2014** 1hr x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2014** 7hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**5 September 2014** 3hrs 20 min x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**30 September 2014** 2.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 February 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 February 2015** 12 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**20 February 2015** 2hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**10 June 2015** 5.25hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**11 June 2015** 5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**17 August 2015** 6.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 August 2015** 8.25 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 August 2015** 8.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**20 August 2015** 8.75hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2015** 2.75hrs x 2 persons	See Appendix 4	Conacher Consulting
Scat search using Spot Assessment Technique (Phillips and Callaghan 2011)	**15 September 2015** 7hrs x 2 persons	See Appendix 4	Conacher Consulting

TABLE 4.4j DETAILS OF TARGETED SURVEYS COMPLETED FOR KOALA			
Survey Technique	**Survey Effort & Timing**	**Weather Conditions**	**Survey Completed By**
Scat search using Spot Assessment Technique (Phillips and Callaghan 2011)	**16 September 2015** 9hrs x 2 persons	See Appendix 4	Conacher Consulting
Scat search using Spot Assessment Technique (Phillips and Callaghan 2011)	**17 September 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 September 2015** 2.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**14 October 2015** 4.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**25 July 2018** 5.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search / Opportunistic Observation	**3 October 2018** 2 persons x 8hrs	See Appendix 4	Conacher Consulting
Diurnal Search / Opportunistic Observation	**9 October 2018** 3 persons x 8.5hrs	See Appendix 4	Conacher Consulting
Spotlighting (walking)	**January 2007** 4 person hours	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (walking)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (driving)	**January 2007** 1 person hour	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (driving)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting / Call playback	**20 & 21 August 2014** 8 persons hrs	Mild temperature, no rainfall	Conacher Consulting
Spotlighting / Call playback	**18 & 19 February 2015** 8 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Spotlighting / Call playback	**17 & 19 August 2015** 4 person hours	Mild, no rainfall during survey	Conacher Consulting
Spotlighting / Call playback	**17 September 2015** 2 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Call Recording	**5 – 30 September 2014** **25 nights of songmeter recording**	See Appendix 4	Conacher Consulting
Baited Infra-red Camera Survey (Peanut butter, honey and oats / bait tree sprayed with honey/water mix) *supplementary survey method only	**1 June – 1 July 2020** 1080 trap nights -36 cameras x 30 nights (Rebaited 16th June)	Variable – see Appendix 4	Umwelt

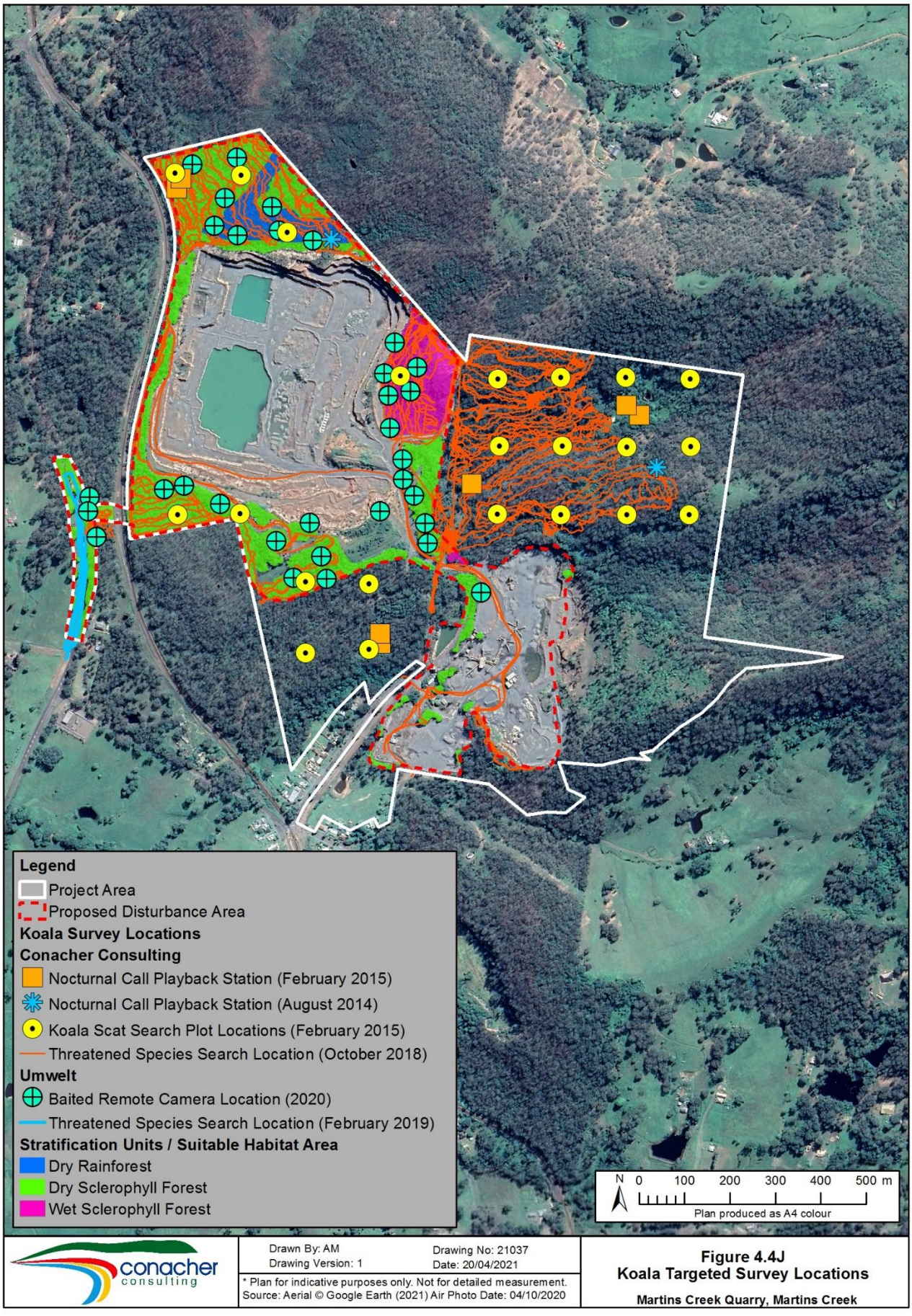

Figure 4.4J
Koala Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.11 *Grey-headed Flying-fox* (*Pteropus poliocephalus*) Breeding Habitat *Surveys*

The Threatened Species Profile Database identifies that surveys for this species can be undertaken between September and March.

Details of the targeted surveys completed for this species are provided in Table 4.4k and survey locations are shown in Figure 4.4k. This species was not observed within the site during targeted surveys.

TABLE 4.4k
DETAILS OF TARGETED SURVEYS COMPLETED FOR GREY-HEADED FLYING-FOX

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Diurnal Search	**5 September 2014** 3hrs 20 min x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**30 September 2014** 2.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**18 February 2015** 8hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**19 February 2015** 12 hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**20 February 2015** 2hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**15 September 2015** 5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**16 September 2015** 9hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**17 September 2015** 8hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**18 September 2015** 2.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**14 October 2015** 4.5hrs x 2 persons	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**3 October 2018** 2 persons x 7hrs	Variable – see Appendix 4	Conacher Consulting
Diurnal Search	**9 October 2018** 3 persons x 7.5hrs	Variable – see Appendix 4	Conacher Consulting
Spotlighting (walking)	**January 2007** 4 person hours	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (walking)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (driving)	**January 2007** 1 person hour	Very warm to hot and dry with dry warm nights	Umwelt (2009)
Spotlighting (driving)	**November 2007** 2 person hours	Mild temperature, patchy rainfall	Umwelt (2009)
Spotlighting (Walking)	**18 & 19 February 2015** 8 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting
Spotlighting (Walking)	**17 September 2015** 2 person hours	Warm, no rainfall during survey (rainfall on two days prior to survey)	Conacher Consulting

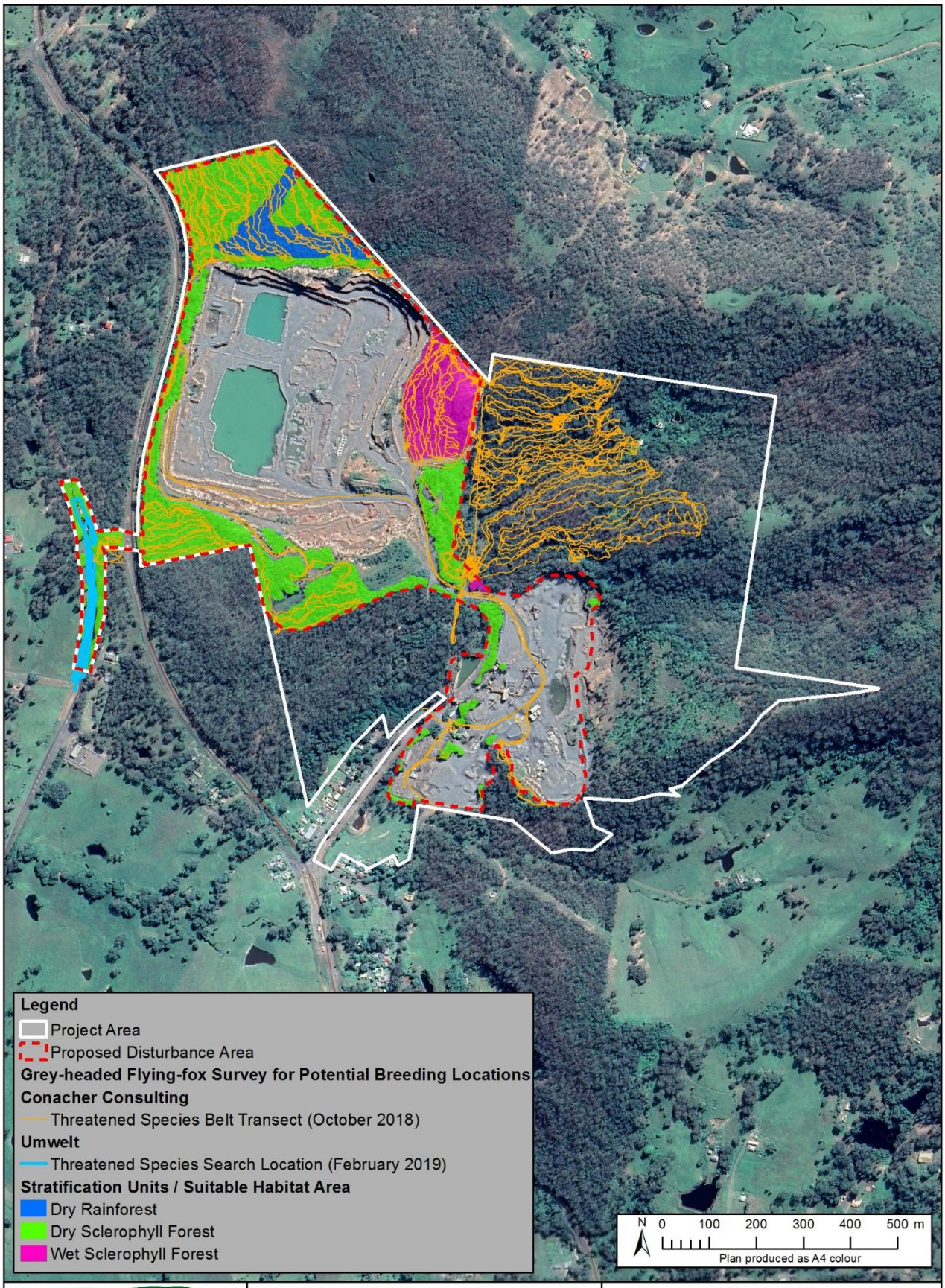

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Figure 4.4K
Grey-headed Flying-fox Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.5.12 Red-backed Button-quail (*Turnix maculosus*) Surveys

The Threatened Biodiversity Data Collection identifies that surveys for this species can be undertaken in any month.

Details of the targeted surveys completed for the Red-backed Button-quail are provided in Table 4.4L and survey locations are shown in Figure 4.4L. This species was not observed within the site during targeted surveys.

TABLE 4.4l
DETAILS OF TARGETED SURVEYS COMPLETED FOR RED-BACKED BUTTON-QUAIL

Survey Technique	Survey Effort & Timing	Weather Conditions	Survey Completed By
Diurnal Search	**20 August 2014** 1hr x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2014** 7hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**5 September 2014** 3hrs 20 min x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**30 September 2014** 2.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 February 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 February 2015** 12 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**20 February 2015** 2hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**10 June 2015** 5.25hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**11 June 2015** 5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**17 August 2015** 8hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**18 August 2015** 8.25 hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**19 August 2015** **8.5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**20 August 2015** **8.75hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**21 August 2015** **2.75hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**15 September 2015** **5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**16 September 2015** **9hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**17 September 2015** **8hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**18 September 2015** **2.5hrs x 2 persons**	See Appendix 4	Conacher Consulting
Diurnal Search	**14 October 2015** 4.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**25 July 2018** 5.5hrs x 2 persons	See Appendix 4	Conacher Consulting
Diurnal Search	**3 October 2018** 2 persons x 7hrs	See Appendix 4	Conacher Consulting
Diurnal Search	**9 October 2018** 3 persons x 7.5hrs	See Appendix 4	Conacher Consulting

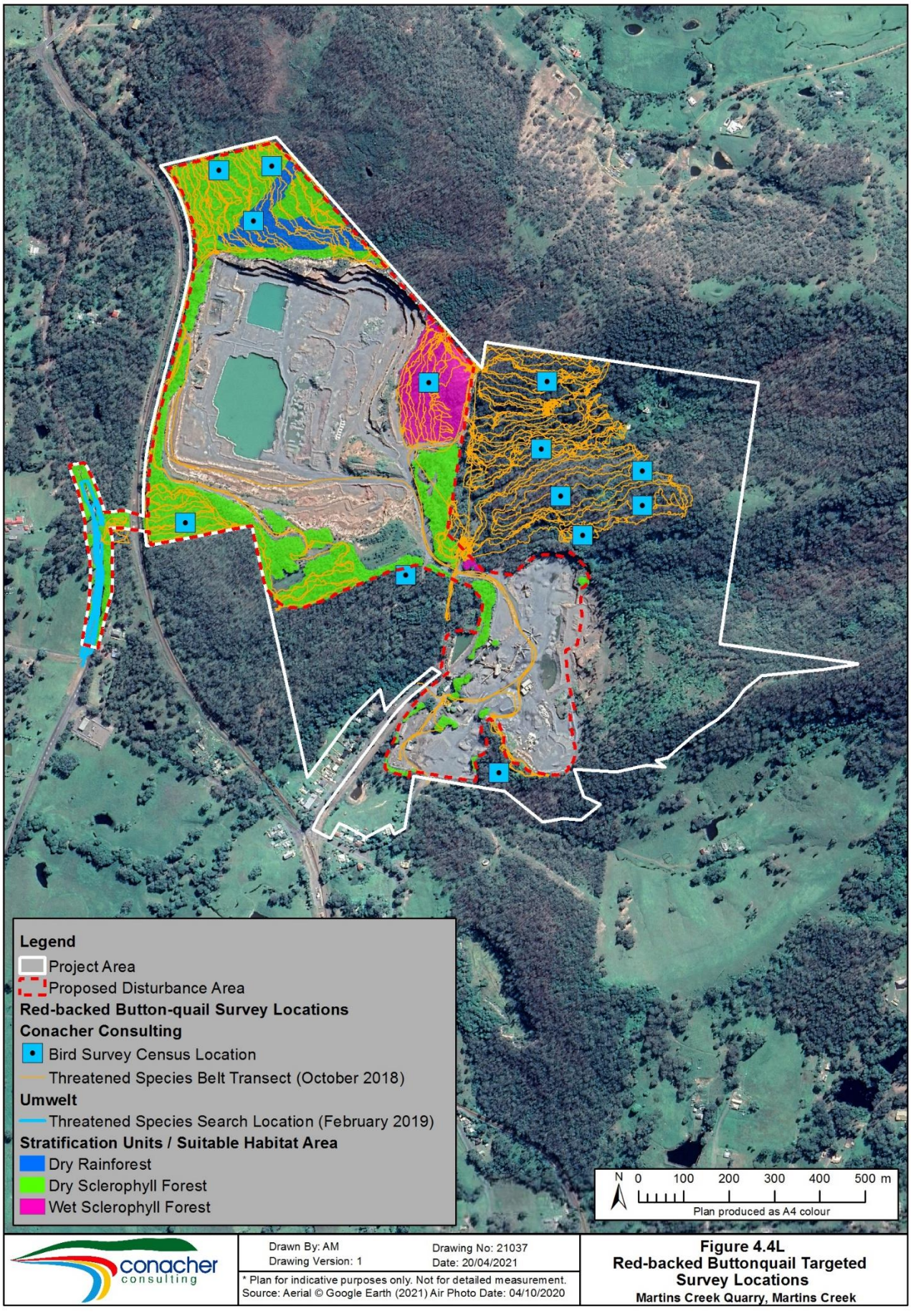
Legend
Project Area
Proposed Disturbance Area
Red-backed Button-quail Survey Locations
Conacher Consulting
Bird Survey Census Location
Threatened Species Belt Transect (October 2018)
Umwelt
Threatened Species Search Location (February 2019)
Stratification Units / Suitable Habitat Area
Dry Rainforest
Dry Sclerophyll Forest
Wet Sclerophyll Forest
N
0
100
200
300
400
500 m
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Figure 4.4L
Red-backed Buttonquail Targeted Survey Locations
Martins Creek Quarry, Martins Creek

4.6 TARGETED THREATENED SPECIES SURVEY RESULTS

4.6.1 *Species Credit Threatened Flora*

i. Slaty Red Gum (Eucalyptus glaucina)

This species was observed during surveys and its distribution corresponds to the extent of plant community type HU619. The area of occupancy (species polygon) for *E. glaucina* is mapped in Figure 4.5. The quadrat sampling results and estimated number of individuals observed for this species are provided in Table 4.5. The estimated number of individuals present within the proposed disturbance area was extrapolated by multiplying the mean density of individuals per hectare by the mapped area of occupancy in hectares.

TABLE 4.5
SLATY RED GUM SURVEY RESULTS

Quadrat Number	Count
1	13
2	12
3	8
4	5
5	31
7	26
9	17
12	60
Average Density within Sample Plots (1000m^2)	21.5
Average Density per Hectare	215
Area of occupancy (ha)	13.43
Estimated Number of individuals	2887

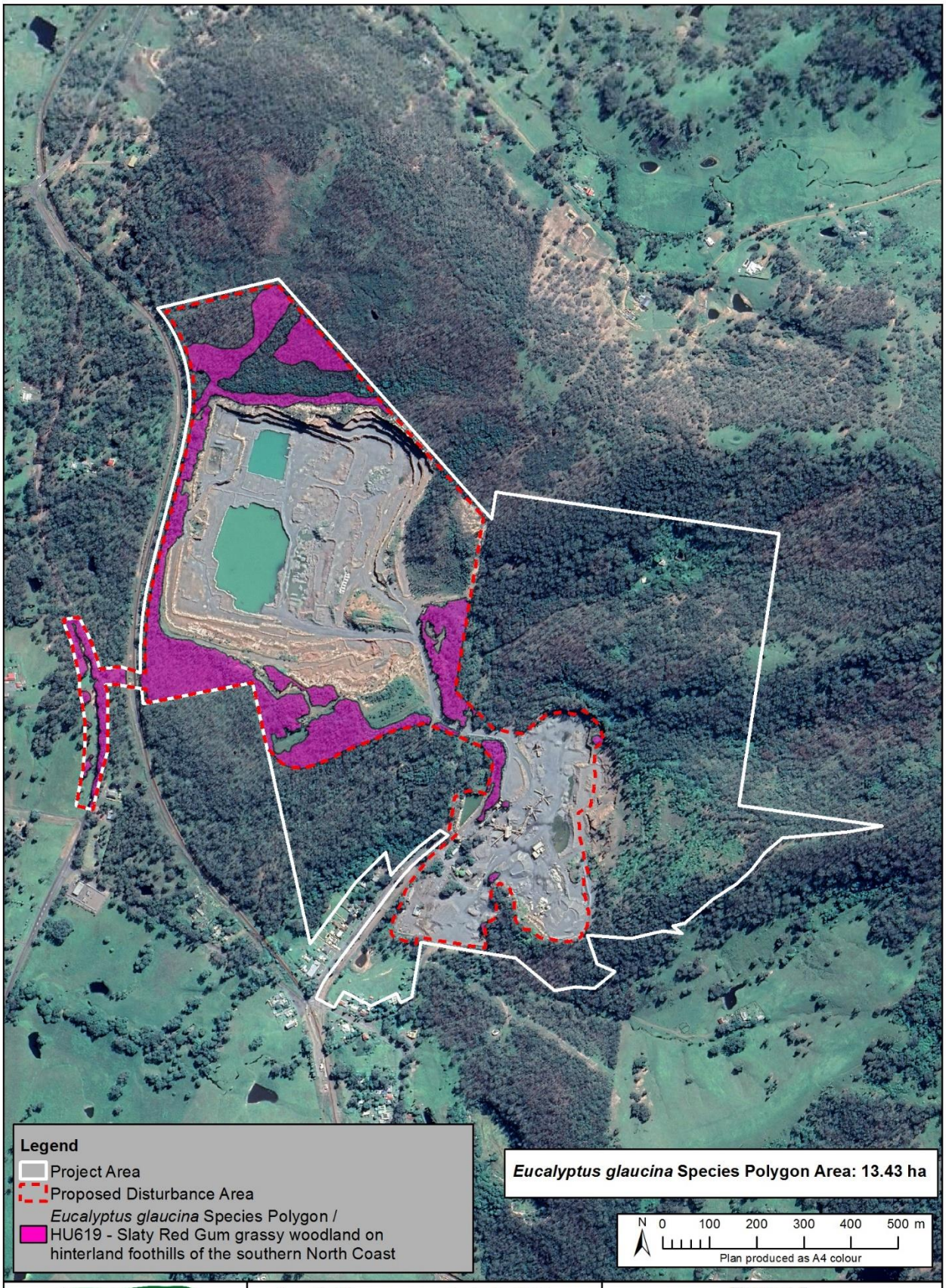


Figure 4.5
***Eucalyptus glaucina* Species Polygon Map**

Martins Creek Quarry, Martins Creek

ii. Scrub Turpentine (*Rhodamnia rubescens*)

A total of 109 stems were observed at three locations and as mapped in Figure 4.6 The three stems observed in the north-western section of the site ranged from approximately 1.5m to 6m in height. The group of 15 stems observed ranged from 1 to 3 metres in height and the large group of 91 stems observed consisted of juvenile plants less than approximately 30cm in height growing within and on the edges of an overgrown access road.

The plants observed had signs of myrtle rust infection evidenced by the presence of brown lesions on some leaves, no spores were observed. Since the completion of surveys which identified the presence of this species, the proposed disturbance area footprint has been reduced and this species will not be impacted by the proposal.

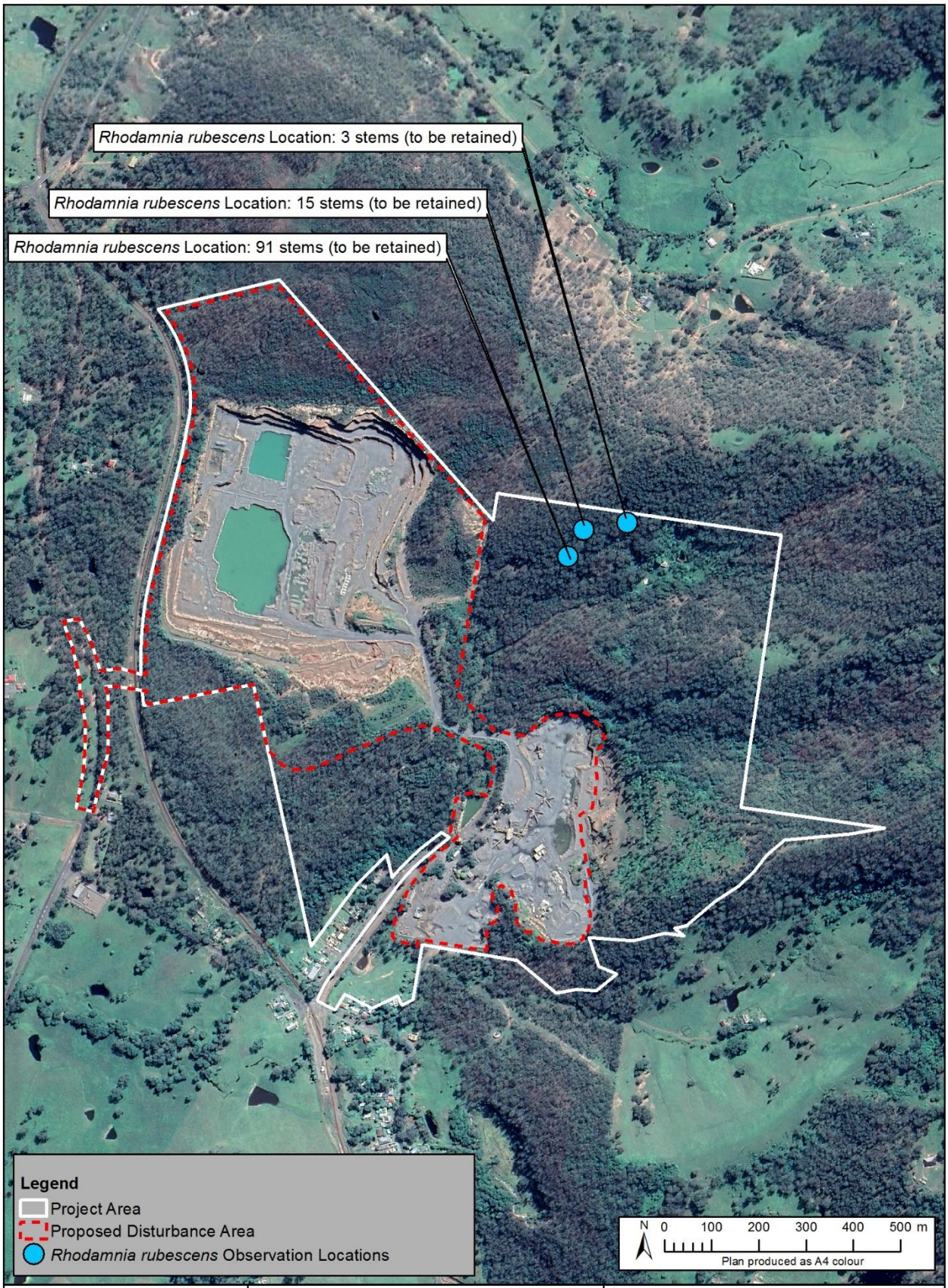


Figure 4.6
***Rhodamnia rubescens* Locations**
Martins Creek Quarry, Martins Creek

4.6.2 *Species Credit Threatened Fauna*

i. Brush-tailed Phascogale (*Phascogale tapoatafa*)

This species was observed during the updated surveys completed by Umwelt within the proposed quarry extension area (6 camera locations).

The occupancy polygon for this species covers an area of 21.13 ha as mapped in Figure 4.7 and includes all mapped plant community types within the site.

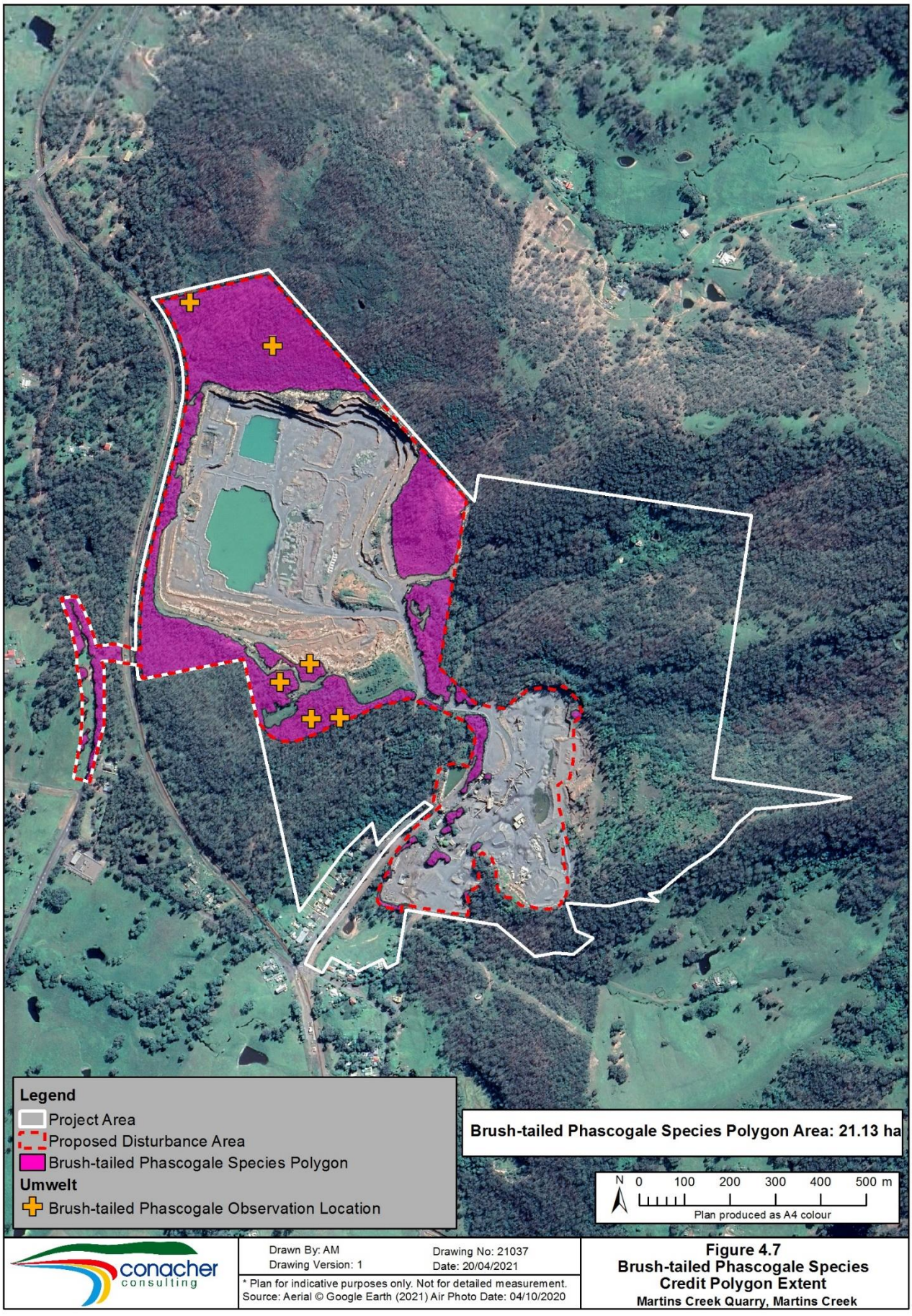


Figure 4.7
Brush-tailed Phascogale Species Credit Polygon Extent
Martins Creek Quarry, Martins Creek

ii. Koala (*Phascolarctos cinereus*)

Previous Site Observations
The Koala was observed at three locations adjoining the proposed quarry extension area during previous surveys undertaken in 2007 by Umwelt (2009).

Current Site Observations
The Koala was also observed during current surveys. The following observation details from the current surveys are provided:

- One Koala was observed during the spotlighting survey undertaken on 20 August 2014 at the top of the hill in the eastern portion of the Project Area. A male Koala was recorded calling on a songmeter device during call recording surveys on the 6th, 7th, 9th and 10th September 2014 within the vicinity of the initial spotlighting observation location.

- A Koala was observed during the spotlighting surveys undertaken on 18 and 19 February 2015 to the west of the detention basin and the western alternate access road.

- A Koala was heard calling from the forested area within the northern section of the site during a spotlighting survey undertaken on 19 February 2015.

- A Koala was recorded at one location during baited infrared camera surveys completed by Umwelt during June 2020.

Koala Habitat Details
The Project Area is located within the Central Coast Koala Management Area (KMA) and the Barrington Area of Regional Koala Significance, identified in the Koala Habitat Information Base (NSW DPIE 2019).

Details of the listed Koala tree species observed within the survey plots for each Plant Community Type (PCT), as identified in the Koala Habitat Information Base (NSW DPIE 2019) are provided in Table 4.6. The associated rank is listed for each tree species for the Central Coast Koala Management Region.

All PCTs within the site contained survey plots with identified Koala Tree Species as identified by NSW DPIE (2019). Koala trees ranked by NSW DPIE (2019) as 'high preferred use' were observed within survey plots for PCTs HU 619 and HU 798. PCT HU 816 contained significant use ranked Koala tree species and the survey plots for plant community type HU 755 contained only irregular or low use ranked Koala tree species. A full list of flora speces observed within each survey plot is provided in Appendix 1.

TABLE 4.6
SUMMARY OF KOALA TREE PRESENCE AND RANK FOR SITE PCTS

Plant Community Types	Koala Tree Species Present	Koala Tree Use Rank
HU 619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Spotted gum (*Corymbia maculata*)	4
	Broad-leaved White Mahogany (*Eucalyptus carnea*)	4
	Narrow-leaved Ironbark (*Eucalyptus crebra*)	3
	Slaty Red Gum (*Eucalyptus glaucina*)	4
	White Stringybark (*Eucalyptus globoidea*)	2
	Grey Box (*Eucalyptus moluccana*)	1
	Grey Ironbark (*Eucalyptus siderophloia*)	4
	Forest Red Gum (*Eucalyptus tereticornis*)	1
	Spotted gum (*Corymbia maculata*)	4

TABLE 4.6 SUMMARY OF KOALA TREE PRESENCE AND RANK FOR SITE PCTS		
Plant Community Types	**Koala Tree Species Present**	**Koala Tree Use Rank**
HU 755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter	White Mahogany (*Eucalyptus acmenoides*)	4
HU 798 White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley	Spotted gum (*Corymbia maculata*)	4
	White Mahogany (*Eucalyptus acmenoides*)	4
	Large-fruited Grey Gum (*Eucalyptus canaliculata*)	1
	Narrow-leaved Ironbark (*Eucalyptus crebra*)	3
	White Stringybark (*Eucalyptus globoidea*)	2
	Grey Ironbark (*Eucalyptus siderophloia*)	4
HU 816 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter	White Stringybark (*Eucalyptus globoidea*)	2
	Narrow-leaved Ironbark (*Eucalyptus crebra*)	3
	Spotted gum (*Corymbia maculata*)	4
	Red Ironbark (*Eucalyptus fibrosa*)	3
Key to Koala Tree Rank 1 = high preferred use; 2 = High use; 3 = Significant use; 4 = Irregular or low use.		

No Koala scats were observed within the Proposed Disturbance Area during the Koala Spot Assessment Technique Surveys (Phillips and Callaghan 2011). The Koala activity within the Proposed Disturbance Area is therefore considered to be in the low activity category, in accordance with the Spot Assessment Technique method of Phillips and Callaghan (2011).

Koala Occupancy PolygonThe occupancy polygon for this species covers an area of 21.13 ha as mapped in Figure 4.8 and includes all plant community types.

State Environmental Planning Policy (Koala Habitat Protection) 2020
SEPP (Koala Habitat Protection) 2020 applies to rural zoned land in the Dungog LGA. The SEPP aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas. While, the SEPP only applies to development applications to be approved by a local Council, that is it does not apply to SSD applications, it provides definitions for potential and core koala habitat that have been applied in this assessment.

Potential koala habitat is defined as native vegetation supporting at least 15% koala feed trees. One Schedule 2 Koala Feed Tree Species, *Eucalyptus tereticornis* (Forest Red Gum) is present within the Proposed Disturbance Area. This species constitutes 20% of the trees present within the upper strata of the tree component within Plot U2 mapped in Figure 3.2. The site therefore contains areas of Potential Koala Habitat, in accordance with this SEPP.

In keeping with SEPP 2020, the site is also likely to contain Core Koala Habitat as a resident population of the Koala is considered to be present, as evidenced by recent sightings and historical records of a Koala population (refer to Figure 4.8).

While the requirements of this SEPP do not apply, as the proposal is a State Significant Development Application, should the project be approved, it is recommended that a Management Plan be prepared to provide measures for the management of Koalas on site, in keeping with the intent of the SEPP.

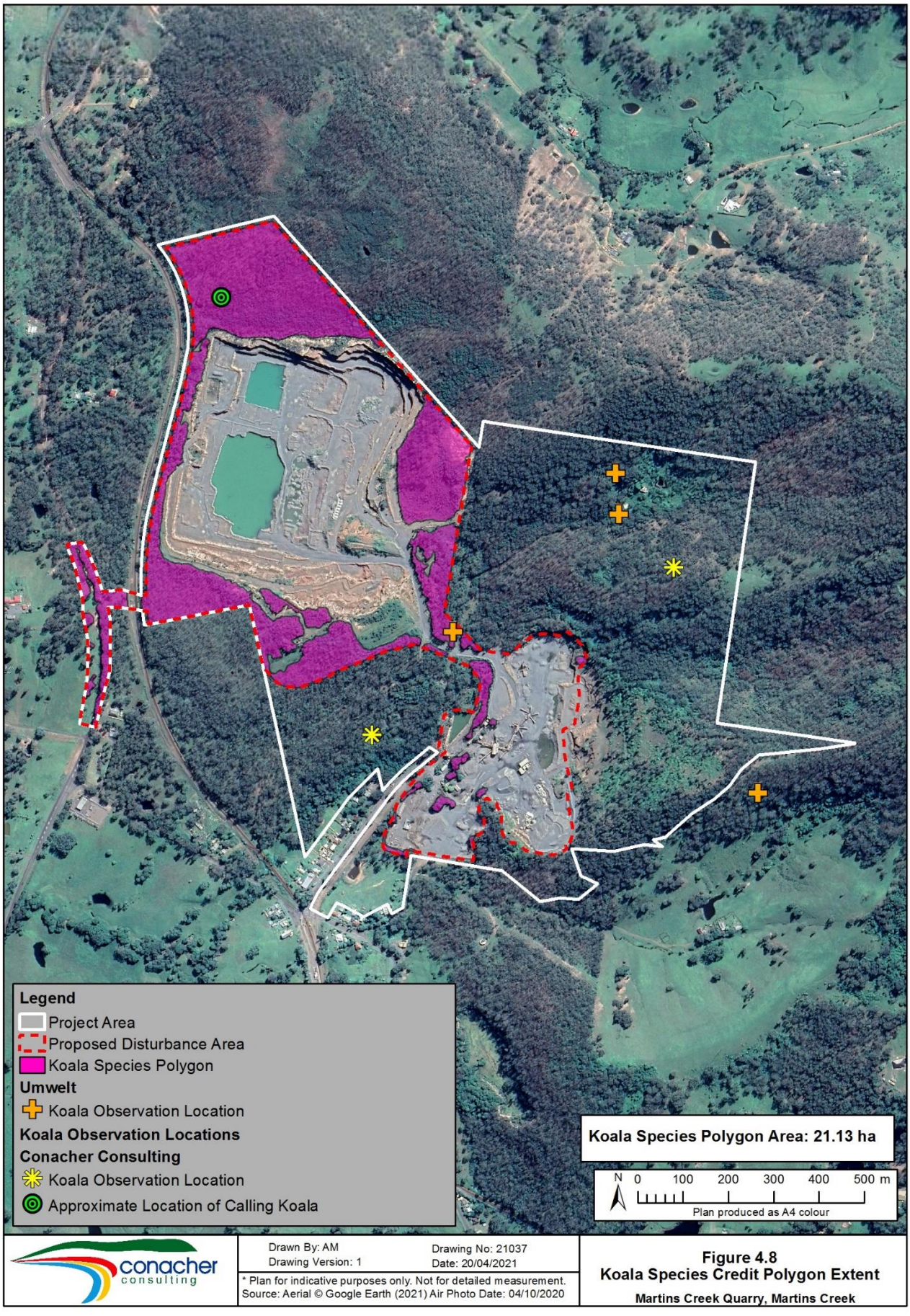


Figure 4.8
Koala Species Credit Polygon Extent
Martins Creek Quarry, Martins Creek

iii. Southern Myotis (*Myotis macropus*)

Three female Southern Myotis bats were captured in a harp trap on 18 February 2015 within the creek line north of the quarry pit. The riparian zones within the site are ephemeral and did not contain suitable foraging habitat for this species. The small dams within and adjoining the site provide potential habitat. The water held in the quarry pit and the detention basin within the site may also provide suitable foraging habitat. No roost or maternity sites for this species were observed during surveys.

The species polygon for this species was determined by mapping all foraging habitat and vegetated habitats on the subject within 200m of waterbodies 3m or wider in accordance with the requirements of NSW OEH (2018). The species polygon for this species covers an area of 13.80 ha as shown in Figure 4.9.

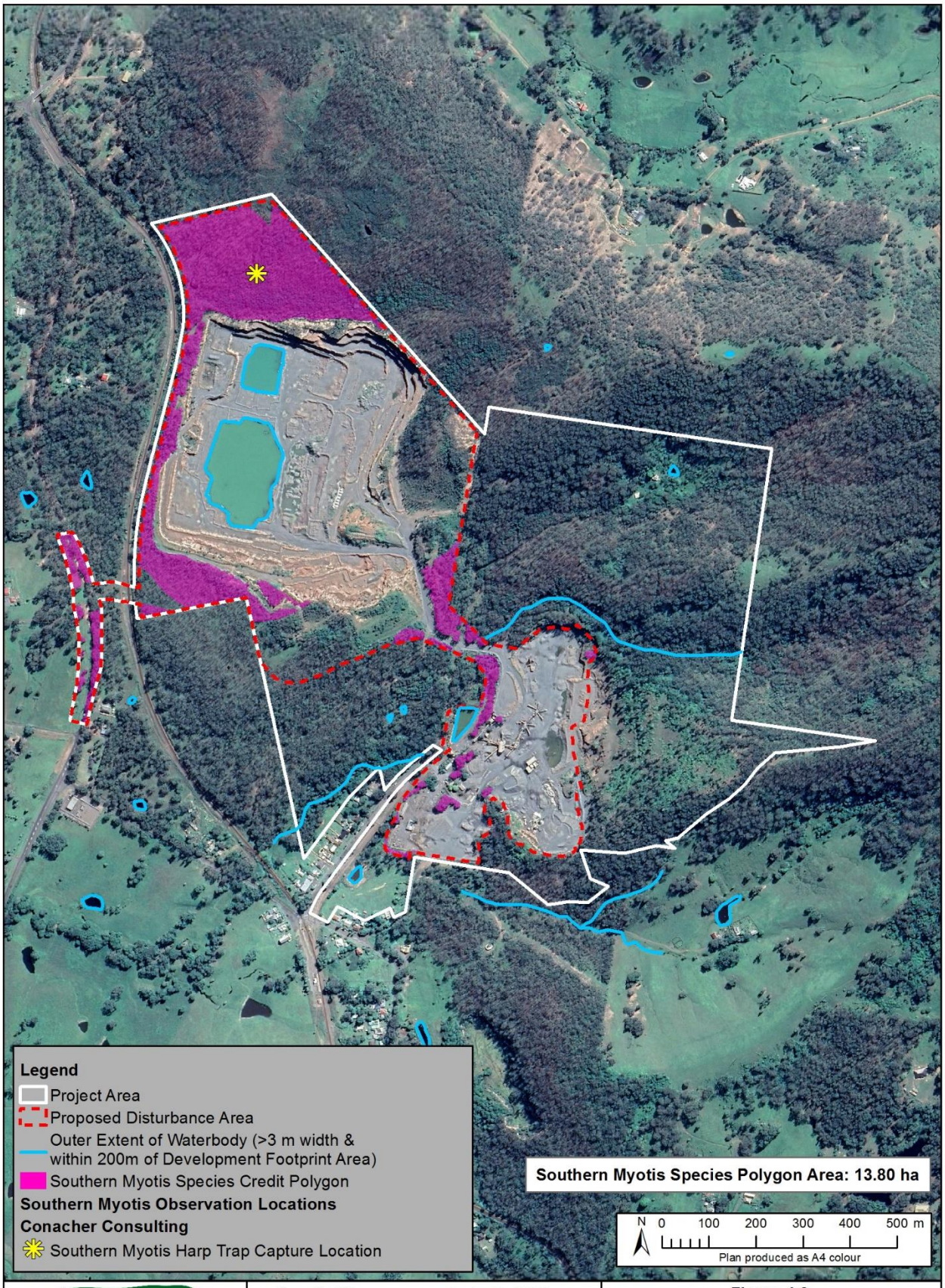


Figure 4.9
Southern Myotis Species Credit Polygon Extent
Martins Creek Quarry, Martins Creek

4.6.3 *Ecosystem Credit Threatened Species*

The following "ecosystem credit" type threatened fauna have been observed within or adjoining the proposed disturbance area during surveys:

- Little Lorikeet (*Glossopsitta pusilla)*;
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Powerful Owl (*Ninox strenua*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (ecosystem credit for foraging habitat);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*);
- Little Bent-winged Bat (*Miniopterus australis*);
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) (previous surveys only); and
- Southern Myotis (*Myotis macropus*) (ecosystem credit for foraging habitat)

The following observation details are provided in relation to the above species:

i. Little Lorikeet

Two Little Lorikeets were observed flying over the site during diurnal fauna surveys undertaken on 20 August 2014.

ii. Speckled Warbler

This species was recorded in 2007 just outside of the quarry lands (Umwelt 2009). This species was not observed during current surveys within the site undertaken by Conacher Consulting.

iii. Varied Sittella

Three Varied Sittellas were observed foraging within the proposed disturbance area during diurnal fauna surveys undertaken on 17 September 2015.

iv. Powerful Owl

A likely roost site of the Powerful Owl was observed during diurnal surveys on 20 August 2015. The likely roost site was identified by the presence of a dead Brush Turkey with a small amount of owl whitewash in a drainage line gully under the canopy of a large rainforest tree. It is considered that the likely roost site is only occasionally used, as this species was not observed at this location during any site visits.

The Powerful Owl was heard calling during nocturnal surveys on 17 September 2015, to the south-west of the development area (study area).

This species was also observed during previous surveys by Umwelt (2009).

v. Squirrel Glider

A Squirrel Glider was observed during spotlight surveys in a tree hollow on 19 February 2015 in the southern section of the site. The Squirrel Glider was also detected in multiple photographs captured on 10 and 27 July 2015 during baited infrared camera surveys at one location in the western section of the site and during baited infrared camera surveys undertaken by Umwelt at seven locations during June 2020.

vi. Grey-headed Flying-fox

Two Grey-headed Flying-foxes were observed within the central area of the site during nocturnal surveys on 17 September 2015. This species was also observed during previous surveys by Umwelt (2009). No breeding habitat or camp sites were observed within the proposed disturbance area or Project Area.

vii. Yellow-bellied Sheathtail-bat

This species was recorded within the site during an ultrasonic call recording survey undertaken in 2007 (Umwelt 2009). This species was also recorded during current surveys on 18 February 2015.

viii. Eastern Coastal Free-tailed Bat

This species was recorded within the site during previous ultrasonic call recording surveys undertaken in 2007 (Umwelt 2009). This species was not observed during current surveys undertaken by Conacher Consulting.

ix. Little Bent-winged Bat

This species was recorded within the site during previous ultrasonic call recording surveys undertaken in 2007 (Umwelt 2009).

This species was also recorded within the site during overnight ultrasonic call recording surveys on the following dates:

- 20 September 2014
- 20 February 2015
- 20-21 August 2015
- 15-17 September 2015

No potential breeding habitat for this species was located during site habitat searches.

x. Large Bent-winged Bat

This species was recorded within the site during previous ultrasonic call recording surveys undertaken in 2007 (Umwelt 2009).

One male and one female Large Bent-winged Bat were captured in a harp trap on 18 February 2015 within the creek line west of the access road through the central section of the Project Area. This species was also recorded within the Project Area during overnight ultrasonic call recording surveys on the following dates:

- 17, 19 & 20 August 2015
- 15 September 2015

No potential breeding habitat for this species was located during site habitat searches.

xi. Greater Broad-nosed Bat

This species was identified as a possible record from an ultrasonic call recording survey undertaken in 2007 (Umwelt 2009). This species was not observed during current surveys undertaken by Conacher Consulting.

Observation locations for ecosystem credit threatened fauna species are shown in Figure 4.10. Locations of threatened fauna species recorded during previous surveys reported by Ecotone Ecological Consultants (2010) are not mapped and were not available. Observation locations for dual credit species are shown where species credits are not required for the entity.

4.6.4 *EPBC Act Listed Migratory Species*

The following migratory species listed under the *EPBC Act* were observed within the Project Area during surveys:

- Rufous Fantail
- Black-faced Monarch

These species were observed during summer surveys within the drainage lines which run through the eastern parts of the Project Area, outside of the proposed disturbance area.

4.6.5 *Other Species Observed*

A list of all fauna species observed during current and previous fauna surveys of the site is provided in Appendix 5.

SECTION 5

AVOIDANCE AND MINIMISATION OF IMPACTS

5.1 MEASURES PROPOSED TO AVOID & MINIMISE IMPACTS ON BIODIVERSITY VALUES

5.1.1 *Site Selection*

(a) Whether there are alternative sites within the property on which the proposed development is located where siting the proposed Major Project would avoid and minimise impacts on biodiversity values.

The proposed disturbance area and the impact avoidance areas for this Project are both mapped in Figure 5.1.

Alternative sites within the property may further avoid impacts to habitat for the threatened species *Eucalyptus glaucina*, however would potentially result in impacts to other biodiversity values such as larger sections of higher order watercourses, other areas of the vulnerable ecological community Lower Hunter Valley Dry Rainforest and other threatened species including the critically endangered *Rhodamnia rubescens* (Scrub Turpentine). The parts of the site containing Scrub Turpentine have been removed from the proposed disturbance area following the identification of this species within the site.

It is considered that the proposed development areas have been suitably located within and adjacent to the existing cleared and disturbed quarry areas present.

(b) How the development site can be selected to avoid and minimise impacts on biodiversity values as far as practicable.

The proponent has sought to reduce proposed disturbance area to balance the biodiversity impacts of the proposal while maintaining a viable resource extraction area for the purposes of ongoing quarry operations.

The proposed disturbance area and the impact avoidance areas for the Project are mapped in Figure 5.1. The reduced current proposed disturbance area has resulted in the avoidance of approximately 15.3 ha of native vegetation clearing associated with the reduction in the east pit area. This reduction in disturbance area has also minimised the area of impact to threatened species habitats initially proposed for clearing and totally avoided impacts to the threatened flora species *R. rubescens*.

(c) Whether an alternative development site to the proposed development site, which would avoid adversely impacting on biodiversity values, might be feasible.

The project is an extension of an existing quarry which has specific geological resources that are required for infrastructure and other developments in the area. It is considered that relocating the proposal to an alternative site is not feasible as the proposal is site specific and based on the presence of an existing quarry with associated infrastructure and resource availability. Extraction of similar resources from another site (if present) would likely involve a similar or greater level of biodiversity impacts.

5.1.2 *Planning*

(a) siting of the project – the Major Project should be located in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower site value score) or which avoid an EEC or CEEC

The existing quarry areas within the proposed disturbance area have been cleared of native vegetation and subject to resource extraction and ancillary activities for many years. The proposed disturbance area has been located to include most of the cleared parts of the property where resource is available for extraction and native vegetation is in lower condition. Areas proposed for clearing of native vegetation adjoin the existing cleared and disturbed areas and logically placed to reduce impacts when compared to potential development areas which do not directly adjoin the existing operations.

(b) minimise the amount of clearing or habitat loss – the Major Project (and associated construction infrastructure) should be located in areas that do not have native vegetation, or in areas that require the least amount of vegetation to be cleared (i.e. the development footprint is minimised), and/or in areas where other impacts to biodiversity will be the lowest.

It is considered that the proposed disturbance areas, including future extraction areas and ancillary use areas have been suitably located within and adjacent to the existing cleared and disturbed quarry areas present to minimise the amount of clearing and habitat loss required.

(c) loss of connectivity – some developments can impact on the connectivity and movement of species through areas of adjacent habitat. Minimisation measures may include providing structures that allow movement of species across barriers or hostile gaps.

The proposal is not likely to result in any hostile gaps and the quarry operations will be limited which will minimise impacts to nocturnal fauna species at connectivity points such as at the haul road between the east and the west pit areas and the site access location.

(d) other site constraints – any other constraints that the assessor has considered in determining the siting and layout of the Major Project, e.g. bushfire protection requirements including clearing for asset protection zones, flood planning levels, servicing constraints.

Other constraints which have influenced the determination of the proposed disturbance area include the location of the existing quarry pit and ancillary facilities, social impacts, noise impacts, traffic impacts, air quality impacts and the location of the available resource.

5.1.3 *Construction Phase*

(a) method of clearing – using a method of clearing during the construction phase that avoids damage to retained native vegetation and reduces soil disturbance. For example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed

Native vegetation clearing will be required for the initial construction of the haul road and the progressive clearing of native vegetation will be undertaken for the proposed pit extension to allow for the staged pit expansion. Clearing of native vegetation at the edges of the quarry areas is to be undertaken in a manner that does not adversely impact retained vegetation. This may include the use of chain-saws rather than heavy machinery. Clearing of hollow bearing trees will be undertaken in a sectional manner by an arborist to minimise potential

impacts to hollow dependant fauna. All trees are to be checked prior to clearing for the presence of Koalas. Any trees containing Koalas are not to be cleared while Koalas are present.

(b) clearing operations – minimising direct harm to native fauna during actual construction operations through onsite measures such as undertaking pre-clearing surveys, daily fauna surveys and the presence of a trained ecologist during clearing events

The biodiversity measures documented in Table 5.1 will be implemented for the Project including pre-clearing surveys, daily fauna surveys during clearing and the supervision of clearing works by a trained ecologist.

(c) timing of construction – identifying reasonable measures that minimise the impacts on biodiversity. For example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat on the site are not breeding or nesting, can minimise the impacts of construction activities on biodiversity

The biodiversity measures documented in Table 5.1 will be implemented for the Project, no measures related to construction timing are proposed.

(d) other measures that minimise inadvertent impacts of the Major Project on the biodiversity values – measures such as installing temporary fencing to protect significant environmental features such as riparian zones, promoting the hygiene of construction vehicles to minimise spread of weeds or pathogens, appropriately training and inducting project staff and contractors so that they can implement all measures that minimise inadvertent adverse impacts of the Major Project on biodiversity values.

The site planning and biodiversity measures documented in Table 5.1 will be implemented for the Project to mitigate disturbance to retained areas. Appropriate training and induction of project staff and contractors will also be completed. It is expected that several of these measures would be further documented in the various plans of management which would be finalised for the project following project approval. These documents include, but are not limited to the following:

- Flora and Fauna Management Plan
- Soil and Water Management Plan
- Integrated Facilities Management Plan

5.1.4 *Operational Phase*

(a) seasonal impacts – whether there are likely to be any impacts that occur during specific seasons. Minimisation measures may include amending operational times to minimise impacts on biodiversity during periods when seasonal events such as breeding or species migration occur

The quarry has been operation at the site for many decades. It is considered that seasonal changes to the quarry operational times are not feasible or necessary as part of the ongoing operational activities.

(b) artificial habitats – using 'artificial habitats' for fauna where they may be effective in minimising impacts on such fauna. These include nest boxes, glider-crossings or habitat bridges.

Any hollow dependant fauna captured during pre-clearing surveys or during clearing works will be released into a nest box in a nearby retained area of the site to minimise impacts associated with relocation. Use of additional artificial habitats during the operational phase are not proposed.

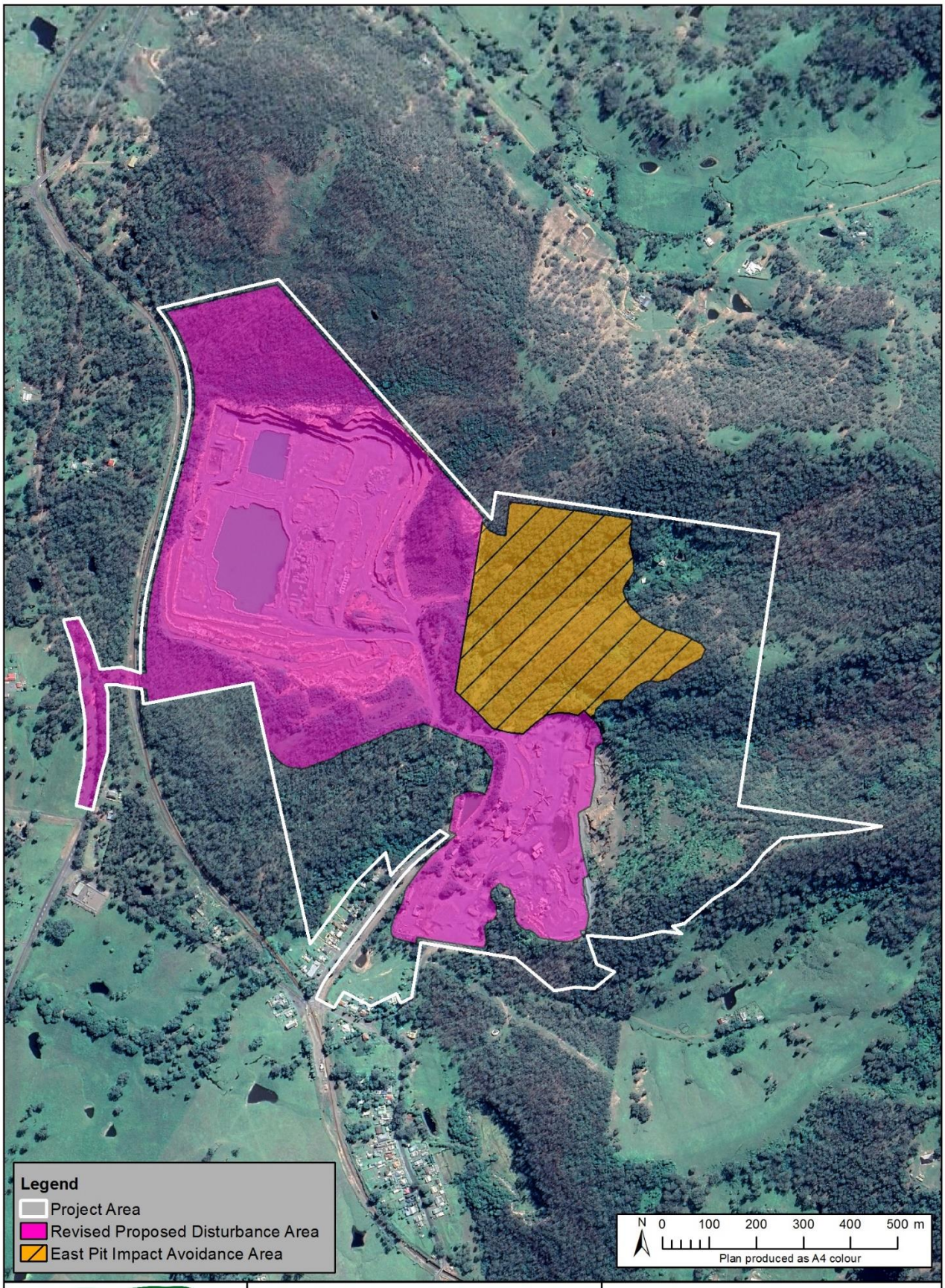
TABLE 5.1 SUMMARY OF MEASURES TO BE IMPLEMENTED TO AVOID AND MINIMISE IMPACTS						
IMPACT	**MEASURE DESCRIPTION**	**TIMING**	**MONITORING SCHEDULE**	**OUTCOME**	**EFFECTIVENESS**	**RESPONSIBILITY**
Site clearing	**Site Planning Measure 1:** Ensure that areas proposed for clearing contain the target resource.	Project planning	Not applicable	Minimisation of clearing footprint to required areas.	High	Proponent
Site clearing	**Site Planning Measure 2:** Ensure that roads and new infrastructure are located within the resource extraction footprint where possible.	Project planning	Not applicable	Minimisation of clearing footprint to required areas.	High	Proponent
Site clearing	**Biodiversity Measure 1:** Fence the outer extent of native vegetation areas not approved for removal.	Fencing to be installed progressively prior to bulk clearing works occurring within 20m of outer extent of approved clearing.	Maintain records and dates of works for annual reporting. Monitor annually to ensure fence is maintained in good condition.	Prevent accidental over-clearing.	High	Proponent
Site clearing	**Biodiversity Measure 2:** Provide temporary fencing for staged clearing areas to be retained.	Prior to commencement of clearing in directly adjoining areas.	Maintain records and dates of fence installation works for annual reporting. Monitor prior to clearing commencement.	Prevent accidental over-clearing.	High	Proponent
Site clearing	**Biodiversity Measure 3:** Staff training and site briefing to communicate environmental features to be protected and measures to be implemented.	Prior to each site clearing event	Maintain records for all clearing events and report annually to DPIE.	Protection and management of site environmental features	High	Site manager and Project ecologist

TABLE 5.1 SUMMARY OF MEASURES TO BE IMPLEMENTED TO AVOID AND MINIMISE IMPACTS						
IMPACT	**MEASURE DESCRIPTION**	**TIMING**	**MONITORING SCHEDULE**	**OUTCOME**	**EFFECTIVENESS**	**RESPONSIBILITY**
Site clearing	**Biodiversity Measure 4:** Pre-clearing surveys to relocate fauna species by a suitably qualified and experienced wildlife handler / ecologist.	Prior to site clearing	Report to DPIE within 2 weeks of completion of clearing events.	Protection of resident fauna	Moderate	Site Manager and Project Ecologist
Downstream Water Quality Deterioration	**Biodiversity Measure 5:** Implement Soil and Water Management Plan (SWMP)	During site clearing and Quarry Operation	As per requirements of SWMP.	Mitigation and management of downstream water quality impacts.	High	Site Manager
Hollow bearing tree loss	**Biodiversity Measure 6:** Identification and supervision of hollow-bearing tree clearing and management to enable relocation of fauna. Relocate displaced fauna to a nest box installed within the retained site area.	During site clearing	Maintain records for each day of hollow tree clearing works. Record hollow tree locations, characteristics and fauna encountered.	Minimise impacts to hollow dependant fauna	Moderate	Site Manager, Project Ecologist / clearing contractor
Pathogen Spread	**Biodiversity Measure 7:** Implement pathogen control protocol to prevent pathogen spread between the site and offsite areas.	During site clearing	Monitor vegetative waste leaving site daily during site clearing.	Prevention pathogen spread	Moderate	Proponent / Site Manager
Weed spread	**Biodiversity Measure 8:** Implement monitoring and weed control program to prevent the spread of weeds between the site and offsite areas.	Operation	Annually	Prevention weed spread	High	Proponent / Site Manager/ Project Ecologist

TABLE 5.1 SUMMARY OF MEASURES TO BE IMPLEMENTED TO AVOID AND MINIMISE IMPACTS						
IMPACT	**MEASURE DESCRIPTION**	**TIMING**	**MONITORING SCHEDULE**	**OUTCOME**	**EFFECTIVENESS**	**RESPONSIBILITY**
Various impacts associated with daily site operations	**Biodiversity Measure 9:** Implement Environmental Site Management Plan & Construction Environmental Management Plan.	During construction and operations	Refer to final plans.	Manage and mitigate indirect impacts associated with dust, noise, vibration, erosion, sedimentation and accidental damage to habitat and species.	High	Proponent / Site Manager
Site Clearing	**Biodiversity Measure 10:** Allow for natural regeneration and utilise local endemic species, including *Eucalyptus glaucina*, in site rehabilitation works.	Post resource extraction	Refer to site rehabilitation planning documentation.	Provision of habitat for local biodiversity.	High	Proponent / Site Manager / Project Ecologist

5.2 FINAL PROJECT FOOTPRINT

The initial proposed disturbance area and the final revised and reduced proposed disturbance area is mapped in Figure 5.1.


Legend
Project Area
Revised Proposed Disturbance Area
East Pit Impact Avoidance Area
N
0
100
200
300
400
500 m
Plan produced as A4 colour
conacher consulting
Drawn By: AM
Drawing Version: 1
Drawing No: 21037
Date: 20/04/2021
* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2021) Air Photo Date: 04/10/2020
Figure 5.1
Final Revised Proposed Disturbance Area
Martins Creek Quarry, Martins Creek

5.3 ASSESSMENT OF DIRECT AND INDIRECT IMPACTS

An assessment of the potential direct and indirect impacts of the proposal are provided in Table 5.2. Mitigation measures proposed are identified in Table 5.2 and further impact avoidance and minimisation measures are documented in Table 5.1.

TABLE 5.2
ASSESSMENT OF POTENTIAL ADVERSE DIRECT AND INDIRECT IMPACTS

Potential Impact of Development	Impact Type	Impact Frequency	Potential Impact Intensity	Impact Duration	Impact Consequence	Mitigation Measures Proposed
Direct removal of organism	Direct Impact	One-off during each clearing stage	High	Permanent	Major alteration to ecosystem components and function	Refinement of project footprint to resource rich areas / reduction of project footprint to reduce biodiversity related impacts Relocation of arboreal fauna in hollow bearing trees to adjoining habitat areas prior to clearing Implementation of a Flora and Fauna Management Plan
Removal of habitat / clearing of native vegetation	Direct Impact	One-off during each clearing stage	High	Permanent	Major alteration to ecosystem components and function	Refinement of project footprint to resource rich areas / reduction of project footprint to reduce biodiversity related impacts Implementation of a Flora and Fauna Management Plan (FFMP).

TABLE 5.2 ASSESSMENT OF POTENTIAL ADVERSE DIRECT AND INDIRECT IMPACTS						
Potential Impact of Development	**Impact Type**	**Impact Frequency**	**Potential Impact Intensity**	**Impact Duration**	**Impact Consequence**	**Mitigation Measures Proposed**
Soil erosion and sedimentation	Indirect Impact	Ongoing following rain events	Moderate	Occasional / during rainfall events	Potential for minor to moderate alteration to riparian ecosystem components and function	Implementation of the Soil and Water Management Plan (SWMP). Impacts limited to disturbance area.
Rubbish dumping	Indirect Impact	Ongoing	Low	Temporary / reversible	Minor to no likely change in ecosystem components and function	Implementation of Integrated Facilities Management Plan (IFMP)
Nutrient runoff	Indirect Impact	Ongoing following rain events	Moderate to High	Occasional / during rainfall events	Potential for minor to moderate alteration to riparian ecosystem components and function	Implementation of SWMP. Impacts limited to disturbance area.
Habitat fragmentation or isolation	Direct Impact	One-off following clearing of Stage 2 area	Moderate to high	Permanent	Potential for moderate alteration to ecosystem components and function	Implementation of FFMP.
Ongoing Management Bushfire Protection Areas	Direct Impact	One-off during each clearing stage	Low	Permanent	Minor to no likely change in ecosystem components and function	Implementation of the Bushfire Emergency Response Procedure in the IFMP.
Loss of genetic diversity	Indirect Impact	One-off following clearing	High	Permanent	Potential for minor to moderate alteration to ecosystem components and function	Implementation of a FFMP.
Altered pollination syndromes that may adversely affect seed set	Indirect Impact	One-off following clearing	High	Permanent	Potential for minor to moderate alteration to ecosystem components and function	Implementation of a FFMP.

TABLE 5.2 ASSESSMENT OF POTENTIAL ADVERSE DIRECT AND INDIRECT IMPACTS						
Potential Impact of Development	**Impact Type**	**Impact Frequency**	**Potential Impact Intensity**	**Impact Duration**	**Impact Consequence**	**Mitigation Measures Proposed**
Altered hydrology regimes	Direct Impact	Ongoing	High	Permanent	Minor – Project avoids additional disturbance in stream areas.	Implementation of SWMP.
Deterioration in downstream water quality	Indirect Impact	Ongoing following rain events	Moderate	Occasional / during rainfall events	Potential for moderate alteration to riparian ecosystem components and function	Implementation of SWMP. Impacts limited to disturbance area.
Fauna exposure to heat / loss of shade	Indirect Impact	One-off following clearing	High	Short period until populations adjust following site clearing	Not likely to occur.	Implementation of a FFMP.
Exposure to predators	Indirect Impact	One-off following clearing	Low	Short period until populations adjust following site clearing	Potential for minor alteration to ecosystem components and function	Implementation of a FFMP.
Weed invasion	Indirect Impact	Ongoing	Low	Ongoing	Potential for minor alteration to ecosystem components and function	Implementation of a FFMP.
Feral animal incursion	Indirect Impact	Ongoing	Low	Occasional	Potential for minor alteration to ecosystem components and function	Implementation of a FFMP.
Trampling of retained threatened species	Indirect Impact	Ongoing	Low	Occasional	Potential for minor alteration to riparian ecosystem components and function	Implementation of a FFMP & IFMP
Introduction and spread of pathogens	Indirect Impact	One-off during clearing phase	Low	Occasional / ongoing	Potential for moderate alteration to ecosystem components and function	Implementation of a FFMP & IFMP.

TABLE 5.2 ASSESSMENT OF POTENTIAL ADVERSE DIRECT AND INDIRECT IMPACTS						
Potential Impact of Development	**Impact Type**	**Impact Frequency**	**Potential Impact Intensity**	**Impact Duration**	**Impact Consequence**	**Mitigation Measures Proposed**
Noise & Vibration	Direct Impact	Ongoing during clearing and blast operations	Moderate to High	Ongoing during operation	Potential for moderate alteration to ecosystem components and function	Implementation of IFMP.
Dust	Direct Impact	Ongoing	Moderate to High	Ongoing during operation	Potential for minor to moderate alteration to ecosystem components and function	Implementation of IFMP.
Light spill	Direct Impact	Ongoing	Low	Ongoing at night	Potential for minor alteration to ecosystem components and function	Implementation of IFMP.
Changes in fire intensity and frequency	Indirect Impact	Ongoing	Low	Occasional	Potential for minor alteration to riparian ecosystem components and function	Implementation of IFMP.
Increased human activity	Indirect Impact	Ongoing	Low	Ongoing during operation	Potential for minor alteration to ecosystem components and function	Implementation of IFMP.
Incremental decline in quality and extent of habitat	Cumulative direct impact	One-off following clearing	Low to moderate	Permanent	Potential for moderate alteration to ecosystem components and function	Implementation of a FFMP & IFMP.

5.4 STATEMENT OF ONSITE MEASURES PROPOSED TO AVOID AND MINIMISE DIRECT AND INDIRECT IMPACTS

The measures proposed to avoid and minimise direct and indirect impacts within the site are listed in Table 5.1, in Section 5.1 of this Report.

SECTION 6

IMPACT SUMMARY

6.1 AREAS WHICH DO NOT REQUIRE ASSESSMENT

Areas mapped as Cleared Land and/or Existing Development Area were not assessed for biodiversity offsets. These areas are mapped in Figure 6.1.

6.2 AREAS WHICH DO NOT REQUIRE OFFSETS

Areas mapped as Cleared Land and/or Existing Development Areas were not assessed for biodiversity offsets. These areas are mapped in Figure 6.1.

6.3 PLANT COMMUNITY TYPES WHICH REQUIRE OFFSETS

The plant community types which required offsets and the corresponding offset requirements are listed in Table 6.1. Plant Community Types which require offsets are mapped in Figure 6.2.

TABLE 6.1
PLANT COMMUNITY TYPE IMPACT SUMMARY

IMPACT SUMMARY CONSIDERATIONS	HU 619 Zone 1	HU 755 Zone 1	HU 798 Zone 1	HU 816 Zone 1
Extent within Proposed Disturbance Area (ha)	13.43	2.22	3.33	2.15
Loss in Site Value Score	76.56	94.00	93.75	96.88
Future Site Value Score	0	0	0	0
Loss in Landscape Value	17.40	17.40	17.40	17.40
EEC Offset Multiplier	1.0	3.0	1.0	1.0
Number of ecosystem credits required	830	166	249	166

6.4 SPECIES CREDIT THREATENED SPECIES WHICH REQUIRE OFFSETS

The threatened species which required offsets and the corresponding offset requirements are listed in Table 6.2.

TABLE 6.2
IMPACT AREAS AND OFFSET REQUIREMENTS
FOR SPECIES CREDIT TYPE THREATENED SPECIES

Species Name	Extent of Proposed Impact	Number of species credits required	Species Polygon Map Reference
Slaty Red Gum (*Eucalyptus glaucina*)	2887 individuals over 13.43 hectares	40,418	Figure 4.5
Southern Myotis (*Myotis macropus*)	13.80 ha	304	Figure 4.7
Brush-tailed Phascogale (*Phascogale tapoatafa*)	21.13 ha	423	Figure 4.8
Koala (*Phascolarctos cinereus*)	21.13 ha	549	Figure 4.9

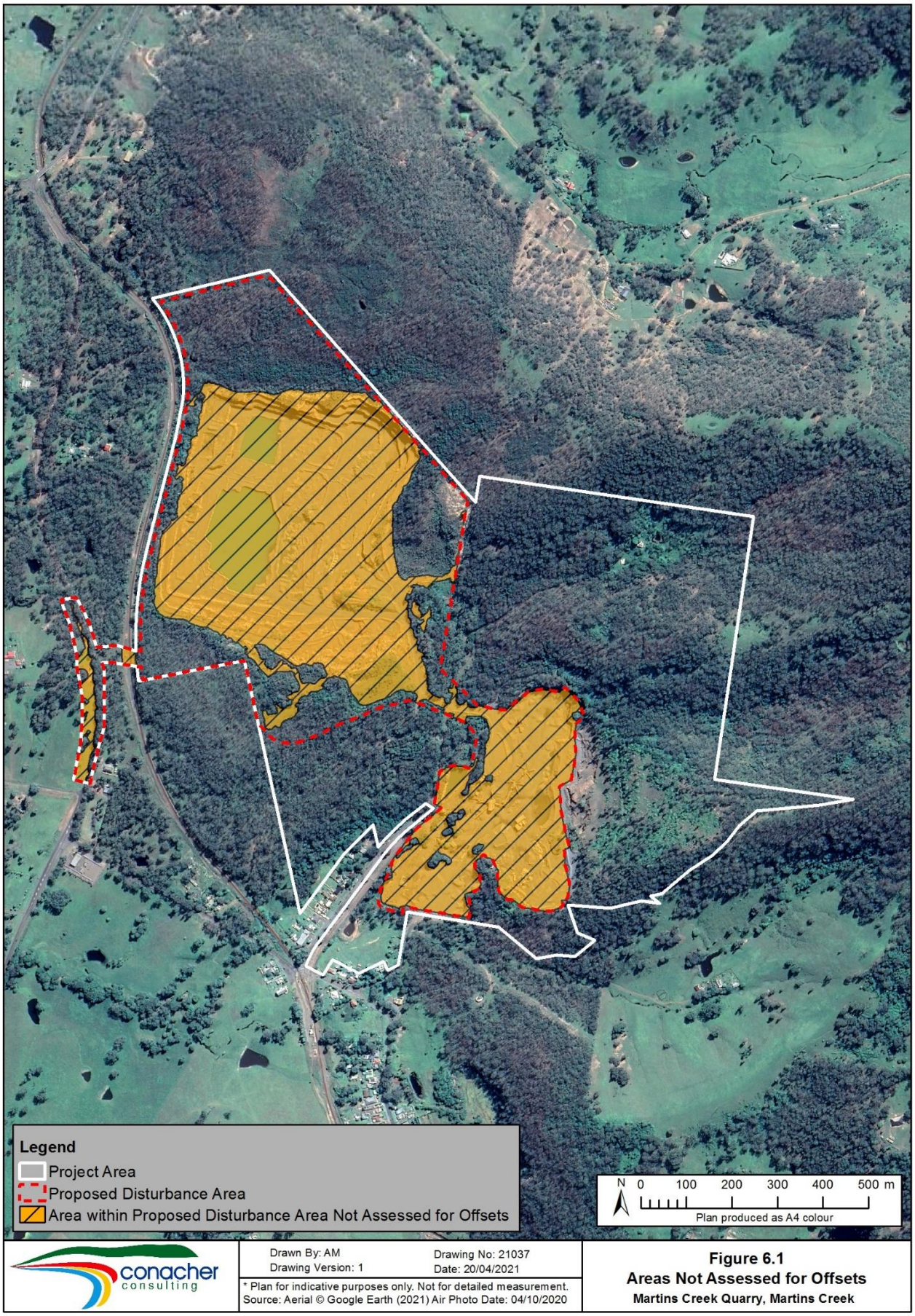


Figure 6.1
Areas Not Assessed for Offsets
Martins Creek Quarry, Martins Creek

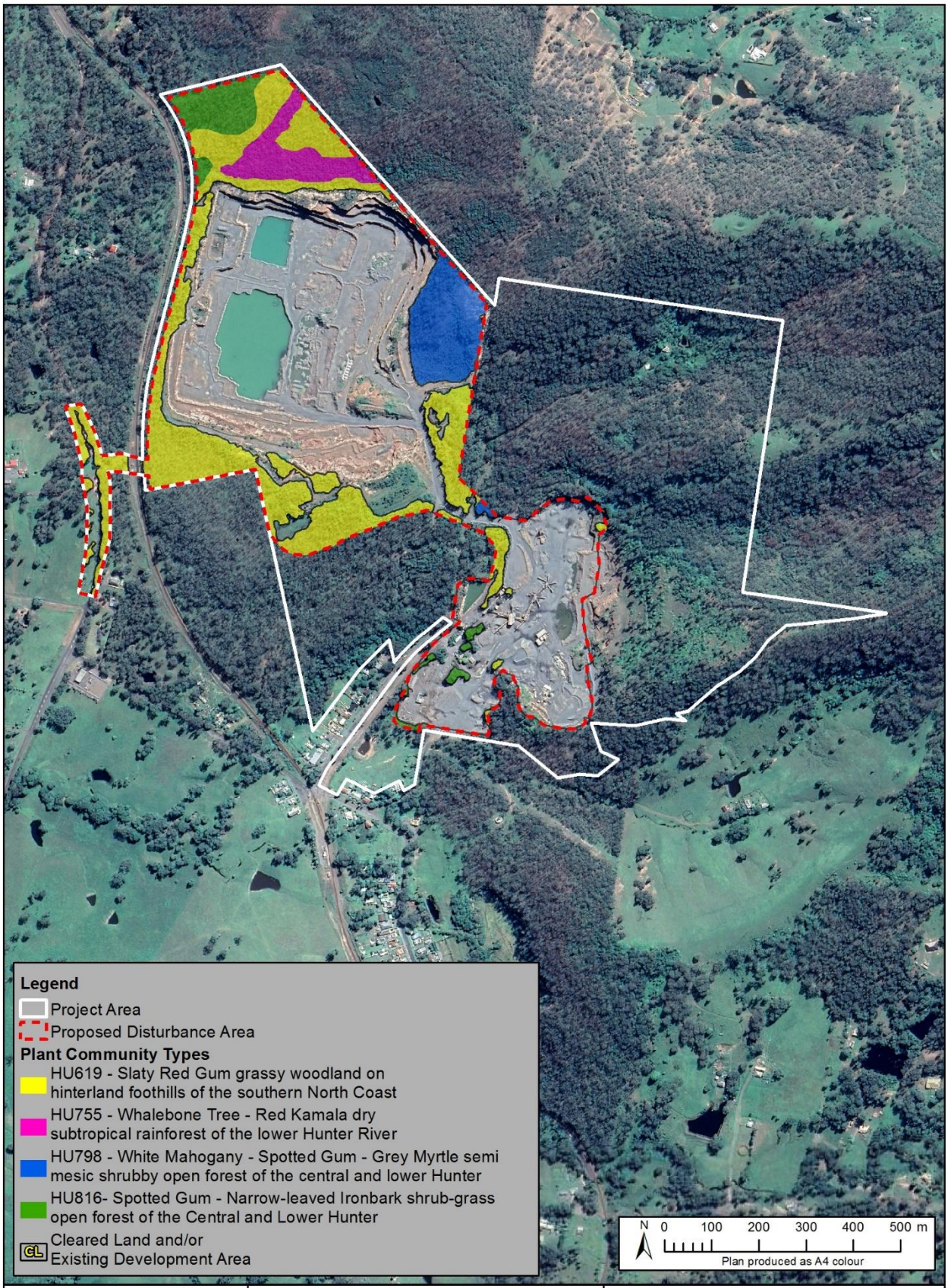


Figure 6.2
Plant Community Types Assessed for Ecosystem Credits
Martins Creek Quarry, Martins Creek

6.5 IMPACTS WHICH MAY REQUIRE FURTHER CONSIDERATION

No impacts which required further consideration have been identified as likely to occur as summarised below.

6.5.1 *Impacts on Landscape Features*

i. *Impacts reducing width of riparian buffer of important rivers, streams or estuaries*

The proposal will not impact on an area of native vegetation within:

- 20m either side of a 4th and 5th order stream;
- 50m either side of a 6th order stream or higher; or
- 50m around an estuarine area.

ii. *Impacts on important wetlands*

The proposal will not impact on any important wetland or associated buffer.

iii. *Impacts on species movement along corridors*

No State Significant Biodiversity Links have been identified as likely to be impacted by the proposal.

iv. Impacts to important wetlands and their buffers

No important wetlands or their buffers are likely to be impacted by the proposal.

6.5.2 *Impacts on Native Vegetation*

The proposal is not likely to impact on any critically endangered ecological communities or any endangered ecological community nominated in the Secretaries Environmental Assessment Requirements (SEARs).

6.5.3 *Impacts on Threatened Species*

No threatened species listed as critically endangered were observed within the proposed disturbance area during surveys. Impacts to the critically endangered species, Scrub Turpentine (*Rhodamnia rubescens*), will be avoided.

The terrestrial orchid known as the Tall Rusty Hood (*Pterostylis chaetophora*) was the only threatened species nominated within the SEARs for further consideration under Section 9.2 of the Framework for Biodiversity Assessment (NSW OEH 2014). This species was not observed during targeted surveys and further consideration is not required.

No threatened species not previously recorded within the IBRA subregion according to the NSW Wildlife Atlas records, were observed.

6.5.4 *Impacts on Critical Habitat*

The proposal is not likely to impact on any areas of critical habitat and no estuary buffer zones are likely to be impacted by the proposal.

i. *Impacts to critically endangered ecological communities which exceed the impact threshold*

No critically endangered ecological communities were observed within the Project Area or proposed disturbance area during surveys.

ii. *Impacts to endangered ecological communities which exceed the impact threshold*

No endangered ecological communities listed within the *BC Act* or the *EPBC Act* were observed within the Project Area or proposed disturbance area during surveys.

The proposal is not likely to result in impacts on endangered ecological communities which exceed the impact threshold.

iii. *Impacts to critical habitat*

No critical habitats are located in or near to the site and no critical habitats are likely to be impacted by the proposal.

SECTION 7

BIODIVERSITY CREDIT REPORT

7.1 BIODIVERSITY CREDIT REPORT SUMMARY

The credit types required and matching credit profiles are provided in Table 7.1. A full Biodiversity Credit Report from the Credit Calculator is provided in Appendix 7.

TABLE 7.1
BIODIVERSITY OFFSET CREDIT TYPES REQUIRED

Entity	Number of Credits Required	Offset Options – Plant Community Types	Offset Options IBRA Sub-regions
HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	249	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798) Tallowwood - Small-fruited Grey Gum - Kangaroo Grass grassy tall open forest on foothills of the lower North Coast, (HU762) Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast, (HU770) Pink Bloodwood - Thin-leaved Stringybark - Grey Ironbark shrub - grass open forest on ranges of the lower North Coast, (HU772)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs
HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	166	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

TABLE 7.1 BIODIVERSITY OFFSET CREDIT TYPES REQUIRED			
Entity	**Number of Credits Required**	**Offset Options – Plant Community Types**	**Offset Options IBRA Sub-regions**
		Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	
HU755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	166	Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River, (HU755) Sandpaper Fig - Whalebone Tree warm temperate rainforest, (HU739)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs
HU619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	830	Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs
Slaty Red Gum (*Eucalyptus glaucina*)	40,418	Not applicable	Not applicable

TABLE 7.1 BIODIVERSITY OFFSET CREDIT TYPES REQUIRED			
Entity	**Number of Credits Required**	**Offset Options – Plant Community Types**	**Offset Options IBRA Sub-regions**
Brush-tailed Phascogale (*Phascogale tapoatafa*)	423	Not applicable	Not applicable
Koala (*Phascolarctos cinereus*)	549	Not applicable	Not applicable
Southern Myotis (*Myotis macropus*)	304	Not applicable	Not applicable

SECTION 8

EPBC ACT KEY ISSUES ASSESSMENT

The referral and decision that the project is a controlled action was based on an earlier project design with a larger impact footprint to the current proposal. The Revised Project has significantly reduced the extent of the biodiversity impacts. This Section provides an updated assessment of the Revised Project's impacts on Matters of National Environmental Significance identified as being controlling provisions.

8.1 RAMSAR WETLANDS OF INTERNATIONAL IMPORTANCE

The Guidelines for preparing Assessment Documentation relevant to the *EPBC Act* 1999 for the Martins Creek Quarry Expansion Project (EPBC 2016/7725: SSD6612) (AGDoE 2016a) have identified that the proposal has potential to impact on the Hunter Estuary Wetlands RAMSAR site and have identified that the level of potential impact should be further investigated. The following assessment is provided in accordance with Key Issues 8 and 9 of the Guidelines (AGDoE 2016a).

8.1.1 *Ramsar Site Location*

The Hunter Estuary Wetlands are part of the estuary of the Hunter River. The Hunter River Catchment is one of the largest Coastal Catchments in NSW and supports a range of activities including agriculture, over 20 large coal mines and three power stations including Australia's largest electricity generator (NSW EPA 2021).

The Hunter Estuary Wetlands consist of two components, Kooragang (listed in 1984) and the Hunter Wetlands Centre (added in 2002) Australia. The locations of these wetlands are shown in Figure 8.1 and are located approximately 32km downstream in a direct line south-southeast from the proposed Project Area with a flow path of approximately 61km.

8.1.2 *Ramsar Site Extent*

The Kooragang component of the Hunter Estuary Wetlands has an extent of 2,926 hectares and the Hunter Wetlands Centre Australia component has an extent of 42 hectares (DAWE 2021a).

8.1.3 *Ramsar Site Ecological Characteristics and Values*

The habitats within the Kooragang component consist of mangrove forests dominated by Grey Mangrove, Samphire saltmarsh, Paperbark and Swamp She-oak swamp forests, brackish swamps, mudflats, and sandy beaches (DAWE 2021a).

The habitat types within the Hunter Wetlands Centre Australia component include rehabilitated semi-permanent/seasonal freshwater ponds and marshes, natural semi-permanent/seasonal brackish ponds and marshes, freshwater swamp forests and a coastal estuarine creek (DAWE 2021a).

The Hunter River Estuary has been identified by DAWE (2021a) as having the following ecological characteristics under the Ramsar Classification System for Wetland Type:

Human-made Wetlands

- Ponds; includes farm ponds, stock ponds, small tanks; (generally below 8 ha)

Marine/Coastal Wetlands

- Estuarine waters; permanent water of estuaries and estuarine systems of deltas
- Intertidal mud, sand or salt flats
- Intertidal marshes; includes salt marshes, salt meadows, saltings, raised salt marshes; includes tidal brackish and freshwater marshes
- Intertidal forested wetlands; includes mangrove swamps, nipah swamps and tidal freshwater swamp forests

Inland Wetlands

- Seasonal/intermittent saline/brackish/alkaline marshes/pools
- Seasonal/intermittent freshwater marshes/pools on inorganic soils; includes sloughs, potholes, seasonally flooded meadows, sedge marshes
- Freshwater, tree-dominated wetlands; includes freshwater swamp forests, seasonally flooded forests, wooded swamps on inorganic soils

The Hunter River Estuary Ramsar site provides habitats for a variety fauna species such as:

- Birds including migratory and non-migratory shorebirds;
- Amphibians including the threatened Green and Golden Bell Frog (*Litoria aurea*);
- Common reptile species;
- Common terrestrial and arboreal mammal species;
- Megachiropteran and microchiropteran bat species;
- Several cartilaginous and bony fish species; and
- Numerous species of invertebrates

Further details on the ecological characteristics and values of the Kooragang Wetland component are provided by Brereton and Taylor-Wood (2010).

8.1.4 *Areas of Wetland Being Destroyed or Substantially Modified*

There is no potential for the proposal to result in a direct impact on the Hunter Estuary Wetlands as this wetland is located approximately 32km (in a direct line) and approximately 61km down-stream from the proposed Project Area.

Potential indirect impacts to the Hunter Estuary Wetlands include degradation of habitat through a reduction in water quality and alteration in water quantity. It is considered however that the proposal will however not have a measurable or appreciable indirect impact on the Hunter Estuary Wetlands.

Potential water quality and quantity associated impacts will be managed and mitigated in accordance with the recommendations for managing water quality and flows provided in the Surface Water Impact Assessment prepared by Umwelt (2021b).

No areas of the Hunter Estuary Wetlands will be destroyed or substantially modified by the proposed development.

8.1.5 *Substantial Changes to the Hydrological Regime*

There is no potential for the proposal to result in a direct impact on the Hunter Estuary Wetlands.

Potential indirect impacts to the Hunter Estuary Wetlands include degradation of habitat through a reduction in water quality and alteration in water quantity. It is considered however that the proposal will however not have a measurable or appreciable indirect impact on the Hunter Estuary Wetlands.

Potential water quality and quantity associated impacts will be managed and mitigated in accordance with the recommendations for managing water quality and flows provided in the Surface Water Impact Assessment prepared by Umwelt (2021b).

The proposed development will not result in a substantial change to the hydrological regime of the Hunter Estuary Wetlands.

8.1.6 *Habitat or Lifecycle of Native Species Dependant on the Wetland at risk of being Affected*

There is no potential for the proposal to result in a direct impact on the Hunter Estuary Wetlands.

Potential indirect impacts to the Hunter Estuary Wetlands include degradation of habitat through a reduction in water quality and alteration in water quantity. It is considered however that the proposal will however not have a measurable or appreciable indirect impact on the Hunter Estuary Wetlands.

Potential water quality and quantity associated impacts will be managed and mitigated in accordance with the recommendations for managing water quality and flows provided in the Surface Water Impact Assessment prepared by Umwelt (2021b).

The proposal is not likely to put any habitat of native species dependent on the wetland at risk.

8.1.7 *Substantial and Measurable Change in Water Quality of the Wetland*

There is no potential for the proposal to result in a direct impact on the Hunter Estuary Wetlands.

Potential indirect impacts to the Hunter Estuary Wetlands include degradation of habitat through a reduction in water quality and alteration in water quantity. It is considered however that the proposal will however not have a measurable or appreciable indirect impact on the Hunter Estuary Wetlands.

Potential water quality and quantity associated impacts will be managed and mitigated in accordance with the recommendations for managing water quality and flows provided in the Surface Water Impact Assessment prepared by Umwelt (2021b).

The proposal is not likely to result in any substantial and measurable change in water quality of the Hunter Estuary Wetlands.

8.1.8 *Invasive Species that may be Harmful to the Ecological Character of the Wetland (If introduced or spread as a result of the development)*

The proposal is not a type of development which is likely to result in the spread of invasive species that may be harmful to the ecological character of the Hunter Estuary Wetlands.

8.1.9 *Description of Mitigation and Management Measures Proposed to Protect or Enhance The Elements of the Impacted Ecological Character of the Wetland on International Importance*

No ecological characters of the Hunter Estuary Wetlands are likely to be impacted. All potential impacts will be managed and mitigated through the implementation of suitable environmental controls located within the proposed disturbance area.

In particular the potential impacts to water quality and flows will be managed and mitigated in accordance with the recommendations provided in the Surface Water Impact Assessment prepared by Umwelt (2021b).

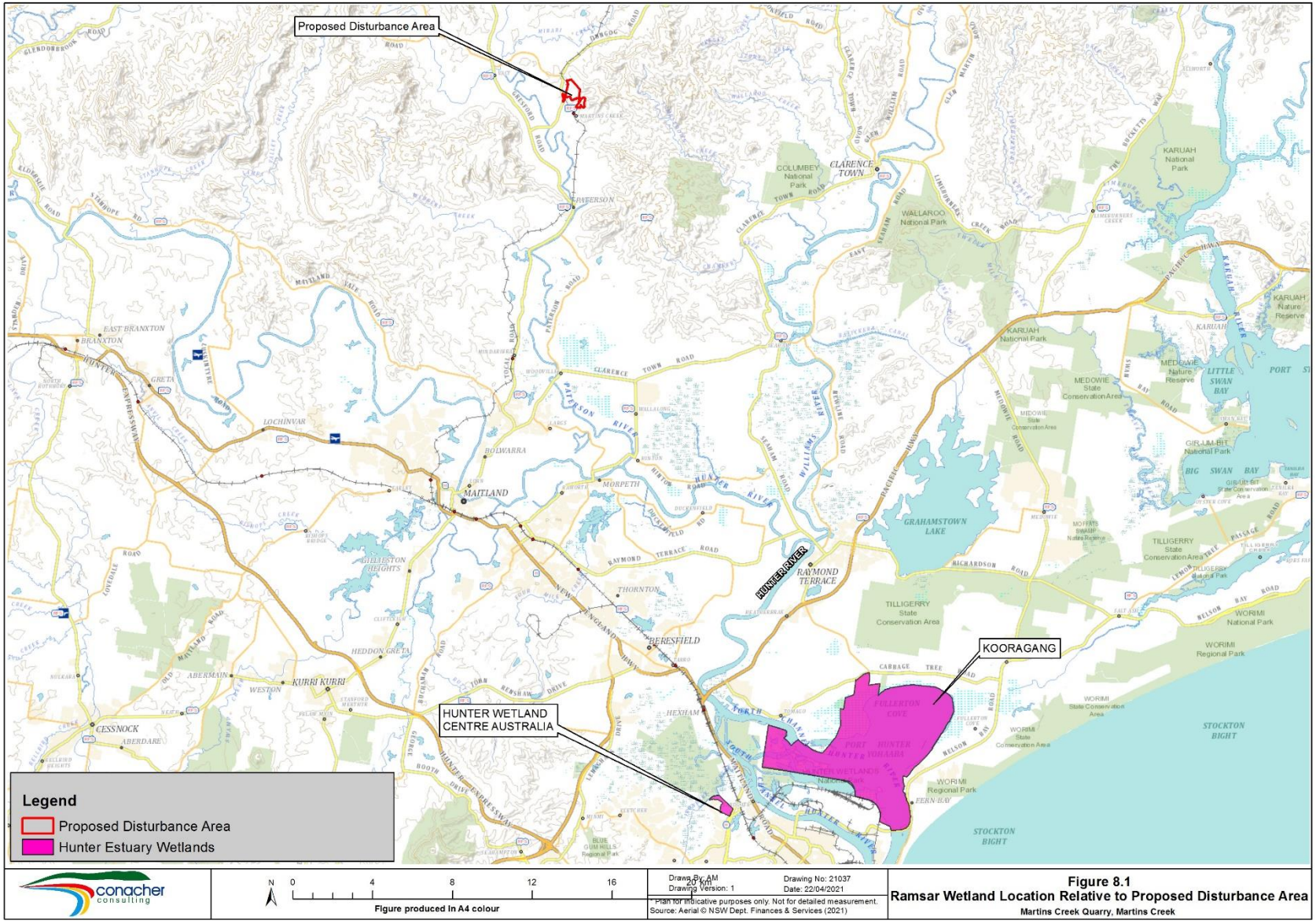


Figure 8.1
Ramsar Wetland Location Relative to Proposed Disturbance Area
Martins Creek Quarry, Martins Creek

8.2 NATIONALLY LISTED THREATENED BIODIVERSITY

8.2.1 Threatened Biodiversity Likely to be Significantly Impacted

The Guidelines for preparing Assessment Documentation relevant to the EPBC Act 1999 for the Martins Creek Quarry Expansion Project (EPBC 2016/7725: SSD6612) (Department of the Environment 2016) have identified that the action as referred has potential to have a significant impact on the following listed threatened species:

- Slaty Red Gum (*Eucalyptus glaucina*)
- Koala (*Phascolarctos cinereus*) combined populations of QLD, NSW & the ACT
- Regent Honeyeater (*Anthochaera phrygia*)
- Swift Parrot (*Lathamus discolor*)
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) SE Mainland population

It is noted that the proposed action as described in the referral was the original project which was assessed in the EIS. The reduction in the Project's Disturbance Area relative to the project originally referred has resulted in a significant reduction in biodiversity impacts.

Section 8.2.3 includes an updated assessment of significance for the above identified species having regard to the reduced impacts associated with the Project.

The Guidelines also require that evidence is provided of why other *EPBC Act* listed threatened species and communities likely to be located in the Project Area or in the vicinity will not be significantly impacted in accordance with the Matters of National Environmental Significance - Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999 (Significant Impact Guidelines). Section 8.2.2 identifies additional species that are likely to be present within the Project Area and includes an assessment of significance of these species.

8.2.2 Assessment of Additional Nationally Listed Threatened Biodiversity

The following assessment in accordance with the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (AGDoE 2013) is provided:

i. Are there any Matters of National Environmental Significance located in the area of the proposed action?

A protected matters search (DAWE 2021b) has been completed for nationally listed threatened species and ecological communities within 5km of the Project Area. The species identified from the search are further assessed for potential occurrence in Table 8.1.

The nationally listed species, Grey-headed Flying-fox (*Pteropus poliocephalus)* and Scrub Turpentine (*Rhodamnia rubescens*) were observed during surveys. Suitable foraging habitat is present for the Grey-headed Flying-fox within the proposed disturbance area. *Rhodamnia rubescens* was observed within the impact avoidance areas and will not be impacted by the proposal.

The following other nationally listed entities have potential to occur within the site:

- Large-eared Pied Bat (*Chalinolobus dwyeri*); and
- Greater Glider (*Petauroides volans).*

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Botaurus poiciloptilus Australasian Bittern	Endangered	Shallow freshwater or brackish wetlands with tall dense vegetation.	Species or species habitat likely to occur within area	No	Not required	Not likely to occur
Calidris ferruginea Curlew Sandpiper	Critically Endangered	Intertidal sheltered coastal mudflats, lagoons, swamps and artificial waterbodies in near-coastal environments (Higgins and Davies 1996).	Species or species habitat may occur within area	No	Not required	Not likely to occur
Dasyornis brachypterus Eastern Bristlebird	Endangered	Coastal woodland, dense scrub and heath, often near taller forest (Higgins and Peter 2002)	Species or species habitat may occur within area	No	Not required	Not likely to occur
Erythrotriorchis radiatus Red Goshawk	Vulnerable	Open woodlands and forests often near permanent water. Rare in NSW (Marchant and Higgins 1993).	Species or species habitat may occur within area	Sub-optimal / species is a vagrant in the area	Yes Not observed	Not likely to occur
Grey Falcon Falco hypoleucos	Vulnerable	Sparsely distributed in NSW, mostly within the Murray-Darling Basin, considered to be a vagrant east of the Great Dividing Range (NSW DPIE 2021).	Species or species habitat likely to occur within area	Sub-optimal / species is a vagrant in the area	Yes Not observed	Not likely to occur
Grantiella picta Painted Honeyeater	Vulnerable	Open forest, woodland and scrubland with mistletoe fruits (Higgins *et al*., 2001).	Species or species habitat may occur within area	Sub-optimal / species is a vagrant in the area	Yes Not observed	Not likely to occur
White-throated Needletail *Hirundapus caudactus*	Vulnerable	Widely distributed, predominantly aerial species.	Species or species habitat known to occur within area	Yes	Yes Not observed	Potential to fly over the site, not likely to utilise the terrestrial habitats present.

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Numenius madagascariensis Eastern Curlew	Critically Endangered	Intertidal sheltered mudflats or sandflats associated with lagoons, swamps and artificial waterbodies in coastal and near-coastal environments (Higgins and Davies 1996).	Species or species habitat may occur within area	No	Not required	Not likely to occur
Rostratula australis Australian Painted-snipe	Endangered	Murray-Darling basin and inland Australia within areas containing marshes and freshwater wetlands with swampy vegetation.	Species or species habitat may occur within area	No	Not required	Not likely to occur
Heleioporus australiacus Giant Burrowing Frog	Vulnerable	Small slowly flowing water courses, soaks and swamps which traverse plateaus and broad upland gullies (NSW NPWS 2001).	Species or species habitat may occur within area	No	Not required	Not likely to occur
Litoria aurea Green and Golden Bell Frog	Vulnerable	Breeds in shallow (<1m) ponds or slowly moving waterways which undergo disturbance regimes such as fluctuating water flow or inflow of saline water with both areas of open water and dense low vegetation (NSW NPWS 1999).	Species or species habitat may occur within area	Sub-optimal habitat present.	Yes Not observed	Not likely to occur
Mixophyes balbus Stuttering Frog	Vulnerable	Undisturbed freshwater streams in rainforest, Antarctic Beech and wet sclerophyll forest (Cogger 2000).	Species or species habitat likely to occur within area	No / no records on Bionet Atlas within 20km (NSW DPIE 2021b).	Yes Not observed	Not likely to occur
Chalinolobus dwyeri Large-eared Pied Bat	Endangered	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies (Churchill 2008).	Species or species habitat likely to occur within area	Yes	Yes Not observed	Low to moderate potential for occurrence

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Petauroides volans Greater Glider	Vulnerable	Inhabits eucalypt forests and shelters in large hollow sections of eucalypt trees (NSW DPIE 2021b).	Species or species habitat may occur within area	Yes	Yes Not observed	Not observed during surveys Low to moderate potential for occurrence
Petrogale penicillata Brush-tailed Rock-wallaby	Vulnerable	Rocky gorges and outcrops (NSW DPIE 2021b).	Species or species habitat likely to occur within area	No	Yes (opportunistic) Not observed	Not observed during surveys Not likely to occur
Potorous tridactylus tridactylus Long-nosed Potoroo	Vulnerable	Coastal heath and dry and wet sclerophyll forests with a dense understorey (Seebeck *et al*., 1989).	Species or species habitat may occur within area.	No, nearest record on the Bionet Atlas (NSW DPIE 2021b) is approx. 39km from the site.	Yes Not observed	Not observed during surveys Not likely to occur
Pseudomys novaehollandiae New Holland Mouse	Vulnerable	Within NSW occurs in a variety of structural vegetation types including heathland and woodland, dry sclerophyll forest with a dense shrub layer and on vegetated sand dunes. Requires sandy soils for burrowing (Wilson and Laidlaw 2003).	Species or species habitat likely to occur within area	No	No	Not likely to occur

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Pteropus poliocephalus Grey-headed Flying-fox	Vulnerable	Rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Roosts in trees in gullies, riparian habitats and urban areas (Tidemann 1995).	Foraging, feeding or related behaviour known to occur within area	Yes	Yes Observed foraging during surveys. No roost or camp sites present.	High / Observed
Arthraxon hispidus Hairy-joint Grass	Vulnerable	Occurs at the edges of rainforest and in wet eucalypt forest, near creeks and swamps and in woodlands, its southern distribution limit within NSW is Kemsey.	Species or species habitat may occur within area.	No, site is located outside of species known range.	No	Not likely to occur
Cryptostylis hunteriana	Vulnerable	Recorded in a variety of habitat types, particularly swamp-heath on sandy soils in coastal districts. NSW populations are known from Jervis Bay to Batemans Bay, Lake Macquarie, Nelson Bay, Eden, Nowendoc, the Blue Mountains and the Gibraltar Range area (deLacey *et al*., 2007)	Species or species habitat may occur within area	No	No	Not likely to occur
Cynanchum elegans White-flowered Wax Plant	Endangered	Grows in dry rainforest, littoral rainforest, coastal scrub, Eucalyptus tereticornis aligned open forest and woodland; *Corymbia maculata* aligned open forest and woodland and *Melaleuca armillaris* scrub (NSW DPIE 2021b).	Species or species habitat likely to occur within area	Yes	Yes Not observed	Not likely to occur

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Dichanthium setosum Bluegrass	Vulnerable	Grows in heavy basaltic black soils and red-brown loams with clay subsoil on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland (NSW DPIE 2021b).	Species or species habitat likely to occur within area	No	No	Not likely to occur
Euphrasia arguta	Critically Endangered	Occurs in the Nundle region in eucalypt forest, particularly in association with disturbed roadside areas (NSW DPIE 2021b).	Species or species habitat may occur within area	No, site is located outside of species known range.	No	Not likely to occur
Phaius australis Lesser Swamp-orchid	Endangered	Occurs in swampy environments in Queensland and north-east NSW as far south as Coffs Harbour (NSW DPIE 2021b).	Species or species habitat may occur within area	No	No	Not likely to occur
Prasophyllum sp. Wybong A Leek Orchid	Critically Endangered	Occurs in eucalypt woodland near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area (NSW DPIE 2021b).	Species or species habitat may occur within area	No, site is located outside of species known range.	No	Not likely to occur
Rhizanthella slateri Eastern Underground Orchid	Endangered	Eucalypt forest	Species or species habitat may occur within area.	Yes	Yes Not observed	Not likely to occur
Rhodamnia rubescens Scrub Turpentine	Critically Endangered	Rainforest and moist sclerophyll forest.	Species or species habitat known to occur within area.	Yes	Yes	Observed within impact avoidance area

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Rhodomyrtus psidioides Native Guava	Critically Endangered	Rainforest and moist sclerophyll forest.	Species or species habitat may occur within area	Yes	Yes Not observed	Not likely to occur
Syzygium paniculatum Magenta Lilly Pilly	Vulnerable	Littoral & subtropical rainforest on sandy soils near the coast (NSW DPIE 2021b)	Species or species habitat likely to occur within area	Marginal, site located outside / west of species known range.	Yes Not observed	Not likely to occur
Tetratheca juncea Black-eyed Susan	Vulnerable	Dry sclerophyll forest and heath / restricted geographically (NSW DPIE 2021b)	Species or species habitat likely to occur within area	No, site is located outside of species known range.	No	Not likely to occur
Thesium australe Austral Toadflax	Vulnerable	Grows in grassland or woodland, often in damp sites. Sporadic and widespread distribution (NSW DPIE 2021b).	Species or species habitat may occur within area	No, not recorded within 85km of the site.	No	Not likely to occur
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Location: Hunter River Catchment. Dominant / Characteristic Species: *Eucalyptus crebra, Corymbia maculata, E. dawsonii* and/or *E. moluccana*. *Allocasuarina torulosa, E. acmenoides* and *E. fibrosa* are largely absent. Topography / Soils: Occurs on lower slopes, ridges and valley floors on soils derived from Permian sedimentary rocks.	Community may occur within area	No Refer to Section 3.3.1 for further discussion	Yes	Not likely to occur

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
Coastal Swamp Oak (Casuarina glauca) Forest of NSW and South East QLD ecological community	Endangered	Location: From Curtis Island, north of Gladstone, in Queensland to Bermagui in southern New South Wales. Dominant / Characteristic Species: Canopy dominated by *Casuarina glauca* and Melaleuca species. Topography / Soils: Coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated Unconsolidated sediments	Community may occur within area	No suitable habitat present	Yes	Not likely to occur
Lowland Rainforest of Subtropical Australia	Critically Endangered	Location: below 300m ASL within the NSW North Coast and South Eastern Queensland bioregions. Dominant / Characteristic Species: See Listing Advice for diagnostic species and species richness requirements. Does not include littoral rainforest, wet sclerophyll forest or dry rainforest community types. Topography / Soils: Occurs on soils derived from basalt or alluvium, enriched rhyolitic soils or basalt enriched metasediments below 300m ASL.	Community may occur within area	No Floristic & structural requirements not met.	Yes	Not likely to occur

TABLE 8.1 ADDITIONAL EPBC ACT LISTED THREATENED SPECIES AND ECOLOGICAL COMMUNITIES ASSESSMENT OF POTENTIAL OCCURRENCE						
Species Name	**EPBC Act Status**	**Habitat Preference**	**Type of Presence (from Protected Matters Search)**	**Suitable Habitat Present**	**Subject to Surveys**	**Likelihood of Occurrence**
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Location: Coastal floodplains of southern New South Wales and eastern Victoria. The northern limit is around Raymond Terrace NSW. Characteristic Species: Canopy species include *Angophora floribunda, Angophora subvelutina, Eucalyptus tereticornis, Eucalyptus amplifolia, Eucalyptus baueriana, Eucalyptus bosistoana, Eucalyptus botryoides, Eucalyptus elata, Eucalyptus ovata* and *Eucalyptus viminalis.* Topography/Landform: Up to 250m ASL on alluvial landforms related to coastal river floodplains.	Community may occur within area	No, floristic and landform elements not met	Yes	Not likely to occur
White Box-Yellow Box-Blakely's Gum Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Location: Western slopes and tablelands of the Great Dividing Range. Dominant / Characteristic Species: Woodland or derived grassland community with a dominance or prior dominance by *Eucalyptus albens*, *Eucalyptus melliodora* or *Eucalyptus blakelyi.* Topography / Soils: moderate to highly fertile soils.	Community may occur within area	No	Yes	Not likely to occur

ii. Considering the proposed action at its broadest scope, is there potential for impacts on Matters of National Environmental Significance?

Yes, it is considered that there is potential for the proposal to impact the following additional threatened species:

- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Greater Glider (*Petauroides volans)*
- Grey-headed Flying-fox (*Pteropus poliocephalus)*

An significant impact assessment has also been completed for Rhodamina rubescens, which was observed within the impact avoidance area during surveys.

iii. Are there any proposed measures to avoid or reduce impacts on Matters of National Environmental Significance?

Yes mitigation measures proposed are outlined in Section 5 of this Report.

iv. Are any impacts of the proposed action on Matters of National Environmental Significance likely to be significant impacts?

a. LARGE-EARED PIED BAT (*Chalinolobus dwyeri*)

For the purposes of assessment of a vulnerable species under the *EPBC Act* an assessment as to whether the species comprises an important population is required. An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows.

1. Whether the population has been identified within a recovery plan

No, the site does not contain a population of this species identified within a recovery plan**.**

2. Whether the population constitutes a key source population either for breeding or dispersal

No individuals or breeding habitats were observed and therefore the site is not likely to contain a population which constitutes a key source population either for breeding or dispersal.

3. Whether the population constitutes a population necessary for maintaining genetic diversity

No individuals were observed and therefore a population necessary for maintaining genetic diversity is not likely to be present.

4. Whether the population is near the limit of the species range

No the site is not located near the limit of this species range.

Important Population Assessment Conclusion
From the above information and details it is considered that the subject site is not likely to contain a:

- Population identified in a recovery plan for this species;
- A key source population for breeding or dispersal;

- A population necessary for maintaining genetic diversity; or
- A population which is near this species range.

Therefore it is considered that the threatened species observed does not satisfy the criteria of an important population as identified by the DoE (2013).

Part B - Significant Impact Assessment
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (Department of the Environment 2013), have been addressed below to determine whether there is a real chance or possibility that the proposed action is likely to have a significant impact on this species.

An action is likely to have a significant impact on a vulnerable listed threatened species if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of an important population of a species.

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

2. Reduce the area of occupancy of an important population;

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

3. Fragment an existing important population into two or more populations;

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

4. Adversely affect habitat critical to the survival of a species;

No, the site does not contain habitat critical to the survival of this species, such as a maternity site.

5. Disrupt the breeding cycle of an important population;

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

No, this species has not been observed within the site during surveys and therefore the proposal is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.

7. Result in invasive species that are harmful to a threatened species becoming established in the vulnerable species' habitat;

It is considered that the proposal is not likely to result in invasive species that are harmful to this species becoming established in habitat for this species, through the implementation of suitable mitigation measures.

8. Introduce disease that may cause a species to decline; or

It is considered that the proposed action and the proposal is not a type of development likely to introduce disease that may cause this species to decline.

9. Interfere with the recovery of the species.

It is considered that the proposal is not likely to interfere with any recovery actions for this species.

Conclusion
It is considered that the Revised Project is not likely to have a significant impact on the Large-eared Pied Bat.

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b. GREATER GLIDER (*Petauroides volans)*
For the purposes of assessment of a vulnerable species under the *EPBC Act* an assessment as to whether the species comprises an important population is required. An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows.

1. Whether the population has been identified within a recovery plan

No, the site does not contain a population of this species identified within a recovery plan**.**

2. Whether the population constitutes a key source population either for breeding or dispersal

No individuals were observed and therefore the site is not likely to contain a population which constitutes a key source population either for breeding or dispersal.

3. Whether the population constitutes a population necessary for maintaining genetic diversity

No individuals were observed and therefore a population necessary for maintaining genetic diversity is not likely to be present.

4. Whether the population is near the limit of the species range

No the site is not located near the limit of this species range.

Important Population Assessment Conclusion
From the above information and details it is considered that the subject site is not likely to contain a:

- Population identified in a recovery plan for this species;
- A key source population for breeding or dispersal;
- A population necessary for maintaining genetic diversity; or
- A population which is near this species range.

Therefore it is considered that the threatened species observed does not satisfy the criteria of an important population as identified by the DOE (2013).

Part B - Significant Impact Assessment
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (Department of the Environment 2013), have been addressed below to determine whether there

is a real chance or possibility that the proposed action is likely to have a significant impact on this species.

An action is likely to have a significant impact on a vulnerable listed threatened species if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of an important population of a species.

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

2. Reduce the area of occupancy of an important population;

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

3. Fragment an existing important population into two or more populations;

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

4. Adversely affect habitat critical to the survival of a species;

No, the site does not contain habitat critical to the survival of this species, such as a maternity site.

5. Disrupt the breeding cycle of an important population;

No, this species was not observed during surveys and the site is not likely to contain an important population of this species.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

No, this species has not been observed within the site during surveys and therefore the proposal is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.

7. Result in invasive species that are harmful to a threatened species becoming established in the vulnerable species' habitat;

It is considered that the proposal is not likely to result in invasive species that are harmful to this species becoming established in habitat for this species, through the implementation of suitable mitigation measures.

8. Introduce disease that may cause a species to decline; or

It is considered that the proposed action and the proposal is not a type of development likely to introduce disease that may cause this species to decline.

9. Interfere with the recovery of the species.

It is considered that the proposal is not likely to interfere with any recovery actions for this species.

Conclusion
It is considered that the Revised Project is not likely to have a significant impact on the Greater Glider.

c. GREY-HEADED FLYING-FOX (*Pteropus poliocephalus)*
For the purposes of assessment of a vulnerable species under the *EPBC Act* an assessment as to whether the species comprises an important population is required. An *"important population"* is one that is necessary for a species' long-term survival and recovery. Questions (in bold) to determine whether a population is an *"important population"* are as follows.

1. Whether the population has been identified within a recovery plan

Yes, the Grey-headed Flying-fox is considered to be a single, mobile population as identified in the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017).

2. Whether the population constitutes a key source population either for breeding or dispersal

Yes, the Grey-headed Flying-fox is considered to be a single, mobile population as identified in the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) and therefore constitutes a key source population either for breeding and dispersal.

3. Whether the population constitutes a population necessary for maintaining genetic diversity

Yes, the Grey-headed Flying-fox is considered to be a single, mobile population as identified in the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) and therefore constitutes a population necessary for maintaining genetic diversity.

4. Whether the population is near the limit of the species range

No, the site is not located near the limit of this species range.

Important Population Assessment Conclusion
From the above information and details it is considered that the subject site is likely to provide foraging habitat for an important population of the Grey-headed Flying-fox.

Part B - Significant Impact Assessment
Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (Department of the Environment 2013), have been addressed below to determine whether there is a real chance or possibility that the proposed action is likely to have a significant impact on this species.

An action is likely to have a significant impact on a vulnerable listed threatened species if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of an important population of a species.

No, the proposal is not likely to lead to a direct or measurable long-term decrease in the size of an important population of this species.

2. Reduce the area of occupancy of an important population;

The proposal will reduce the area of foraging habitat available to this species within the site, however the proposal will not result in a range reduction for this species.

3. Fragment an existing important population into two or more populations;

This species is mobile and highly nomadic. The proposal is not likely to fragment an existing important population of Grey-headed Flying-foxes into two or more populations.

4. Adversely affect habitat critical to the survival of a species;

The Draft Recovery Plan for the Grey-headed Flying-fox (AGDoEE 2017) identifies that '*All foraging habitat has the potential to be productive during general food shortages and therefore provide a critical resource*'. The proposal is therefore likely to adversely affect foraging habitat which has the potential to be critical to the survival of this species.

5. Disrupt the breeding cycle of an important population;

The subject site does not contain any maternity roost or camp sites for this species. It is considered that the proposal is not likely to disrupt the breeding cycle of an important population of Grey-headed Flying-foxes.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

It is considered that the proposal is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the proposal is likely to result in a direct and measurable decline in this species. A small incremental population decline may result as an indirect result of the proposed action.

7. Result in invasive species that are harmful to a threatened species becoming established in the vulnerable species' habitat;

It is considered that the proposal is not likely to result in invasive species that are harmful to this species becoming established in habitat for this species, through the implementation of suitable mitigation measures.

8. Introduce disease that may cause a species to decline; or

It is considered that the proposed action and the proposal is not a type of development likely to introduce disease that may cause this species to decline.

9. Interfere with the recovery of the species.

It is considered that the proposal is not likely to directly interfere with any recovery actions for this species.

Conclusion

It is considered that the Revised Project is not likely to have a significant impact on the Grey-headed Flying-fox. This species is assessed as a 'ecosystem credit' species under the FBA (NSW OEH 2014) and suitable offsets for foraging habitat are proposed. There are no significant residual impacts to this species which will not be addressed in accordance with the FBA. Despite the conclusion that the proposal is not likely to have a significant impact on the Grey-headed Flying-fox, this species was observed foraging within the site during surveys and further assessment under Section 8.2.3 of this Report has been undertaken as a precautionary measure.

d. SCRUB TURPENTINE (*Rhodamnia rubescens*)

Criteria identified within the EPBC Act Policy Statement 1.1 *Significant Impact Guidelines* (Department of the Environment 2013), have been addressed below to determine whether there is a real chance or possibility that the proposed action is likely to have a significant impact on this species.

An action is likely to have a significant impact on a vulnerable listed threatened species if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of a population.

No, this species was only observed within the impact avoidance area during surveys and is not located within or directly adjacent to the proposed disturbance area.

2. Reduce the area of occupancy of the species;

No, this species was only observed within the impact avoidance area during surveys and is not located within or directly adjacent to the proposed disturbance area.

3. Fragment an existing important population into two or more populations;

No, this species was only observed within the impact avoidance area during surveys and is not located within or directly adjacent to the proposed disturbance area.

4. Adversely affect habitat critical to the survival of a species;

No, this species was only observed within the impact avoidance area during surveys and is not located within or directly adjacent to the proposed disturbance area.

5. Disrupt the breeding cycle of a population;

No, this species was only observed within the impact avoidance area during surveys and is not located within or directly adjacent to the proposed disturbance area.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;

This species was only observed within the impact avoidance area during surveys and is not located within or directly adjacent to the proposed disturbance area. Therefore the proposal is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.

7. Result in invasive species that are harmful to a threatened species becoming established in the endangered or critically endangered species' habitat;

It is considered that the proposal is not likely to result in invasive species that are harmful to this species becoming established in habitat for this species, through the implementation of suitable mitigation measures.

8. Introduce disease that may cause the species to decline; or

It is considered that the proposal is not a type of development likely to introduce disease that may cause this species to decline. Symptoms of Myrtle Rust were seen on the plants observed during surveys.

9. Interfere with the recovery of the species.

It is considered that the proposal is not likely to interfere with any recovery actions for this species.

Conclusion
It is considered that the Revised Project is not likely to have a significant impact on *Rhodamnia rubescens*.

8.2.3 Assessment for Nationally Listed Species Identified as having potential to be Significantly Impacted

i. SLATY RED GUM (*Eucalyptus glaucina*)

a. *Habitat description*

The approved conservation advice (ACA) for *Eucalyptus glaucina* identifies that it occurs in the Rappville district, south of Casino, and in a number of localities in the Taree, Stroud, Dungog and Paterson districts, NSW (AGDEWHA 2008). The Bionet Atlas (NSW DPIE 2021b) identifies that the majority of the records for this species within the Hunter region are roughly bounded by Muswellbrook, Stroud, Kurri Kurri, Broke and Denman.

AGDEWHA (2008) have also identified that this species grows in a range of situations, from shallow soils or stony hillsides, but not on poor sandstones to grassy woodlands and on deep, moderately fertile and well-watered soil to gentle slopes near drainage lines in alluvial and clayey soils. This species has been described as locally frequent, but sporadic across its range (Royal Botanic Gardens and Domain Trust 2021).

The proposal will result in the removal of an estimated 2887 *E. glaucina* individuals within the proposed disturbance area associated with approximately 13.43 ha of the Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast plant community type. This habitat type occurs within the site at elevations of approximately 40 to 100m. A map of the site areas occupied by this species within the subject site is shown in Figure 4.5.

The areas occupied by *E. glaucina* within the site occur mostly on the erosional Ten Mile Road Soil Landscape and to a lesser extent on the colluvial Birdsview Soil Landscape in the east of the site. The Ten Mile Road Soil Landscape is characterized by moderately deep to deep, well to imperfectly drained brown Soloths, yellow Soloths and shallow, well drained Bleached Loams and Lithosols. These soils are identified as of low to moderate fertility, and have potential to be strongly to extremely acidic (Matthei 1995).

Disturbances to the site habitats of this species include historical clearing associated with previous quarry activities and likely previous stock grazing.

b. *Important populations and habitat critical for survival*

Within the Hunter region this species is conserved within the Belford National Park and Werekata National Park, however most occurrences appear to be located outside of formal conservation reserves (NSW DPIE 2021c).

The Belford National Park population and an adjoining area of private land is part of an approximately 5,738.30 ha area protected and managed under the OEH Saving Our Species program (NSW DPIE 2021c).

This species is also conserved within a flora reserve within the Braemar State Forest, south of Casino. An area of 6,715 ha on private land within the Braemar area is also protected and managed under the OEH Saving Our Species program (NSW DPIE 2021c).

Two additional occurrences of this species, on private land at Bremer and a local population on private land and within the Belford National Park at Minimbah are proposed to be established as Key Management Sites under the OEH program Saving Our Species (NSW DPIE 2021c). These local populations have been identified as containing 10000 and 5000 individuals respectively and are considered to constitute important populations and contain habitat critical to the survival of this species over the next 100 years. The subject site has not been identified as habitat critical to the survival of this species.

An important population is a population that is necessary for a species' long term survival and recovery. It is considered that the *E. glaucina* present within the site forms a part of a larger regional population contained within the Hunter region. This population is considered to be an important population as it is likely to be necessary for breeding and dispersal and for maintaining genetic diversity, in accordance with the Important Population Criteria provided by DoE (2013).

c. Details of surveys undertaken

Details on the surveys completed for this species are provided in Section 4 of this Report.

d. Consistency with published Australian Government guidelines and policy statements

There are no published Australian Government Guidelines or policy statements of relevance to this species.

e. Description of impacts with regard to the national extent of the species range

The national range of this species extends from the Northern Rivers region in the north from near Casino where it is locally common to areas south of Taree and Pokolbin. The proposed disturbance area is not at the limit of the national extent of the species range.

The proposal will result in the direct removal of an estimated 2887 *E. glaucina* individuals within the proposed disturbance area over approximately 13.43 ha.

f. *Identification of significant residual adverse impacts after avoidance and mitigation measures have been taken into account*

The proposal will result in the direct removal of approximately 2887 *E. glaucina* individuals within the proposed disturbance area over approximately 13.43 ha.

g. *Details of how the Framework for Biodiversity Assessment has been applied in accordance with the objects of the EPBC act to offset significant residual adverse impacts*

The objects of the *EPBC Act* will be achieved through the implementation of the Bilateral Agreement made under Section 45 of the Act relating to environmental assessment between the Commonwealth of Australia and The State of New South Wales. The Framework for Biodiversity Assessment is the current accredited assessment process.

This Report provides details of how the Framework for Biodiversity Assessment has been applied to the proposed development to assess significant residual adverse impacts. Details

on how the Framework for Biodiversity Assessment has been applied to offset significant residual adverse impacts are provided in the BOS prepared by Conacher Consulting (2021). The BOS identifies that this species will be offset on lands adjoining and within the vicinity of the proposed disturbance area.

h. ***Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.***

The ecosystem and species credit profiles required to offset the development are provided in Section 6 of this Report. Mapping and description of the extent and condition of the relevant habitat occurring on the proposed offset sites is provided in the BOS (Conacher Consulting 2021).

i. ***Consideration of significant residual impact not addressed in the FBA required to be addressed under the EPBC Act Environmental Offset Policy.***

This species is assessed as a 'species credit' species under the FBA (NSW OEH 2014). There are no significant residual impacts to this species which will not be addressed in accordance with the FBA.

Conclusion
It is considered that the Revised Project is likely to have a significant impact on this species due to the removal of 13.43 hectares of habitat. Impact avoidance, mitigation and management measures have been applied to the proposal and the impacts to this species will also be offset in accordance with the requirements of the Framework for Biodiversity Assessment, as documented in the BOS (Conacher Consulting 2021).

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ii. KOALA (*Phascolarctos cinereus*)

a. ***Habitat description and observation details***

General habitat description
The approved conservation advice (ACA) for *the Koala combined populations of QLD, NSW and the ACT* identifies that Koalas inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by species from the genus Eucalyptus (AGDoE 2012). The ACA also identifies that the listed Koala populations extend from the latitude of Cairns to the New South Wales – Victorian Border, including some island populations. The distribution of koalas is also affected by altitude (limited to <800m ASL), temperature and, at the western and northern ends of the range, leaf moisture (AGDoE 2012).

Previous site observations
The Koala was observed at three locations adjoining the proposed quarry extension area during previous surveys undertaken in 2007 by Umwelt (2009).

Current site observations
The Koala was also observed during current surveys. The following observation details from the current surveys are provided:

- One Koala was observed during the spotlighting survey undertaken on 20 August 2014 at the top of the hill in the eastern portion of the Project Area. A male Koala was recorded

calling on a songmeter device during call recording surveys on the 6th, 7th, 9th and 10th September 2014 within the vicinity of the initial spotlighting observation location.

- A Koala was observed during the spotlighting surveys undertaken on 18 and 19 February 2015 to the west of the detention basin and the western alternate access road.

- A Koala was heard calling from the forested area within the northern section of the site during a spotlighting survey undertaken on 19 February 2015.

- A Koala was recorded at one location during baited infrared camera surveys completed by Umwelt during June 2020.

Site habitat details

The Project Area is located within the Central Coast Koala Management Area (KMA) and the Barrington Area of Regional Koala Significance, identified in the Koala Habitat Information Base (NSW DPIE 2019).

No Koala scats were observed within the Proposed Disturbance Area during the Koala Spot Assessment Technique Surveys (Phillips and Callaghan 2011). The Koala activity within the Proposed Disturbance Area is therefore considered to be in the low activity category, in accordance with the Spot Assessment Technique method of Phillips and Callaghan (2011).

Details of the listed Koala tree species observed within the survey plots for each Plant Community Type (PCT), as identified in the Koala Habitat Information Base (NSW DPIE 2019) are provided in Table 8.2. The associated rank is listed for each tree species for the Central Coast Koala Management Region.

All PCTs within the site contained survey plots with identified Koala Tree Species as identified by NSW DPIE (2019). Koala trees ranked by NSW DPIE (2019) as 'high preferred use' were observed within survey plots for PCTs HU 619 and HU 798. PCT HU 816 contained significant use ranked Koala tree species and the survey plots for plant community type HU 755 contained only irregular or low use ranked Koala tree species. A full list of flora speces observed within each survey plot is provided in Appendix 1.

TABLE 8.2
SUMMARY OF KOALA TREE PRESENCE AND RANK FOR SITE PCTS

Plant Community Types	Koala Tree Species Present	Koala Tree Use Rank
HU 619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Spotted gum (*Corymbia maculata*)	4
	Broad-leaved White Mahogany (*Eucalyptus carnea*)	4
	Narrow-leaved Ironbark (*Eucalyptus crebra*)	3
	Slaty Red Gum (*Eucalyptus glaucina*)	4
	White Stringybark (*Eucalyptus globoidea*)	2
	Grey Box (*Eucalyptus moluccana*)	1
	Grey Ironbark (*Eucalyptus siderophloia*)	4
	Forest Red Gum (*Eucalyptus tereticornis*)	1
HU 755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter	Spotted gum (*Corymbia maculata*)	4
	White Mahogany (*Eucalyptus acmenoides*)	4
HU 798 White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the	Spotted gum (*Corymbia maculata*)	4
	White Mahogany (*Eucalyptus acmenoides*)	4
	Large-fruited Grey Gum (*Eucalyptus canaliculata*)	1
	Narrow-leaved Ironbark (*Eucalyptus crebra*)	3
	White Stringybark (*Eucalyptus globoidea*)	2

TABLE 8.2 SUMMARY OF KOALA TREE PRESENCE AND RANK FOR SITE PCTS		
Plant Community Types	**Koala Tree Species Present**	**Koala Tree Use Rank**
central and lower Hunter Valley	Grey Ironbark (*Eucalyptus siderophloia*)	4
HU 816 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter	White Stringybark (*Eucalyptus globoidea*)	2
	Narrow-leaved Ironbark (*Eucalyptus crebra*)	3
	Spotted gum (*Corymbia maculata*)	4
	Red Ironbark (*Eucalyptus fibrosa*)	3
Key to Koala Tree Rank 1 = high preferred use; 2 = High use; 3 = Significant use; 4 = Irregular or low use.		

No Koala scats were observed within the Proposed Disturbance Area during the Koala Spot Assessment Technique Surveys (Phillips and Callaghan 2011). The Koala activity within the Proposed Disturbance Area is therefore considered to be in the low activity category, in accordance with the Spot Assessment Technique method of Phillips and Callaghan (2011).

Koala occupancy polygon

The occupancy polygon for this species covers an area of 21.13 ha as mapped in Figure 4.8 and includes all plant community types.

b. *Important populations and habitat critical for survival*

The DoE (2014) have identified that the concept of 'important populations' has not been used in the koala referral guidelines as sufficient information was not available to adequately identify and separate the nature of any important populations throughout the range of the listed species. It is therefore considered that all populations may be important, including the population present within the Hunter Region. Important populations of Koalas have not been separated throughout the range of the listed species (DoE 2014).

The DoE (2014) have identified that an impact area that scores five or more using the habitat assessment tool for the Koala in Table 4 of the Guidelines is highly likely to contain habitat critical to the survival of the Koala. The proposed disturbance area has a score of ten as identified through application of the Koala Habitat Assessment Tool, as summarised in Table 8.3.

TABLE 8.3 EPBC KOALA HABITAT ASSESSMENT TOOL RESULTS SUMMARY		
Assessment Attribute	**Habitat Assessment Category**	**Corresponding Score**
Koala Occurrence	Evidence of 1 or more koalas within the last 2 years	+2 (high)
Vegetation Composition	Has forest or woodland with 2 or more known koala food tree species,	+2 (high)
Habitat Connectivity	Area is part of a contiguous landscape ≥ 500 ha.	+2 (high)
Key Existing Threats	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence.	+2 (high)
Recovery Value	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	+2 (high)
	Total Score	10/10

c. Details of surveys undertaken

Details on the surveys completed for this species are provided in Section 4 of this Report.

d. Consistency with published Australian Government guidelines and policy statements

This species was observed during surveys and impacts to the Koala have been referred, assessed and are proposed to be offset for all suitable habitat areas within the site.

It is therefore considered that the assessment of this species is consistent with the EPBC Act referral guidelines for the vulnerable koala (Combined populations of Queensland, NSW South Wales and the Australian Capital Territory) (AGDoE 2014)

e. Description of impacts with regard to the national extent of the species range

The natural range of this species extends from north-eastern Queensland to the south-east corner of South Australia. This range is widespread in coastal and inland areas over 22° of latitude and 18° of longitude, or about one million square kilometres. The occurrence of individuals within the species distribution is not continuous and is defined by factors including habitat extent, condition and connectivity, the presence of suitable food trees and the absence of threats such as disease and mortality resulting from sources such as dog attacks and vehicle strikes (DAWE 2021c).

The proposal will result in the direct removal of approximately 21.13 hectares of suitable habitat for this species.

f. *Identification of significant residual adverse impacts after avoidance and mitigation measures have been taken into account*

The revised proposal will result in the removal of 21.13 hectares of suitable habitat for this species and the avoidance of impacts to approximately 15.82 ha of suitable habitat for this species.

g. *Details of how the Framework for Biodiversity Assessment has been applied in accordance with the objects of the EPBC act to offset significant residual adverse impacts*

The objects of the *EPBC Act* will be achieved through the implementation of the Bilateral Agreement made under Section 45 of the Act relating to environmental assessment between the Commonwealth of Australia and The State of New South Wales. The Framework for Biodiversity Assessment is the current accredited assessment process.

This Report provides details of how the Framework for Biodiversity Assessment has been applied to the proposed development to assess significant residual adverse impacts. Details on how the Framework for Biodiversity Assessment has been applied to offset significant residual adverse impacts are provided in the BOS prepared by Conacher Consulting (2021).

h. *Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.*

The species credit profiles required to offset the impacts of the proposed development on this species are provided in Section 6 of this Report. Mapping and description of the extent and condition of the relevant habitat occurring on proposed offset sites is provided in the BOS (Conacher Consulting 2021).

i. *Consideration of significant residual impact not addressed in the FBA required to be addressed under the EPBC Act Environmental Offset Policy.*

This species is assessed as a 'species credit' species under the FBA (NSW OEH 2014). There are no significant residual impacts to this species which will not be addressed in accordance with the FBA.

Conclusion
It is considered that the Revised Project is likely to have a significant impact on the Koala through the clearing of 21.13 ha of suitable habitat. Impact avoidance, mitigation and management measures have been applied to the proposal and the impacts to this species will also be offset in accordance with the requirements of the Framework for Biodiversity Assessment, as documented in the BOS (Conacher Consulting 2021)

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iii. REGENT HONEYEATER (*Anthochaera phrygia*)

a. *Habitat description*

The National Recovery Plan for the Regent Honeyeater (DoE 2016) identifies that most records for this species are from habitats which consist of box-ironbark eucalypt associations on sites with more fertile soils and higher water content, including creek flats, broad river valleys and lower slopes. Other forest types identified as providing regularly used habitats include wet lowland coastal forest dominated by Swamp Mahogany, Spotted Gum – Ironbark Associations and riverine woodlands. Riparian habitats are also selected as breeding habitat in some years (often adjacent to box-ironbark woodlands). Remnant stands of timber, roadside reserves, travelling stock routes and street trees are also identified as providing important habitat at certain times (DoE 2016b).

One key tree species for the Regent Honeyeater, *Corymbia maculata*, is present within the subject site (DoE 2016b). Other tree species present, such as stringybarks, red gums and ironbarks also contribute to the available nectar food resources present.

This species has not been observed within the subject site during targeted surveys completed in accordance with the requirements of the FBA (NSW OEH 2014) and NSW DEC (2004) requirements.

The subject site is located within an area mapped by DoE (2016b) as habitat where this species is likely to occur, and suitable foraging habitat is present for this species within the Dry Sclerophyll Forest and Wet Sclerophyll Forest habitats and to a lesser extent the Dry Rainforest habitats where suitable emergent trees for foraging are present. These habitat types are mapped in Figure 4.4a.

b. *Important populations and habitat critical for survival*

DoE (2016) have identified that habitat critical to the survival of the regent honeyeater includes:

- Any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in Figure 2 of the Recovery Plan); and

- Any newly discovered breeding or foraging locations.

There is no Figure 2 contained within the National Recovery Plan for this species. The proposed disturbance area is located within an area mapped as 'species likely to occur' in Figure 1 of the National Recovery Plan, however is not located within a 'key' or 'other' breeding area mapped.

The remaining individuals of the national population are considered to be an important population, in accordance with the criteria provided by DoE (2013). No Regent Honeyeaters have been observed within the subject site during surveys.

c. Details of surveys undertaken

Details on the surveys completed for this species are provided in Section 4 of this Report.

d. Consistency with published Australian Government guidelines and policy statements

The Survey Guidelines for Australia's Threatened Birds (DEWHA 2010a) identify survey effort requirements of 20 hours of area searches over 10 days and 20 hours of targeted searches over 5 days. These requirements were exceeded during the completion of both the warm and cool season surveys undertaken.

e. Description of impacts with regard to the national extent of the species range

The National Recovery Plan for the Regent Honeyeater (DoE 2016) identifies this species has an extremely patch distribution with a small number of breeding sites across its current range which extends from 100km north of Brisbane west to the coastal areas of NSW and Victoria and west to Narrabri, Dubbo, Parkes and Finley in NSW to as far as Bendigo in central Victoria.

There are four main known breeding sites, these are in Bundarra-Barraba, Capertee Valley and the Hunter Valley of NSW within the Hunter Economic Zone and within the Chiltern area in north-east Victoria.

Threats to the Regent Honeyeater across its national range include habitat loss, fragmentation and degradation, small population size, nest site predation by other birds and native mammals and competition for food resources.

The proposal will result in the direct removal of approximately 21.13 hectares of suitable habitat for this species, however this species was not observed during surveys.

f. *Identification of significant residual adverse impacts after avoidance and mitigation measures have been taken into account*

The proposal will result in the direct removal of approximately 21.13 hectares of suitable habitat for this species, however this species was not observed during surveys and it is considered that the Revised Project is not likely to have a significant impact on this species.

g. *Details of how the Framework for Biodiversity Assessment has been applied in accordance with the objects of the EPBC act to offset significant residual adverse impacts*

The objects of the *EPBC Act* will be achieved through the implementation of the Bilateral Agreement made under Section 45 Act relating to environmental assessment between the Commonwealth of Australia and The State of New South Wales, through the application of the Framework for Biodiversity Assessment.

This Report provides details of how the Framework for Biodiversity Assessment has been applied to the proposed development to assess significant residual adverse impacts. Details on how the Framework for Biodiversity Assessment has been applied to offset significant residual adverse impacts are provided in the BOS prepared by Conacher Consulting (2019).

Under the FBA this species is designated as a species credit entity. This species was not observed during surveys. Under the FBA a biodiversity offset is not required for species credit entities where surveys have determined the species to not be present.

Under the Current Biodiversity Offsets Scheme under the *Biodiversity Conservation Act* this species has been designated as a dual credit entity with potential foraging habitats assessed and offset with ecosystem credits. The proposed impacts to suitable habitat for this species will be offset with ecosystem credits established under the *Biodiversity Conservation Act*.

h. ***Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.***

The credit profiles required to offset the impacts of the proposed development are provided in Section 6 of this Report. Mapping and description of the extent and condition of the relevant habitat occurring on proposed offset sites is provided in the BOS (Conacher Consulting 2021).

i. ***Consideration of significant residual impact not addressed in the FBA required to be addressed under the EPBC Act Environmental Offset Policy.***

There are no significant residual impacts to this species which will not be addressed in accordance with the FBA.

Conclusion
This species was not observed during surveys and it is considered that the Revised Project is not likely to have a significant impact on this species.

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iv. SWIFT PARROT (*Lathamus discolor*)

a. *Habitat description*

The National Recovery Plan for the Swift Parrot (Commonwealhth of Australia 2019) identifies that the Swift Parrot breeds in Tasmania during the austral summer and the entire population migrates north to mainland Australia for the austral winter. The Swift Parrot disperses widely across Victoria and New South Wales in the dry forests and woodlands of the box-ironbark region on the inland western slopes of the Great Dividing Range and coastal forests particularly in times of drought. Their non-breeding range extends as far north as south-eastern Queensland and as far west as south-eastern Australia in areas of suitable habitat (Commonwealth of Australia 2019).

Two key tree species for the Swift Parrot identified by (Commonwealth of Australia 2019) are present within the subject site, these are *Corymbia maculata* and *Eucalyptus tereticornis*. *Eucalyptus glaucina* is also present, with some potential hybridisation between this species and *Eucalyptus tereticornis.*

The Swift Parrot has not been observed within the subject site during targeted surveys completed in accordance with the requirements of the FBA (OEH 2014a) and NSW DEC (2004) requirements.

and the Draft National Recovery Plan for this species (Commonwealth of Australia 2019) identifies that habitat critical for the survival of the Swift Parrot includes; any nesting sites or foraging areas where the species is known or likely to occur as mapped in Figure 1 of the Draft Recovery Plan and any newly discovered breeding or important foraging areas .

Saunders and Tzaros (2011) have listed the following habitats of particular importance for conservation management for Swift Parrots:
• Those used for nesting,
• Those used by large proportions of the Swift Parrot population,
• Those used repeatedly between seasons (site fidelity), or
• Those used for prolonged periods of time (site persistence).

Suitable foraging habitat is present within the site for this species within the following plant community types mapped in Figure 3.2:

- White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley
- Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
- Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast
- Whalebone Tree – Red Kamala dry subtropical rainforest of the lower Hunter River (where suitable emergent eucalypts are present).

This species has not been observed within the subject site during targeted surveys completed in accordance with the requirements of the FBA (OEH 2014a) and NSW DEC (2004) requirements.

The Project Area is located within an area where this species is known or likely to occur in Figure 1 of the Draft Recovery Plan (Commonwealth of Australia 2019). The site has not been observed to provide habitat for nesting, habitat used by large proportions of the population, habitat used repeatedly between seasons or habitat used for prolonged periods of time.

b. *Important populations and habitat critical for survival*

The remaining individuals of the national population are considered to be an important population, in accordance with the criteria provided by DoE (2013). This species does not breed on mainland Australia and no Swift Parrots have been observed within the subject site during surveys.

c. Details of surveys undertaken

Details on the surveys completed for this species are provided in Section 4 of this Report.

d. Consistency with published Australian Government guidelines and policy statements

Under the FBA this species is classified as an ecosystem credit entity and is predicted to occur. Targeted surveys are not required under the FBA.

The Survey Guidelines for Australia's Threatened Birds (DEWHA 2010a) identify survey effort requirements of 20 hours of area searches over 8 days and 20 hours of targeted searches over

8 days. These requirements were exceeded during the completion of surveys undertaken for bird species, dates of diurnal fauna surveys are listed in Appendix 3. This species was not observed during surveys.

e. Description of impacts with regard to the national extent of the species range

The Draft National Recovery Plan for the Swift Parrot (Commonwealth of Australia 2019) identifies that it breeds in Tasmania disperses widely across Victoria and New South Wales in the dry forests and woodlands of the box-ironbark region on the inland western slopes of the Great Dividing Range and coastal forests particularly in times of drought. Their non-breeding range extends as far north as south-eastern Queensland and as far west as south-eastern Australia in areas of suitable habitat (Commonwealth of Australia 2019).

Threats to the Swift Parrot across its national range include habitat loss, fragmentation and degradation, small population size, nest site predation and competition for food resources. DoEE (2016) have identified that in Tasmania, loss of primary breeding habitat and predation by the introduced Sugar Glider (*Petaurus breviceps*) is a severe threat.

Predation has been identified as the main cause of breeding failure for the Swift Parrot, and in most instances the adult female and the egg are killed. For example, a study by Stojanovic *et al*., (2014), identified annual predation mortality of 42.6 % for breeding adult females across Tasmania.

The subject site does not contain potential breeding habitat for this species, however does provide potential winter foraging resources across the following vegetation types:

- White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley
- Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
- Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast
- Whalebone Tree – Red Kamala dry subtropical rainforest of the lower Hunter River (where suitable emergent eucalypts are present).

The proposal will result in the direct removal of approximately 21.13 hectares of suitable foraging habitat for this species, however this species was not observed during surveys.

f. *Identification of significant residual adverse impacts after avoidance and mitigation measures have been taken into account*

The proposal will result in the direct removal of approximately 21.13 hectares of suitable habitat for this species, however this species was not observed during surveys and it is considered that the Revised Project is not likely to have a significant impact on this species.

g. *Details of how the Framework for Biodiversity Assessment has been applied in accordance with the objects of the EPBC act to offset significant residual adverse impacts*

The objects of the *EPBC Act* will be achieved through the implementation of the Bilateral Agreement made under Section 45 of the Act relating to environmental assessment between the Commonwealth of Australia and The State of New South Wales. The Framework for Biodiversity Assessment is the current accredited assessment process.

This Report provides details of how the Framework for Biodiversity Assessment has been applied to the proposed development to assess significant residual adverse impacts. Details on how the Framework for Biodiversity Assessment has been applied to offset significant residual adverse impacts are provided in the BOS prepared by Conacher Consulting (2021).

Under the Framework for Biodiversity Assessment this species is designated as an ecosystem credit entity as is predicted to occur. Under the FBA this species will be offset with ecosystem credits.

h. ***Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.***

The credit profiles required to offset the impacts of the proposed development are provided in Section 6 of this Report. Mapping and description of the extent and condition of the relevant habitat occurring on proposed offset sites is provided in the BOS (Conacher Consulting 2021).

i. ***Consideration of significant residual impact not addressed in the FBA required to be addressed under the EPBC Act Environmental Offset Policy.***

There are no significant residual impacts likely to occur to this species which will not be addressed in accordance with the FBA.

Conclusion
This species was not observed during surveys and it is considered that the Revised Project is not likely to have a significant impact on this species.

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v. SPOTTED-TAILED QUOLL (*Dasyurus maculatus maculatus*)

a. *Habitat description*

The National Recovery Plan for the Spotted-tailed Quoll (Victorian Department of Environment, Land, Water and Planning 2016) identifies that this species is forest-dependant and occupies a wide range of habitat types with the highest densities recorded from wet and dry forest habitats. Home ranges are several hundred to several thousand hectares is size. A variety of structures are used for den sites including rock crevices, hollow trees and logs, windrows, vegetation clumps, caves and boulder tumbles, under buildings and underground burrows including self-dug burros and those of other species such as wombats and rabbits.

It is considered that all of the plant community types present within the site provide suitable foraging habitat for this species. Suitable den habitats are also present including rock piles in riparian areas, hollow logs and hollow trees and vegetation clumps.

b. *Important populations and habitat critical for survival*

VDELWP (2016) have identified that it is not possible to define or map habitat critical to the survival of the Spotted-tailed Quoll, however have identified that all habitats within this species current distribution that are known to be occupies are considered important.

Under the FBA this species is classified as an ecosystem credit entity and is predicted to occur. It is therefore likely that the site contains important habitat for this species.

c. Details of surveys undertaken

Under the FBA this species is classified as an ecosystem credit entity and is predicted to occur. Targeted surveys are not required under the FBA.

d. Consistency with published Australian Government guidelines and policy statements

Under the FBA this species is classified as an ecosystem credit entity and is predicted to occur. Targeted surveys are not required under the FBA. Completion of additional surveys in accordance with the published Australian Government guidelines is not required.

This species was not detected during surveys for other target species utilising suitable survey techniques including spotlighting, diurnal habitat searches, remote camera surveys and hair tube surveys

e. Description of impacts with regard to the national extent of the species range

This species is widely distributed from north-eastern Queensland to Tasmania. VDELWP (2016) have identified that the abundance and distribution of the Spotted-tailed Quoll has declined throughout its total range with many populations not isolated and fragmented with reduction in range estimated to be as high as 50%.

Threats across this species range include habitat loss and modification, fragmentation, timber harvesting, poison baiting, competition and predation from introduced species, deliberate killing, road mortality, bushfire and prescription burning, poisoning by cane toads and climate change (VDELWP 2016).

The subject site contains suitable foraging and breeding habitat for this species within all vegetation types mapped in Figure 3.2 including:

- White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley
- Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
- Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast
- Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter

The proposal will result in the direct removal of approximately 21.13 hectares of suitable foraging habitat for this species.

f. *Identification of significant residual adverse impacts after avoidance and mitigation measures have been taken into account*

The proposal will result in the direct removal of approximately 21.13 hectares of suitable habitat for this species, however this species was not observed during surveys and it is considered that the Revised Project is not likely to have a significant impact on this species.

g. *Details of how the Framework for Biodiversity Assessment has been applied in accordance with the objects of the EPBC act to offset significant residual adverse impacts*

The objects of the *EPBC Act* will be achieved through the implementation of the Bilateral Agreement made under Section 45 of the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) relating to environmental assessment between the

Commonwealth of Australia and The State of New South Wales. The Framework for Biodiversity Assessment is the current accredited assessment process.

This Report provides details of how the Framework for Biodiversity Assessment has been applied to the proposed development to assess significant residual adverse impacts. Details on how the Framework for Biodiversity Assessment has been applied to offset significant residual adverse impacts are provided in the BOS prepared by Conacher Consulting (2021).

Under the Framework for Biodiversity Assessment this species is designated as an ecosystem credit entity and is predicted to occur. Under the FBA this species will be offset with ecosystem credits.

h. ***Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.***

The credit profiles required to offset the impacts of the proposed development are provided in Section 6 of this Report. Mapping and description of the extent and condition of the relevant habitat occurring on proposed offset sites is provided in the BOS (Conacher Consulting 2021).

i. ***Consideration of significant residual impact not addressed in the FBA required to be addressed under the EPBC Act Environmental Offset Policy.***

There are no significant residual impacts likely to occur to this species which will not be addressed in accordance with the FBA.

Conclusion
This species was not observed during surveys and it is considered that the Revised Project is not likely to have a significant impact on this species.

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vi. GREY-HEADED FLYING-FOX (*Pteropus poliocephalus*)

a. *Habitat description*

The Draft National Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) identifies that this species occupies forests and woodlands of south eastern Australia from Bundaberg to Geelong with recent expansions of its range into Adelaide, the Australian Capital Territory and inland areas of central and southern New South Wales and Victoria.

All of the plant community types present within the site provide suitable foraging habitat for this species.

High densities of blossom food plants, particularly eucalypts are present within the following plant community types:

- White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley
- Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter
- Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast

Fruit food plants occur and are more prevalent in the Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter plant community types.

No camp sites have been recorded within the site. The nearest camp site is seasonally occupied and is located at Tocal approximately 7.8 km to the south-west of the proposed disturbance area. Other camps are mapped west of Paterson (no details of occupancy available) and west of the site at Glen William (>15km west of the site).

b. *Important populations and habitat critical for survival*

The Grey-headed Flying-fox is considered to be a single, mobile population as identified in the Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017), this population is an important population.

The Draft Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) identifies that '*All foraging habitat has the potential to be productive during general food shortages and therefore provide a critical resource*'.

The subject site does not contain any maternity roost or camp sites for this species.

c. Details of surveys undertaken

Under the FBA this species is classified as a dual credit species with foraging habitat offset with ecosystem credits and breeding habitat assessed by species credits. This species has been observed foraging within the site during surveys, however no roost or camp sites are present.

d. Consistency with published Australian Government guidelines and policy statements

The Survey Guidelines for Australia's threatened bats (DEWHA 2010b) identifies that "*Consultants should demonstrate that they have sought information about the location of historic camps from the appropriate authoritative sources as outlined above. It should also be demonstrated that a comprehensive vegetation survey has been completed for the survey area, and a clear assessment of the contribution of the project area in terms of food plants, especially in relation to the broader region, is provided*".

Information on camp locations has been obtained from the National Flying-fox Monitoring Viewer (DAWE 2021d).

A comprehensive flora survey has been completed for the site and the species observed are listed in Appendix 5.

Under the FBA this species is classified as a dual credit species with foraging habitat offset with ecosystem credits and breeding habitat assessed by species credits. This species has been observed foraging within the site during surveys, although no roost or camp sites were present during surveys.

e. Description of impacts with regard to the national extent of the species range

The Australian Government (DoEE 2017) has identified that across the national extent of this species range the threats faced include:

- Loss of foraging habitat, particularly winter and spring foraging resources
- Loss of roosting habitat and camp disturbance
- Mortality in commercial fruit crops
- Heat stress
- Entanglement in backyard netting
- Electrocution on powerlines

- Climate change
- Disease

The proposal will result in the removal of 21.13 hectares of suitable foraging habitat for this species. All vegetation types present within the site have the potential to provide winter and/or spring foraging habitat for this species.

f. *Identification of significant residual adverse impacts after avoidance and mitigation measures have been taken into account*

The revised proposal will result in the removal of 21.13 hectares of suitable habitat for this species and the avoidance of impacts to approximately 15.82 ha of suitable habitat for this species.

g. *Details of how the Framework for Biodiversity Assessment has been applied in accordance with the objects of the EPBC act to offset significant residual adverse impacts*

The objects of the *EPBC Act* will be achieved through the implementation of the Bilateral Agreement made under Section 45 of the Act relating to environmental assessment between the Commonwealth of Australia and The State of New South Wales. The Framework for Biodiversity Assessment is the current accredited assessment process.

This Report provides details of how the Framework for Biodiversity Assessment has been applied to the proposed development to assess significant residual adverse impacts. Details on how the Framework for Biodiversity Assessment has been applied to offset significant residual adverse impacts are provided in the BOS prepared by *Conacher Consulting* (2021).

Under the Framework for Biodiversity Assessment foraging habitats for this species are designated as an ecosystem credit entity and are predicted to occur. Under the FBA foraging habitat for this species will be offset with ecosystem credits.

h. *Details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the development in accordance with the FBA and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.*

The credit profiles required to offset the impacts of the proposed development are provided in Section 6 of this Report. Mapping and description of the extent and condition of the relevant habitat occurring on proposed offset sites is provided in the BOS (*Conacher Consulting 2021*).

i. *Consideration of significant residual impact not addressed in the FBA required to be addressed under the EPBC Act Environmental Offset Policy.*

There are no significant residual impacts likely to occur to this species which will not be addressed in accordance with the FBA.

Conclusion
It is considered that the Revised Project is not likely to have a significant impact on this species.

SECTION 9

CONCLUSIONS

9.1. SUMMARY OF BIODIVERSITY SURVEY FINDINGS

Based on the surveys and assessments documented within this Report it is concluded that:

i. The following species credit threatened species were observed during surveys and will be impacted and offset with species credits:

- Slaty Red Gum (*Eucalyptus glaucina*) (40,418 credits);
- Brush-tailed Phascogale (*Phascogale tapoatafa*) (423 credits)
- Koala (*Phascolarctos cinereus*) (549 credits) ; and
- Southern Myotis (*Myotis macropus*) (304 credits) .

ii. The following ecosystem credit threatened species were observed during surveys:

- Little Lorikeet (*Glossopsitta pusilla*);
- Speckled Warbler (*Pyrrholaemus sagittatus*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Powerful Owl (*Ninox strenua*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Grey-headed Flying-fox (*Pteropus poliocephalus*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*);
- Little Bent-winged Bat foraging habitat (*Miniopterus australis*);
- Large Bent-winged Bat foraging habitat (*Miniopterus orianae oceanensis*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

These species will be offset with the ecosystem credits identified for each plant community type.

iii. The vulnerable ecological community Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions will be impacted by the proposed development. This ecological community will be offset with the ecosystem credits for PCT HU 755.

iv. The following plant community types will be impacted and offset with ecosystem credits:

- HU 619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast (830 credits)
- HU 755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter (166 credits)
- HU 798 White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley (249 credits)
- HU 816 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter (166 credits)

9.2 ASSESSMENT CONCLUSIONS

i. This Report complies with the information requirements identified in Table 20 of the FBA, as documented in Appendix 8;

ii. The Impact avoidance and mitigation measures outlined in Section 5 of this Report should be implemented for the Project;

iii. The Biodiversity Offset Credits required for the proposal are further documented in Section 7 of this Report.

The biodiversity offsets for the Project will be delivered in consultation with DPIE, BCD and the Biodiversity Conservation Trust (BCT). A formal credit equivalency assessment will be undertaken once the Project is approved, which will require an application to have the FBA credit requirement converted to BAM credits through an Assessment of Reasonable Equivalence. A comprehensive Biodiversity Offset Strategy (BOS) for the Project has been under development for several years as the Project was subject to environmental assessment. The work completed to date for the offset strategy has included desktop assessment, extensive field surveys (including targeted surveys and FBA Biometric plots) across five potential sites, application of the FBA Credit Calculator using FBA Biometric plots, GIS analysis of native vegetation extent and habitat connectivity (as per the FBA), GIS mapping and reporting. The five potential offset sites occur directly adjacent to the Project Area and were found to support suitable PCTs and threatened species habitat required for the Project.

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APPENDIX 1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q12		Q13		Q14		U2	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Canopy Stratum																										
Moraceae	*Ficus rubiginosa*	Rusty Fig					X	X							X	X	5	2								
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	3	2			111	60					3	3	55	23	70	34	3	2			8	9		
Myrtaceae	*Corymbia maculata*	Spotted Gum	20	14	5	1					2	1	5	2	10	2			11	6	27	21	17	8	20	6
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany					4	1							3	1			28	16	2	1	5	2		
Myrtaceae	*Eucalyptus canaliculata*	Grey Gum											15	3												
Myrtaceae	*Eucalyptus carnea*	Thick-leaved Mahogany									X	X														
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	10	7	9	9			26	22	X	X	X	X							18	10	20	12	10	4
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	6	3																						
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum			18	20			11	11	20	6														
Myrtaceae	*Eucalyptus globoidea*	White Stringybark	20	9	15	14							X	X							3	1	10	5		
Myrtaceae	*Eucalyptus moluccana*	Grey Box									2	1									X	X			10	2
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark					10	2					25	13	10	2			4	1						
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark									15	7	10	8												
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum																							2	3
Rubiaceae	*Hodgkinsonia ovatiflora*						5	1							4	1	45	11								
Sub-Canopy Stratum																										
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak											X	X									2	2		
Fabaceae (Mimosoideae)	*Acacia binervata*	Two-veined Hickory							14	17																
Moraceae	*Streblus brunonianus*	Whalebone Tree					X	X					<1	1	15	23	5	7								
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree													X	X					2	1				
Rhamnaceae	*Alphitonia excelsa*	Red Ash									1	1											6	6		
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart																					2	1		
Shrub Stratum																										
Araliaceae	*Polyscias sambucifolia* subsp. *Long leaflets*																		<1	1						
Asteraceae	*Cassinia quinquefaria*								<1	1																
Asteraceae	*Ozothamnus diosmifolius*	Rice Flower																			<1	1				
Cactaceae	*Opuntia stricta**	Common Prickly Pear																							0.1	3
Capparaceae	*Capparis arborea*	Native Pomegranate															<1	1								
Celastraceae	*Denhamia silvestris*	Narrow-leaved Orangebark			<1	1					<1	1	4	20	X	X			1	3	<1	2	<1	2		
Celastraceae	*Elaeodendron australe* var. *australe*	Red Olive Plum													1	3							1	1		
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower																	1	5						
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower	<1	1					<1	2	<1	1							1	10	<1	7	<1	5		
Ebenaceae	*Diospyros australis*	Black Plum															3	4								
Ericaceae (Styphelioideae)	*Leucopogon juniperinus*	Prickly Beard-heath	3	10	2	10	X	X	2	10	<1	3	<1	4							<1	3	1	3		
Euphorbiaceae	*Alchornea ilicifolia*	Dovewood					3	5							1	4	1	3								
Euphorbiaceae	*Claoxylon australe*	Brittlewood					X	X									<1	1								
Euphorbiaceae	*Croton verreauxii*	Green Native Cascarilla					X	X							<1	1	2	3								
Fabaceae (Faboideae)	*Bossiaea obcordata*	Spiny Bossiaea																					<1	2		

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FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q12		Q13		Q14		U2	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Fabaceae (Faboideae)	*Chorizema parviflorum*	Eastern Flame Pea																					<1	1		
Fabaceae (Faboideae)	*Daviesia genistifolia*	Broom Bitter Pea																			X	X				
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea																							0.01	1
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo											X	X												
Fabaceae (Faboideae)	*Jacksonia scoparia*	Winged Broom-pea	1	2																						
Fabaceae (Faboideae)	*Podolobium ilicifolium*	Prickly Shaggy Pea																					2	4		
Fabaceae (Mimosoideae)	*Acacia falcata*	Hickory Wattle	1	2	5	10					2	3											<1	1	3	10
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle							4	7	5	6	1	2					<1	2	9	116	<1	1		
Fabaceae (Mimosoideae)	*Acacia saligna**	Golden Wreath Wattle																								
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses	<1	3	1	5			1	4											<1	2	1	2		
Flacourtiaceae	*Scolopia braunii*	Flintwood													1	2										
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum					3	2											<1	2						
Malvaceae	*Brachychiton populneus*	Kurrajong																					<1	1		
Malvaceae	*Hibiscus heterophyllus*	Native Rosella					X	X									1	3								
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea					X	X									1	3								
Moraceae	*Ficus coronata*	Sandpaper Fig															X	X								
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn																			<1	1				
Myoporaceae	*Eremophila debilis*	amulla																							0.8	10
Myrsinaceae	*Myrsine variabilis*												<1	2	<1	1										
Myrtaceae	*Leptospermum polygalifolium*	Tantoon					X	X																		
Myrtaceae	*Sannantha crassa*		2	5	35	200			1	3	1	2	X	X												
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant													<1	1										
Oleaceae	*Jasminum volubile*	Stiff Jasmine			<1	1	5	10			10	6	5	50	3	5	1	10	2	10	<1	3	2	10		
Oleaceae	*Notelaea longifolia*	Large Mock-olive	<1	2	2	5	2	3	1	3			6	20	<1	2	10	20	6	10			8	20		
Oleaceae	*Olea europaea* subsp. *cuspidata**	African Olive					<1	2	3	2	3	3							<1	1						
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	<1	1	1	5	3	5	5	20	2	5	5	20	2	5	<1	3	1	3	5	10			7	20
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree									6	4														
Phyllanthaceae	*Phyllanthus gunnii*	Scrubby Spurge											X	X												
Phyllanthaceae	*Phyllanthus hirtellus*	Thyme Spurge	1	20	<1	20																	1	50		
Pittosporaceae	*Bursaria spinosa*	Blackthorn	3	10	10	20																	1	3		
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn											2	20	<1	5										
Pittosporaceae	*Pittosporum revolutum*	Wild Yellow Jasmine					X	X	<1	1	5	20	1	5	<1	2			1	5	1	2	1	3		
Pittosporaceae	*Pittosporum undulatum*	Native Daphne							1	1	10	5	2	5	2	5	2	5	10	5	10	8				
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	1	2					3	5									<1	1	1	1	1	2	0.8	1
Putranjivaceae	*Drypetes deplanchei*	Yellow Tulipwood															15	30								
Rutaceae	*Boronia polygalifolia*	Dwarf Boronia	<1	1																						
Rutaceae	*Correa reflexa*	Common Correa																	<1	1						
Rutaceae	*Zieria smithii*	Sandfly Zieria											X	X									4	10		
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart	<1	1					1	1	2	2														
Sapindaceae	*Diploglottis australis*	Native Tamarind											5	20												

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FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q12		Q13		Q14		U2	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush											X	X												
Sapindaceae	*Dodonaea viscosa* subsp. *angustifolia*	Sticky Hop-bush	<1	4																						
Sapindaceae	*Dodonaea viscosa* subsp. *cuneata*	Wedge-leaf Hop-bush	<1	1																						
Ulmaceae	*Trema tomentosa*	Native Peach					X	X																		
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree															1	1								
Verbenaceae	*Lantana camara**	Lantana	20	50	10	20	15	20	15	20			5	10	3	10	5	10	10	10	15	20	5	5	10	10
Ground Stratum (Ferns and Allies)																										
Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern													<1	2										
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern											3	200	3	50	2									
Blechnaceae	*Doodia caudata*	Small Rasp Fern													5	100	5	100								
Lindsaeaceae	*Lindsaea microphylla*	Lacy Wedge Fern															<1	10								
Polypodiaceae	*Dictymia brownii*	Strap Fern													1	20										
Pteridaceae	*Adiantum aethiopicum*	Common Maidenhair					5	50					5	200	15	500	10	200					1	10		
Pteridaceae	*Adiantum hispidulum*	Rough Maidenhair Fern					5	50					<1	1	5	100	5	100	2	100						
Pteridaceae	*Cheilanthes distans*	Bristly Cloak Fern																			<1	5				
Pteridaceae	*Cheilanthes sieberi*		2	50	1	50			2	50	1	50							1	50	1	50	1	100		
Pteridaceae	*Pellaea paradoxa*						5	100							5	200	3	50	1	20						
Ground Stratum - Dicots (Herbs)																										
Acanthaceae	*Brunoniella australis*	Blue Trumpet	1	20					1	50	1	50	3	100	<1	2			1	50			<1	20		
Acanthaceae	*Brunoniella pumilio*	Dwarf Brunoniella																					<1	1		
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower					2	20							1	20	1	20					<1	5		
Apiaceae	*Centella asiatica*	Indian Pennywort									<1	20														
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery									<1	20														
Asteraceae	*Bidens pilosa**	Cobblers Pegs					<1	3	<1	10	<1	20							<1	5	<1	10			0.04	20
Asteraceae	*Euchiton sphaericus*										X	X														
Asteraceae	*Hypochaeris microcephala**	White Flatweed									<1	3														
Asteraceae	*Hypochaeris radicata**	Flatweed							<1	1																
Asteraceae	*Lagenophora stipitata*	Blue Bottle-daisy			<1	7																				
Asteraceae	*Senecio madagascariensis**	Fireweed									1	20														
Asteraceae	*Solenogyne bellioides*										<1	3														
Asteraceae	*Sonchus oleraceus**	Common Sowthistle																			<1	1				
Asteraceae	*Vernonia cinerea*								<1	1									<1	5						
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell																			<1	2				
Campanulaceae	*Wahlenbergia stricta*	Tall Bluebell																							0.01	1
Caryophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed									<1	10														
Clusiaceae	*Hypericum gramineum*	Small St. John's Wort																			X	X				
Clusiaceae	*Hypericum japonicum*										<1	10														
Convolvulaceae	*Dichondra repens*	Kidney Weed							1	50			3	200					1	200	1	100			0.01	20
Droseraceae	*Drosera peltata*										X	X														
Fabaceae (Faboideae)	*Swainsona galegifolia*	Smooth Darling-pea											<1	1												
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower					<1	2							<1	2	<1	5			<1	1				

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q12		Q13		Q14		U2	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Lamiaceae	*Scutellaria humilis*	Dwarf Skullcap																			<1	4				
Lobeliaceae	*Pratia purpurascens*	Whiteroot	3	500	2	200			2	200	3	500	5	500					3	200	1	100	1	200		
Myrsinaceae	*Anagallis arvensis**	Scarlet Pimpernel																			<1	5				
Oxalidaceae	*Oxalis perennans*				2	100	X	X	<1	3	<1	10					<1	1	<1	1						
Peperomiaceae	*Peperomia blanda* var. *floribunda*																<1	20								
Phyllanthaceae	*Poranthera microphylla*				<1	1					<1	2											<1	5		
Plantaginaceae	*Plantago debilis*																				X	X				
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues									1	20									<1	3			0.01	5
Rubiaceae	*Galium gaudichaudii*	Rough Bedstraw																	<1	2						
Rubiaceae	*Galium leiocarpum*						<1	1																		
Rubiaceae	*Opercularia diphylla*		<1	5	<1	10			<1	4	<1	10														
Rubiaceae	*Pomax umbellata*		<1	10	<1	1																	<1	10	0.01	3
Solanaceae	*Solanum prinophyllum*	Forest Nightshade					X	X	<1	2							<1	1					<1	1		
Solanaceae	*Solanum stelligerum*	Devil's Needles					X	X					1	10	<1	1							<1	1		
Verbenaceae	*Verbena bonariensis**	Purpletop																							1	20
Verbenaceae	*Verbena rigida**	Veined Verbena																			1	20				
Violaceae	*Viola hederacea*						X	X																		
Ground Stratum – Monocots (Grasses)																										
Poaceae	*Andropogon virginicus**	Whisky Grass																							2	20
Poaceae	*Aristida ramosa*	Purple Wiregrass																			5	50			5	100
Poaceae	*Aristida vagans*	Threeawn Speargrass	5	50	5	200			5	200			X	X							1	10	3	50		
Poaceae	*Bothriochloa decipiens*	Red Grass																			<1	10				
Poaceae	*Capillipedium parviflorum*	Scented-top Grass									1	10														
Poaceae	*Chloris gayana* *	Rhodes Grass																							0.05	5
Poaceae	*Chloris truncata*	Windmill Grass																							0.01	5
Poaceae	*Chloris ventricosa*	Plump Windmill Grass																			<1	10				
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	5	50	10	200			10	500	15	1000	1	5					5	20	2	20	1	20		
Poaceae	*Digitaria diffusa*	Open Summer-grass																			<1	10				
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass	<1	2	1	10													<1	10			<1	1		
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass	1	20	<1	5			<1	5	<1	10														
Poaceae	*Ehrharta erecta**	Panic Veldtgrass																							5	100
Poaceae	*Entolasia stricta*		5	100															<1	10	1	10	<1	10	5	100
Poaceae	*Entolasia marginata*	Bordered Panic			3	50	X	X							X	X	1	10	<1	2	<1	2				
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	2	20					3	50											1	20	<1	3		
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass							<1	10	10	500							<1	10	<1	3	<1	2		
Poaceae	*Imperata cylindrica*	Blady Grass											15	2000					5	500	5	200	2	500		
Poaceae	*Microlaena stipoides*	Weeping Grass	15	1000	10	500	3	50	5	500	5	500	5	2000							2	50	5	500	10	100
Poaceae	*Oplismenus aemulus*	Australian Basket Grass							<1	20	1	20	2	50					<1	10	1	20				
Poaceae	*Oplismenus imbecillis*	Creeping Beard Grass			1	20	5	500					10	2000	3	50	5	200	1	50						
Poaceae	*Panicum effusum*	Hairy Panic			5	200			5	200	2	20									4	50	<1	3		
Poaceae	*Panicum simile*	Two Colour Panic			<1	5							1	10					<1	2						

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q12		Q13		Q14		U2	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Poaceae	*Paspalidium distans*								1	50											3	100			0.8	20
Poaceae	*Poa labillardierei* var. *labillardierei*	Tussock											1	10												
Poaceae	*Sporobolus creber*	Western Rat-tail Grass																			<1	1				
Poaceae	*Themeda triandra*	Kangaroo Grass	30	500	10	200			35	1000	50	2000									5	50				
Ground Stratum - Monocots (Other)																										
Anthericaceae	*Arthropodium minus*														<1	5										
Anthericaceae	*Arthropodium* sp. B sensu Harden (1993)		<1	5			<1	3					<1	10					<1	10						
Araceae	*Gymnostachys anceps*	Settlers' Twine											5	20	X	X	1	3								
Commelinaceae	*Aneilema acuminatum*								X	X					<1	2	<1	4								
Cyperaceae	*Carex inversa*																				<1	3				
Cyperaceae	*Cyperus enervis*						X	X							X	X	2	20								
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge							3	10	3	10	2	2					<1	1	2	5				
Cyperaceae	*Lepidosperma gunnii*		1	5	20	50	3	5	5	20																
Cyperaceae	*Lepidosperma laterale*	Sword-sedge	3	10	5	50							3	10					<1	5			<1	5		
Cyperaceae	*Scleria mackaviensis*				<1	20	1	50																		
Orchidaceae	*Acianthus fornicatus*	Pixie Caps	<1	20	<1	20																				
Orchidaceae	*Caladenia catenata*	White Fingers	<1	20	<1	5			<1	3	<1	20	X	X												
Orchidaceae	*Pterostylis pedunculata*	Maroonhood					1	50																		
Lomandraceae	*Lomandra confertifolia*	Mat-rush									1	10	5	20					45	500	40	200	55	1000		
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush			1	20			<1	20	<1	20														
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	1	5	3	10							10	20												
Lomandraceae	*Lomandra multiflora*	Many-flowered Mat-rush	4	20	3	20			3	20	3	50							<1	2	1	5	1	10		
Phormiaceae	*Dianella caerulea* var. *cinerascens*		<1	1					1	10	<1	5	<1	2					<1	3	<1	4	<1	2		
Phormiaceae	*Dianella caerulea* var. *producta*								<1	2			2	10					1	5	2	10	1	5		
Phormiaceae	*Dianella longifolia*	Blueberry Lily													X	X										
Phormiaceae	*Dianella revoluta*	Blue Flax-Lily	1	10					<1	1																
Phormiaceae	*Stypandra glauca*	Nodding Blue Lily	<1	1	<1	2																				
Xanthorrhoeaceae	*Xanthorrhoea latifolia*																		5	10			1	3		
Climbers & Vines																										
Aphanopetalaceae	*Aphanopetalum resinosum*	Gum Vine					<1	2																		
Apocynaceae	*Marsdenia flavescens*	Hairy Milk Vine													1	10	1	20								
Apocynaceae	*Marsdenia rostrata*	Milk Vine													<1	2										
Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia					X	X									<1	2								
Apocynaceae	*Parsonsia straminea*	Common Silkpod					X	X	<1	3			2	20			2	5	<1	1						
Apocynaceae	*Parsonsia velutina*																<1	1								
Asparagaceae	*Asparagus asparagoides**	Bridal Creeper			<1	1					<1	1														
Asparagaceae	*Asparagus officinalis**	Asparagus																							5	100
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	1	5	<1	3	X	X			<1	2	5	20	<1	3	1	3	<1	3	<1	4	<1	5		
Dioscoreaceae	*Dioscorea transversa*	Native Yam					3	200							5	200	5	50								
Fabaceae (Faboideae)	*Austrosteenisia blackii* var. *blackii*	Blood Vine													5	2	5	5								
Fabaceae (Faboideae)	*Desmodium gunnii*		1	50					<1	5			2	50					2	100	1	50	<1	20		
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*		1	10	<1	2			1	10									<1	3	1	10	<1	20		

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q12		Q13		Q14		U2	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Fabaceae (Faboideae)	*Desmodium varians*	Tick Trefoil							<1	10									<1	2	<1	10				
Fabaceae (Faboideae)	*Glycine clandestina*	Love Creeper																			X	X				
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine	<1	20	<1	3					<1	20							1	20	<1	10				
Fabaceae (Faboideae)	*Glycine tabacina*		<1	3					<1	20											<1	10				
Loranthaceae	*Amyema miquelii*										X	X														
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	1	20	<1	2	<1	1	<1	2			3	20	1	10			<1	5			<1	5		
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	<1	2	<1	5	<1	5	<1	3	<1	3	2	20					1	20	<1	5	1	20		
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry							<1	1									<1	5	<1	3	<1	3		
Ranunculaceae	*Clematis aristata*	Old Man's Beard											<1	1							<1	1			0.8	20
Rosaceae	*Rubus moluccanus*	Molucca Bramble																			<1	2				
Rosaceae	*Rubus parvifolius*	Native Raspberry											<1	2												
Rubiaceae	*Morinda jasminoides*	Sweet Morinda															<1	1								
Vitaceae	*Cayratia clematidea*	Native Grape					<1	10											<1	5						
Vitaceae	*Cissus antarctica*	Kangaroo Vine											3	5	<1	2	1	2								
Vitaceae	*Clematicissus opaca*	Pepper Vine			<1	10	1	20					1	10	<1	1	X	X	1	20			<1	10		
Vitaceae	*Tetrastigma nitens*						<1	1							5	20	5	20								

X = observed adjacent to plot

APPENDIX 2
PLOT AND TRANSECT FIELD DATA SHEETS

DEVELOPMENT SITE 1 of 3

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Hunter/Central Rivers	Upper Hunter	J. Manuwai	9-20/8/15

Proposal ID	Proposal name	Zone ID
132/2016/244/1	Martins Creek Quarry Expansion.	1

Vegetation formation wet sclerophyll forest (grassy)

Vegetation class

Vegetation type White Mahogany - Spotted Gum - Grey Myrtle Semi-moist shrubby open forest of the Central Lower Hunter

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
mod/good		✓

Coordinates (GPS datum GDA94:_____)

Transect / plot number	6	9	10	12	14	6	7	8	9	10
Easting	378821	378089	377113	378860	378551					
Northing	6397451	6397491	6397561	6397682	6397714					
Zone AMG	56	56	56	56	56.					

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	45.5	42.5	46	42.5	37.4					
Native mid-storey cover (%)	14	4	7.5	24.5	3.2					
Native ground cover (grasses) (%)	40	40	18	16	26					
Native ground cover (shrubs) (%)	20	0	0	2	10					
Native ground cover (other) (%)	66	68	42	50	68					
Exotic plant cover	1	5	8.25	1.2	1.4					

Larger sampling area

Native plant species richness [1]	49	48	69	54	57					
Number of trees with hollows [2]	1	1	0	0	3					
Over-storey regeneration [3]	100	100	100	100	100					
Total length of fallen logs (m) [2]	25	42	49	54	57					

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Upper Hunter / Central Rivers	Upper Hunter	J. Mowbray	18-20/8/15

Proposal ID	Proposal name	Zone ID
	Martins Creek Quarry Expansion	1

Vegetation formation: wet Sclerophyll Forest (grassy)

Vegetation class:

Vegetation type: White Mahogany-Spotted Gum-Grey Myrtle moist wet shrubby open forest of the Central & Lower Hunter

Condition (low or mod/good)	**Zone descriptor** (optional)	**Geographic/habitat features** (tick after printing step 2 of Credit Calculator)
mod/good		✓

Transect number 6	Number of hits (tally)	%
Native over-storey cover (%)	60, 55, 40, 40, 40, 50, 45, 35, 50	45.5
Native mid-storey cover (%)	20, 40, 30, 20, 5, 5, 5, 5, 5	14
Native ground cover (grasses) (%)	𝍸 𝍸 𝍸 𝍸	40
Native ground cover (shrubs) (%)	𝍸	20
Native ground cover (other) (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	66
Exotic plant cover (%)	mid 0,0,5,5,0,0,0,5,5 ground nil	1

Transect number 9	Number of hits (tally)	%
Native over-storey cover (%)	55, 45, 45, 30, 40, 45, 40, 50, 35, 40	42.5
Native mid-storey cover (%)	5, 5, 5, 5, 5, 5, 5, 0, 5, 0	4
Native ground cover (grasses) (%)	𝍸 𝍸 𝍸 𝍸	40
Native ground cover (shrubs) (%)		0
Native ground cover (other) (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	68
Exotic plant cover (%)	mid 5,5,0,5,5,5,5,5,0 ground 11	5

Transect number 16	Number of hits (tally)	%
Native over-storey cover (%)	45, 45, 55, 50, 55, 60, 45, 40, 45, 20	46
Native mid-storey cover (%)	5, 5, 20, 10, 5, 5, 5, 5, 10, 5	7.5
Native ground cover (grasses) (%)	𝍸	18
Native ground cover (shrub) (%)		0
Native ground cover (other) (%)	𝍸 𝍸 𝍸 𝍸	42
Exotic plant cover (%)	mid 30,30,5,5,5,5,20,30,5,30 ground-nil	8.75

Transect number 12	Number of hits (tally)	%
Native over-storey cover (%)	55, 45, 50, 45, 40, 40, 30, 30, 45, 45	42.5
Native mid-storey cover (%)	10, 15, 40, 60, 25, 10, 5, 10, 20, 50	24.5
Native ground cover grasses (%)	𝍸	16
Native ground cover shrubs (%)	1	2
Native ground cover other (%)	𝍸 𝍸 𝍸 𝍸	50
Exotic plant cover (%)	mid 2,?,0,0,0,0,10,5,0,5 grd. nil	1.2

Transect number 14	Number of hits (tally)	%
Native over-storey cover (%)	30, 40, 45, 4, 45, 45, 45, 40, 40, 40	37.4
Native mid-storey cover (%)	2, 0, 5, 15, 15, 5, 0, 0, 0, 0	3.2
Native ground cover (grasses) (%)	~~||||~~ ~~||||~~ |||	26
Native ground cover (shrubs) (%)	~~||||~~	10
Native ground cover (other) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||||	68
Exotic plant cover (%)	Mid 2, 0, 1, 5, 10, 2, 0, 0, 0, 2 ground - nil	1.1

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Date: 18/8/15 Waypoint: ______ Job #: 15118 Site: Dungog hGA Q: 6

Personnel: JM, B.F Easting: ______ Quadrat size: ☑ 20x20m ☐ 20x50m

Photo ID: ______ Northing: ______ Aspect: S Slope: ______

Community: ______ Soil: ______

Canopy	C	A	Shrubs	C	A	Dicots	C	A	Monocots (Grasses)	C	A
Euc. panic.	25	8	Christ. pani.	2	20	Pratia purp.	5	500	Oplis. imbecill	18	1000
Euc. camal.	15	3	Notelaea long	6	20	Solanum stelligerum	1	10	Imperata cylindr.	15	200
Euc. siderophloia	5	5	Pitto. undul.	2	5	Brunon. aust.	3	100	Micro. stip.	5	1000
Corymb. mac.	4	1	Breynia oblong.	5	20	Swainson galeg.	<1	1	Cymbo refract.	1	5
Euc. creb.			Clerodendrum cuvid.	5	10	Dichondra repens	3	200	Poa sp. ?(s) lab.	1	100
Euc. gib.			Jasminum volub.	5	50				Oplis aem.	2	50
			Maytenus silv.	4	20				Panicum sp. (s) sim.	1	10
			Pitto revol.	1	5				Arist. vag.		
			Diploglottis aust.	5	20						
			Breck. myrt.	3	3						
			~~Notelaea long (s)~~	~~1~~	~~1~~						

Sub-canopy	C	A	Shrubs	C	A
Corymbia mac.	1	1	Streblus brunon.	<1	1
Euc. siderophloia	5	3	Leuco. junip.	<1	4
Euc. panic.	10	5	Myrsine variabil.	<1	2
Allo. tor.			Acacia implex.	<1	2
			Sannanth. cun.		
			Dodonaea triquetra		

Ferns and Allies	C	A
Adiant. aeth.	5	200
Doodia asp.	3	200
Adiantum hisp.	<1	1

Monocots (Other)	C	A
Lomand. long	10	20
Dianella cae. var. prod.	2	10
Lomandra conf.	5	20
Gymnostachys ancep.	5	20
Lepido lat.	3	10
Gahnia asp.	2	2
Arthropodium sp. (s)	<1	10
Dianella ~~revol.~~ (s)	<1	2
Geitonoplesium cym. / Caladenia catenata		

Climbers/Vines	C	A
Eustrephus lat.	3	20
Cissus antarct.	3	5
Parsonsia str.	2	20
Pand. pand.	5	20
Clematicis. opac.	1	10
Desmod. gunn.	2	50
Geiton. cymos.	2	20
Clemat. arist.	<1	1
Rubus parv.	<1	2

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	30-40	10-20	0.4-5	0.1-0.4	Bare (%): —
PFC (%)	40	16	50	60	Litter (%): 25
Weeds (%)	—	—	—	—	Rock (%): 15
					Moss (%): —

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Date: 20/8 Waypoint: Job #: 1518 Site: Q: 12

Personnel: BF Easting: Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: Northing: Aspect: Slope:

Community: Soil:

lots of tallish, thin, regrowth trees.

Canopy	C	A	Shrubs	C	A	Dicots	C	A	Monocots (Grasses)	C	A
Euc. acmen.	20	12	Correa reflex.	<1	1	Pratia purp.	3	200	Imp. cylindr.	5	500
Corymb. macu.	11	6	Hibbert. diff.	1	10	Brunon. austr.	1	50	Oplis. imb.	1	50
Euc. panic.	4	1	Hibbertia asp.	1	5	Galium gaudichaudi sp (5)	<1	2	Cymbo. refr.	5	20
			Pitto undul.	10	5	Oxalis perenn.	<1	1	Oplis. aem.	<1	10
			Polyscias sambuc. "long"	<1	1	Dichond. rep.	1	200	Eragrost. lept.	<1	10
			Jas. volub.	2	10	Vernon. cin.	<1	5	Ento. mary.	<1	2
			Breyn. myrt.	3 <1	1	*Bidens pill.	<1	5	Digit. parv.	<1	10
			Not. long.	6	10				Pan. cum. sim.	<1	2
			Acacia implex.	<1	2				Ento. strict.	<1	10
			~~Not. 'long' ovat (?)~~	~~<1~~	~~1~~						
			Mayten. silv.	1	3						
Sub-canopy	**C**	**A**	Clero. tom.	<1	2						
Back. myrt.	3	1	Pitto rev.	1	5						
Euc. ac.	8	4	*Olea europ. cusp. (seedlings)	<1	1						
			*Lant. cam.	10	10						
			Breynia oblong.	1	3						
			Persoon. lin.	<1	1						

Ferns and Allies	C	A
Adiantum hisp.	2	100
Cheil. sieb.	1	50
Pellaea ~~falc.~~ para.	1	20

Monocots (Other)	C	A
Lomand conf.	10	500
Dianella cae. prod.	1	5
Gahnia asp.	<1	1
Xanth. ~~sp. (5)~~ lati.	5	10
Arthr. sp. B	<1	10
Lomand. mult.	<1	2
Dianella "blue, long"	<1	3
Lepido lat.	<1	5

(margin notes: lati fo; no kerb, broad leaves up to about 1.5m; lati f)

(annotation with arrow to Dianella "blue, long": caerulea var. cinerea)

Climbers/Vines	C	A
Glycine micro.	1	20
Eustreph. lat.	<1	5
Desmod. gunn.	2	100
Clemat. glyc.	1	20
Desmod. varians	<1	2
Geitono. cymos.	1	20
Pand. pand.	<1	3
Billard. scan.	<1	5
Desmod. rhytid.	<1	8
Cayrat. clem.	<1	5

Shrubs (cont.): Parsons. stram. | <1 | 1

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	~~20~~ 17-25	10-17	0.1-6	0.1-0.4	Bare (%): –
PFC (%)	35	11	35	70	Litter (%): 10
Weeds (%)	–	–	30	–	Rock (%): 20
					Moss (%): –

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1-5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Date: 20/8 Waypoint: ____ Job #: 15118 Site: ____ Q: 14

Personnel: B + P Easting: ____ Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: ____ Northing: ____ Aspect: ____ Slope: ____

Community: ____ Soil: ____

Canopy	C	A	Shrubs	C	A	Dicots	C	A	Monocots (Grasses)	C	A
Corymb. mac.	15	4	Jasmin. vol.	2	19	~~Dianella caer.~~			D. y. parv.	<1	1
Euc. creb.	15	6	Ziera pil 1.3mill	4	10	Pratia purp.	1	200	Ento. strict.	<1	10
Euc. glob.	10	5	*Lant. cam.	5	5	Brunon. aust.	<1	20	Arist. vag.	3	50
Euc. amen.	5	2	~~Notel. long.~~	~~5~~	~~10~~	Poranth. micro.	<1	5	Lymbo. refr.	1	20
			Persoonia lin.	1	2	Pseuderanth. var.	<1	5	Micro. stip.	5	50+
			Phyll. hirt.	1	50	Pomax umb.	<1	10	Eragrost. lept.	<1	2
			Leucop. junip.	1	3	Brunon. pumil.	<1	1	Imperat. cyl.	2	500
			Alphit. excels.	1	2	Solanum prin.	<1	1	Panicum effus.	<1	3
			Hibbert. diffus.	<1	5				Eragrost. brown.	<1	3
			Mayten. silv.	<1	2						
			Not. long.	8	20						

Sub-canopy	C	A	Shrubs (cont.)	C	A
Exo. cupress	2	1	Bossiaea obcord.	<1	2
Euc. creb.	5	6	Chorizema parv.	<1	1
Allo. tor.	2	2	Back. myrt.	3	5
Back. myrt.	5	4	Oxylob. ilic.	2	4
Alphit. excels.	5	4	Acacia ulic.	1	2
Corymb. mac.	2	4	Brachy pop.	<1	1
			Burs. spin.	1	3
			Pitto. rev.	1	3
			Acacia implex.	<1	1
			Acacia fald.	<1	1
			~~Cassine aust.~~	1	1
			Elaeodendr. aust.		

Ferns and Allies	C	A
Cheil. sieb.	1	100
Adiant. aeth.	1	10

Monocots (Other)	C	A
Lom. confert.	55	1000
Lepido. lat.	<1	5
Xanth. spicat.	1	3
Dianella ~~long.~~ caer. var.	<1	2
Dianella cae. prod.	1	5
Lomand. multi.	1	10

Dianella caer. var. / cinc. revol.

Climbers/Vines	C	A
Geiton. cym.	1	20
Desmod. rhytid.	<1	20
Pand. pand.	<1	5
Clemat. glyc.	<1	10
Desmod. gunn.	<1	20
Eustreph. lat.	<1	5
Billard. scand.	<1	3

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	20 - 30	10 - 20	0.1 - 7	0.1 - 0.4	Bare (%):
PFC (%)	45	17	35	80	Litter (%): 45
Weeds (%)	-	-	10	-	Rock (%): 25
					Moss (%):

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Upper Hunter / Central Rivers	Upper Hunter	J. Manners	18/8/15

Proposal ID	Proposal name	Zone ID
32/2016/244/1	Martins Creek Quarry Expansion	2

Vegetation formation: Dry Sclerophyll Forest (shrub/grass)

Vegetation class:

Vegetation type: Spotted Gum - Narrow-leaved Ironbark shrub-grass open forest of the Central Lower Hunter

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
mod/good		✓

Coordinates (GPS datum GDA94: _____)

Transect / plot number	1	23	3	4	5	6	7	8	9	10
Easting	370100	370985								
Northing	6398449	6397795								
Zone AMG	56	56								

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	33.5	29.5								
Native mid-storey cover (%)	1.4	15								
Native ground cover (grasses) (%)	76	60								
Native ground cover (shrubs) (%)	12	4								
Native ground cover (other) (%)	46	26								
Exotic plant cover	1.25	5.6								

Larger sampling area

Native plant species richness [1]	50	57								
Number of trees with hollows [2]	3	0								
Over-storey regeneration [3]	100	100								
Total length of fallen logs (m) [2]	51	49								

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	Upper Hunter / Central Rivers
CMA subregion	Upper Hunter
Recorder	J. Mammus
Date	20/8/15
Proposal ID	132/2016/2446
Proposal name	Martins Creek Quarry Expansion
Zone ID	2
Vegetation formation	Dry Sclerophyll Forest (shrub/grass)
Vegetation class	
Vegetation type	Spotted Gum - Narrow-leaved Ironbark shrub-grass open forest of Central + Lower Hunter
Condition (low or mod/good)	mod/good
Zone descriptor (optional)	
Geographic/habitat features (tick after printing step 2 of Credit Calculator)	✓

Transect number 1	Number of hits (tally)	%
Native over-storey cover (%)	30, 40, 40, 40, 40, 25, 30, 20, 35, 35	33.5
Native mid-storey cover (%)	10, 1, 1, 1, 0, 1, 0, 0, 0, 0	1.4
Native ground cover (grasses) (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 III	76
Native ground cover (shrubs) (%)	𝍸 I	12
Native ground cover (other) (%)	𝍸 𝍸 𝍸 𝍸 III	46
Exotic plant cover (%)	mid 5, 5, 0, 5, 5, 0, 0, 5, 0, 0, ground - Nil	2.5

Transect number 13	Number of hits (tally)	%
Native over-storey cover (%)	35, 45, 45, 40, 40, 40, 20, 0, 15, 45	29.5
Native mid-storey cover (%)	30, 20, 20, 25, 25, 10, 5, 5, 5, 5	15
Native ground cover (grasses) (%)	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	60
Native ground cover (shrubs) (%)	II	4
Native ground cover (other) (%)	𝍸 𝍸 III	26
Exotic plant cover (%)	mid 5, 10, 5, 5, 2, 5, 15, 5, 5, 5 ground III	5.6

Transect number	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrub) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

Date: 18/8/15 Waypoint: Job #: 15 118 Site: Q: 1

Personnel: B K Easting: Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: Northing: Aspect: Slope:

Community: Soil:

Canopy	C	A	Shrubs	C	A	Dicots	C	A	Monocots (Grasses)	C	A
Euc. creb	5	3	Persoonia lin.	1	2	Plat... purp.	3	500	Themeda tri.	30	500
Euc. ~~"stringy" (S)~~ glob	15	5	Bursaria spin.	3	10	Branon? aust.	1	20	Aristida vagans	5	50
Corymb. mac.	10	4	Lept. ...	20	50	Operc. diphyll.	<1	5	Entolasia stric.	5	100
Euc. fibros.	5	2	Leuco. junip.	3	10	Pomax umbell.	<1	10	Echino. caes	1	20
			Acacia ulicifol. ~~brown (S)~~	<1	3				Micro. stip	15	1000
			Phyllanthus hirt.	1	20				Cymbo refract.	5	50
			Boronia polyg. / ~~Rutaceae sp. - subshrub~~	<1	1				Eragrost. brown.	2	20
			Bede. myrt.	3	2				Digitaria parv.	<1	2
			Jacksonia scop.	1	2						
			Sannantha cuss.	2	5						
			Dodonaea visc.	<1	1						
Sub-canopy	**C**	**A**	Notelaea long.	<1	2						
Corymb. mac.	10	8	Dodonaea visc. ...	<1	4						
Euc. creb.	5	4	Breynia oblong.	<1	1						
Euc. ~~"stringy"~~ glob.	5	4	Hibbertia diffus.	<1	1						
Euc. fibr.	1	1	Corymb. mac.	<1	2						
			Exocarp. cupress.	<1	1						
			Acacia falc.	1	2						

Ferns and Allies	C	A
Cheil. sieb.	2	50

Monocots (Other)	C	A
Lomandra mult.	4	20
Caladenia cat.	<1	20
Lomandra long	1	5
Lepido ~~sp. (S)~~ gunn.	1	5
Arthropodium sp.	<1	5
Lepido. lat.	3	10
Acianthus fornic. sp. (S)	<1	20
Dianella revol.	1	10
Dianella revol.? "broad blue leaves"	<1	1
Stypandra glauca	<1	1

Climbers/Vines	C	A
Pandorea pand.	1	5
Glycine microp.	<1	20
Eustreph. lat.	1	20
Desmodium rhytid.	1	10
Pand. pand.	1	5
Geitono. cymos.	<1	2
Glycine tab.	<1	3
Desmod. gunn.	1	50

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	20-35	8-20	0.5-6	0.1-0.3	Bare (%): –
PFC (%)	35	20	30	15	Litter (%): 10
Weeds (%)	–	–	70	–	Rock (%): 5
					Moss (%): –

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Date: 26/8 Waypoint: ______

Job #: 1518

Site: ______

Q: 13

Personnel: B, F Easting: ______ Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: ______ Northing: ______ Aspect: ______ Slope: ______

Community: ______ Soil: ______

lots of tall, thin regrowth.

Canopy	C	A
Corymb. mac.	17	16
Euc. creb.	10	4
~~Euc. tere.~~		
Euc. glob.	3	1
Euc. mol.	Maclura cochin.	
Euc. glob.		

Sub-canopy	C	A
Euc. ac.	2	1
corymb. mac.	10	5
Euc. creb.	5	3
Acacia impl.	4	6
Mel. styph.	2	1

Ferns and Allies	C	A
Cheil. sieb.	1	50
Cheil. dist.	<1	5

Climbers/Vines	C	A
Glycine tab.	<1	10
Desmod. gunn.	1	50
Desmod. var.	<1	19
Geitan. cym.	<1	5
Desmod. rhytid.	1	10
Rubus mol.	<1	2
Clemati. aristat.	<1	1
Billard. scan.	<1	3
Pand. pand.	<1	4
Glycine micro	<1	10

Shrubs	C	A
*Lant. cam.	15	20
Pitto. undul.	10	8
Acacia implex.	5	10
Acacia ulic.	<1	2
Leuco. junip.	<1	3
Hibbert. diffus.	<1	7
Jasmin. volub.	<1	3
Maytenus silv.	<1	2
Persoonia lin.	1	1
Breyn. oblong.	5	10
~~Capparis sp.? (5)~~	<1	1
Pitto. rev.	1	2
Ozotham. dios.	<1	1
Euc. creb.	35	3
Davies genist.		
Plant debil		
Glycine cland.		

wet spotted gum comm.

Dicots	C	A
*Verbena rig.	1	20
Dichondra rep.	1	100
*Bidens pil.	<1	10
*Plant. lanc.	<1	3
Scut. humil.	<1	4
Wahlen. grac.	<1	2
Plect. parv.	<1	1
*Anagallis arv.	<1	5
Pratia purp.	1	100
*Sonchus olera.	<1	1
Hypericum gram.		

*spig. (maybe ...) some spikes on/in stem 1.5cm

Monocots (Grasses)	C	A
Panicum effus.	4	50
~~Lomand. conf.~~		
Chloris ventr.	<1	10
Cymbo refr.	2	20
Paspalid. dist.	3	100
Sporob. creb.	<1	1
Themeda tri.	5	50
Both. decip.	<1	10
Eragros. brown.	1	20
Micro. stip.	2	50
Oplis. aem.	1	20
Digit. diffus.	<1	10
Ento. strict.	1	10
Arist. ram.	5	50
Arist. vag.	1	10
Imper. cylindr.	5	200
Ento. marg.	<1	2
Eragro. lepto	<1	3

Monocots (Other)	C	A
Dianella (tall, long, blue)	<1	4 40
Lomand. conf.	30	200
Lomand. multi.	1	5
Gahnia asp.	2	5
Carex invers.	<1	3
Dianella cae. prod.	2	10

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	20-30	10-20	0.1-6	0.1-0.4	Bare (%):
PFC (%)	80	21	40	70	Litter (%): 15
Weeds (%)	—	—	35	—	Rock (%): 15
					Moss (%):

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Upper Hunter/Central Rivers	Upper Hunter	J. Mcinnes	18-20/8/16

Proposal ID	Proposal name	Zone ID
132/2016/24447	Martins Creek Quarry Expansion	3

Vegetation formation: Rainforest

Vegetation class:

Vegetation type: White Cedar Tree - Red Kamala dry subtropical rainforest of the lower Hunter River

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
mod/good		✓

Coordinates (GPS datum GDA94:_____)

Transect / plot number	3	7	8	4	5	6	7	8	9	10
Easting	370765	370811	370910							
Northing	6397814	6397868	6397899							
Zone AMG										

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	73	71.5	71.5							
Native mid-storey cover (%)	14	10	8							
Native ground cover (grasses) (%)	24	0	2							
Native ground cover (shrubs) (%)	2	0	0							
Native ground cover (other) (%)	32	42	52							
Exotic plant cover	9.25	0.35	1.65							

Larger sampling area

Native plant species richness [1]	28	40	43							
Number of trees with hollows [2]	2	0	0							
Over-storey regeneration [3]	100	100	100							
Total length of fallen logs (m) [2]	0	68	83							
Comments/additional conservation values (riparian areas, special features, geology, etc.):										

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area Upper Hunter / Central Rivers **CMA subregion** Upper Hunter **Recorder** [illegible] **Date** 18-20/8/15

Proposal ID 152/2016/2441MP **Proposal name** Martins Creek Quarry Expansion **Zone ID** 3

Vegetation formation Rainforest

Vegetation class

Vegetation type Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River

Condition (low or mod/good) Mod/good **Zone descriptor** (optional) **Geographic/habitat features** (tick after printing step 2 of Credit Calculator)

Transect number 3	Number of hits (tally)	%
Native over-storey cover (%)	80, 70, 70, 80, 70, 80, 75, 70, 70, 65	73
Native mid-storey cover (%)	30, 30, 30, 30, 20, 10, 15, 10, 5, 10	19
Native ground cover (grasses) (%)	~~||||~~ ~~||||~~ ||	
Native ground cover (shrubs) (%)	|	
Native ground cover (other) (%)	~~||||~~ ~~||||~~ ~~||||~~ |	
Exotic plant cover (%)	Mid 0, 0, 0, 5, 5, 5, 5, 20, 30, 35 good ||||	9.25

Transect number 7	Number of hits (tally)	%
Native over-storey cover (%)	80, 70, 70, 80, 70, 70, 65, 70, 70, 75	76.5
Native mid-storey cover (%)	10, 10, 10, 10, 15, 10, 5, 10, 10, 10	10
Native ground cover (grasses) (%)		0
Native ground cover (shrubs) (%)		0
Native ground cover (other) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |	
Exotic plant cover (%)	Mid 2, 2, 0, 0, 0, 1, 0, 1, 1, 0 good Nil	0.35

Transect number 8	Number of hits (tally)	%
Native over-storey cover (%)	70, 70, 75, 80, 75, 70, 70, 65, 70, 70	71.5
Native mid-storey cover (%)	10, 10, 5, 10, 15, 5, 5, 5, 5, 10	8
Native ground cover (grasses) (%)	|	2
Native ground cover (shrub) (%)		0
Native ground cover (other) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |	52
Exotic plant cover (%)	Mid 5, 5, 5, 2, 2, 10, 2, 0, 0, 2 good nil	1.65

Transect number______	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

Date: 18/8/15 Waypoint: | Job #: 15118 | Site: | Q: 3

Personnel: B.F. Easting: Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: Northing: Aspect: Slope:

Community: Soil:

Canopy	C	A
Euc. panic.	10	2
Back. myrt.	61	20
Rainforest. sp.? (5)	5	1
Euc. acmen.	4	1

Sub-canopy	C	A
Back. myrt.	30	20

Ferns and Allies	C	A
Adiantum hisp.	5	50
Pellaea paradoxa	5	100
Adiantum aeth.	5	50

Climbers/Vines	C	A
Geitor. cym.	<1	5
Dioscorea transv.	3	200
Cayratia clem.	<1	10
opposite slightly serrate	<1	2
Tetrastig. nit.	<1	1
Clematicissus opac.	1	20
Eustreph. lat.	<1	1
Parsons. stram.		
Marsden. suaveolens		

Shrubs	C	A
Breynia oblong.	3	5
Alchorn. ilic.	3	5
*Lantana cam.	15	20
Not. long.	2	3
Jasminum vol.	5	10
Clerodendr. tom.	3	2
*Olea europ. cusp.	<1	2
Back. myrt.	20	50
		20
Hibisc. hetro.		
Leuco. junip.		
Lepto. poly.		
Wilkiea huegel.		
Acronych.? (slight. serr.) ← Croton verreauxii		
Streblus brunon.		
Claox. austral.		
Pitto. rev.		
Ficus rubig.		
Trema tom.		
Pand. pand.		
← Aphanopetalum resinosum		

Dicots	C	A
Pseuderanth. var.	2	20
*Bidens pil.	<1	3
Plectranth. parv.	<1	2
Galium leiocl.	<1	1
Solanum stellig.		
Oxalis perenn.		
Sida heder.		
Solan. prin.		

Monocots (Grasses)	C	A
Oplis. imb.	5	500
Micro. stip.	3	50
Ent. marg.		

Monocots (Other)	C	A
Pterostylis "ophioglossa"	1	50
Scleria mack.	1	50
Arthropodium sp.	<1	3
Lepido. gunn.	3	5
Cyperus enervis		

Parameter	Tree	Small tree	Shrub	Groundcover
Height (m)	20 – 25	10 – 20	0.5 – 8	0.1 – 0.3
PFC (%)	80	30	50	30
Weeds (%)	–	–	35	<1

Bare (%):	5
Litter (%):	5
Rock (%):	80
Moss (%):	10

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Date: 19/8/15	Waypoint:
Personnel:	Easting:
Photo ID:	Northing:
Community:	

Job #: 15118 | Site: | Q: 7

Quadrat size: ☐ 20x20m ☐ 20x50m

Aspect: Slope:

Soil:

Canopy	C	A	Shrubs	C	A	Dicots	C	A	Monocots (Grasses)	C	A
Back. myrt.	10	43	Laur. cam.	3	10	Pseuder. var.	1	20	Oplis. imbecil.	3	50
Tree sp.	4	1	Breynia oblong.	2	5	Brunon. aust.	<1	2			
Corymb. mac.	10	2	Streblus brunon.	10	20	Plectr. parv.	<1	2			
Euc. panic.	10	2	Not. long.	<1	2	Solanum	<1	1			
Euc. acmen.	3	1	~~opposite thick elliptic~~	1	3	← Sideroderma stellig.					
			Jasminum vol.	3	5						
Fic. rubig.			Pitto. rev.	<1	2						
			~~Diamond shaped~~ (5)	1	2	← Scolopia braun.					
			Pitto. undul.	2	5						
			Ochna serr.	<1	1						
			Citrio. pauc.	<1	5						
Sub-canopy	**C**	**A**	~~serrate~~	<1	1	← Croton verreauxii					
Back. myrt.	45	20	Myrsine variabil.	<1	1						
Streblus brunon.	5	3	Alchorne. ilic.	1	4						
			Mayten. silv.								
Mel. styph.											

Ferns and Allies	C	A		Monocots (Other)	C	A
Pellaea para.	5	200		Anedilema sp.	<1	2
Adiant. aeth.	15	500		Arthro. sp.	<1	5
Adiant hisp.	5	100		Cyperus		
~~Pellaea paradoxa~~				Eusto. marg.		
Asplenium austral.	<1	2	← Doodia caud.	Pandorea? long.		
~~Pellaea shaped~~	5	100		Gymno. anceps.		
Doodia asp.	3	50				

Climbers/Vines	C	A	
Dioscorea trans.	5	200	Austrosteenisia blackii var. blackii
Tetra. nitens	5	20	
~~Thick pandorea like~~ (5)	5	2	
~~climbing~~ (5)	1	20	← Dictymia brownii
Mars. denia flav.	1	10	
Cissus antarct.	<1	2	
Marsdenia	<1	9	
Pand. pand.	<1	3	
Eustreph. lat.	1	19	
Clematis opac.	<1	1	

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	25 - 40	10 - 25	0.5 - 8	0.1 - 0.3	Bare (%): 10
PFC (%)	38	50	20	50	Litter (%): 15
Weeds (%)	—	—	5	—	Rock (%): 25
					Moss (%):

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1-5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Check 1st rainforest plot tree sp. against Guio 9. (Not Aut)

Date: 20/8 Waypoint: ______ Job #: 15118 Site: ______ Q: 8

Personnel: B.F. Easting: ______ Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: ______ Northing: ______ Aspect: ______ Slope: ______

Community: ______ Soil: ______

Canopy	C	A
Back. myrt. (slight buttress)	25	4
Tree sp. 'opposite, drip tip' (buttress)	30	6
Ficus rubig. (Rainforest sp.)	5	1
Croton verreauxii		
Hodgkinsonia ovatiflora (some plants)		

Sub-canopy	C	A
Styphelia brunon.	5	7
Back. myrt.	40	20
Tree sp. Rainforest sp.	15	5

Ferns and Allies	C	A
Doodia asp.	2	
Pellaea paradox	3	50
'Pellaea-shaped' (s)	5	100
Adiantum hispi.	5	100
Adiant. aeth.	10	200
Lindsaea micro	<1	10
Doodia caud.		

Climbers/Vines	C	A
Deeringia? (dicot, fury) (s)	<1	20
Diosc. trans.	5	50
Parsons. stram.	2	5
Ipomea-like 'opposite' (s)	<1	1
Tetrastig. nitens	5	20
Marsden. flav.	1	20
Pand. pand.	1	3
Pandorea like 'rusty' (s)	5	5
Marsden. Heyd.? (s)	<1	2
Cissus antarct.	1	2

Shrubs	C	A
Back. myrt.	5	10
Jasminum vol.	1	10
Alchornea illic.	1	3
~~'thick, leathery, alternate'~~	~~5~~	~~10~~
'Alternate, long petiole'	2	3
Not. long.	10	20
Breynia oblong.	<1	3
Pitto. undul.	2	5
'Alternate leathery, serrate'	15	30
Lant. cam.	5	10
Olap. austr.	3	4
Ficus rubig.	<1	1
Hibiscus hetr.	1	3
'spiny, pointed leaves'	<1	1
within hung.	1	3
Claox. aust.	<1	1
~~Sting. tree~~	1	1
Ficus cor.		
Peperomia blanda var. floribunda		
Denr. ofre		
Morinda jas	<1	1

Dicots	C	A
Solan. pin.	<1	1
Pseuder. var.	1	20
Oxalis (s) perenn.	<1	1
Plectr. parv.	<1	5
Dysoxylum? Diplocyclos? doplanchei		
Capparis arborea		
Dendrocnide excelsa		

Monocots (Grasses)	C	A
Oplis. imb.	5	200
Ento. marg.	1	10

Monocots (Other)	C	A
Cyperus ~~Hat~~ enerv.	2	20
Aneilema acum.	<1	4
Gymno. anceps	1	3

Parameter	Tree	Small tree	Shrub	Groundcover
Height (m)	20-35	10-25	0.5-8	0.1-0.4
PFC (%)	55	60	50	40
Weeds (%)	—	—	5	—

Bare (%): 10
Litter (%): 15
Rock (%): 30
Moss (%): 5

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1-5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Upper Hunter / Central Rivers	Upper Hunter	J. Mauws	18-20/8/15

Proposal ID	Proposal name	Zone ID
132/2016/2441MP	Martins Creek Quarry Expansion	4 15

Vegetation formation Dry sclerophyll Forest (shrub/grass)

Vegetation class

Vegetation type Slaty Red Gum Grassy Woodland on hinterland foothills of the Southern North Coast

Condition (low or mod/good): mod/good

Zone descriptor (optional):

Geographic/habitat features (tick after printing step 2 of Credit Calculator) ✓

Coordinates (GPS datum GDA94:_____________)

Transect / plot number	2	4	5	11	15	6	7	8	9	10
Easting	370180	369992	370511	370678	370363					
Northing	6398435	6397655	6397523	6397088	6397381					
Zone AMG	56	56	56	56	56					

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	23.5	12.5	37	28	43.5					
Native mid-storey cover (%)	36	20	25	2.7	14.5					
Native ground cover (grasses) (%)	76	98	76	14	74					
Native ground cover (shrubs) (%)	52	16	10	2	18					
Native ground cover (other) (%)	22	50	40	20	44					
Exotic plant cover	3.5	2.95	11.25	70	4.75					

Larger sampling area

Native plant species richness [1]	46	49	43	35	49					
Number of trees with hollows [2]	1	0	0	1	0					
Over-storey regeneration [3]	100	100	100	100	100					
Total length of fallen logs (m) [2]	120	17	25	15	7					

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value: Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area Upper Hunter / Central Rivers	**CMA subregion** Upper Hunter	**Recorder** J. Mayers	**Date** 18-20/8/15
Proposal ID 132/2016/2441 MP	**Proposal name** Martins Creek Quarry Expansion	**Zone ID** 4+5	

Vegetation formation Dry sclerophyll Forest (shrub/grass)

Vegetation class

Vegetation type Slaty Red Gum Grassy Woodland on lowland foothills of the Southern North Coast

Condition (low or mod/good) mod/good

Zone descriptor (optional)

Geographic/habitat features (tick after printing step 2 of Credit Calculator) ✓

Transect number 2	Number of hits (tally)	%
Native over-storey cover (%)	10, 20, 10, 15, 20, 30, 30, 20, 30, 50	23.5
Native mid-storey cover (%)	60, 40, 20, 80, 40, 40, 30, 30, 10, 10	36
Native ground cover (grasses) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||	76
Native ground cover (shrubs) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |	52
Native ground cover (other) (%)	~~||||~~ ~~||||~~ |	22
Exotic plant cover (%)	Mid 10, 0, 10, 0.5, 5, 5 ground ||	3.5

Transect number 4	Number of hits (tally)	%
Native over-storey cover (%)	10, 5, 10, 15, 20, 10, 10, 10, 15, 20	12.5
Native mid-storey cover (%)	5, 0, 5, 5, 15, 25, 60, 40, 15, 30	20
Native ground cover (grasses) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ||||	98
Native ground cover (shrubs) (%)	~~||||~~ |||	16
Native ground cover (other) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~	50
Exotic plant cover (%)	Mid 5, 0, 2, 2, 0, 5, 10, 15, 10, 10 ground - nil	2.95

Transect number 5	Number of hits (tally)	%
Native over-storey cover (%)	35, 40, 45, 45, 40, 40, 30, 25, 30, 40	37
Native mid-storey cover (%)	5, 15, 15, 20, 50, 30, 10, 85, 10, 10	25
Native ground cover (grasses) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~ |||	76
Native ground cover (shrub) (%)	~~||||~~	10
Native ground cover (other) (%)	~~||||~~ ~~||||~~ ~~||||~~ ~~||||~~	40
Exotic plant cover (%)	Mid 0, 0, 0, 0, 5, 0, 5, 5, 70, 20 ground ~~||||~~ |	11.25

Date: 18/8/15 Waypoint: Job #: 1518 Site: Q: 2

Personnel: Easting: Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: Northing: Aspect: Slope:

Community: Soil:

Canopy	C	A
Euc. glauc	10	5
Corymb. mac.	5	1
Euc. "string globb	10	6
Euc. creb.	5	2

Sub-canopy	C	A
Euc. glauc.	5	10
Euc. creb.	2	3
Euc. "string glob"	5	8

Ferns and Allies	C	A
cheil. sieb.	1	50

Climbers/Vines	C	A
Clematis. apic.	<1	10
Geiton. cymos	<1	5
Glycine micro.	<1	3
Eustreph. lat.	<1	2
Pandor. pand.	<1	3
Desmod. rhytid.	<1	2
*Aspar. aspar.	<1	1
Pandor. pand.	<1	2

Shrubs	C	A
Acacia falc.	5	10
Sannantha crass	40 35	200
*Lant. cam.	10	20
Euc. creb.	2	4
Burs. spin.	10	20
Breynia oblong.	1	5
Phyllanth. hirt.	<1	20
Leuco. junip.	2	10
Acacia ulic.	1	5
~~Not. long~~	1	2
Euc. glauc.	83	5
Maytenus silv.	<1	1
Not. long.	2	5
Jasminum vol.	<1	1

Dicots	C	A
Pratia purp.	2	500
Hypericum? gramin.?	<1	7
Pomax umb.? micro.	<1	1
Operc. diphyll.	<1	10
Oxalis perenn.	2	100
Pomax umb.	<1	1

Monocots (Grasses)	C	A
Themeda tri.	40	1000 20
Micro. stip.	10	500
Arist. vag.	5	200
Ento. marg.	3	50
Cymbo. refr.	10	200
Panicum effus.	5	50 20
Digit. parv.	<1	10
Echino. cres.	<1	5
Oplis. imbec.	1	20
Panicum simile	<1	5

Monocots (Other)	C	A
Lepido. lat.	5	50
Lepido sp. gram.	20	50
Lomandra multi.	3	20
Caladen. cat.	<1	5
Acianthus sp. form	<1	20
Lomand. long.	3	10
Scleria mack.	<1	20
Lomand. fil. fil.	1	20
Stypandra glauc.?	<1	2

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	15-30	8-15	0.3-7	0.1-0.4	Litter (%): 10
PFC (%)	40	20	65	75	Rock (%): 10
Weeds (%)	—	—	7	<1	Moss (%): —

Bare (%): 5

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Date: 18/8/15 Waypoint: ______ Job #: 15118 Site: ______ Q: 4

Personnel: ______ Easting: ______ Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: ______ Northing: ______ Aspect: ______ Slope: ______

Community: ______ Soil: ______

Canopy	C	A	Shrubs	C	A	Dicots	C	A	Monocots (Grasses)	C	A
Euc. glauc.	5	2	Bursaria obovata	5	20	*Bidens pil.	<1	10	Cymbo. refr.	35	1000
Euc. creb.	15	9	Acacia ulic.	1	4	Oxalis perenn.	<1	3	Panicum effus.	5	200
			Pitto undul.	1	1	Vernon. cin.	<1	1	Themeda tri.	35	2000
			Acacia implex.	4	7	Solanum prin.	<1	2	Arist. vag.	5	200
			Euc. glauc.	1	3	Plat. purp.	2	200	Eragrost. lepto.	<1	10
			*Lant. cam.	15	20	Hibbertia diffusa	<1	2	Micro. stip.	5	500
			Cassinia quin.	<1	1	Dichond. rep.	1	50	Paspalid. dist.	1	50
			Not. long.	1	3	Brunon. aust.	1	50	Oplis. aem.	<1	20
			Exo. cupress.	1	1	Operc. diphyll.	<1	4	Echino. caes.	<1	5
			Persoonia lin.	3	5	*Hypo rad.	<1	1	Eragrost. brown.	3	50
			Pitto. rev.	<1	1						
Sub-canopy	**C**	**A**	Leuco. junip.	2	10						
*Olea europ. cusp.	3	2	~~Acacia ulic.~~								
Euc. creb.	10	9	Acacia binervat.	4	7						
Euc. glauc.	5	6	~~Notelaea ovata~~	~~<1~~	~~1~~						
Acacia binervat.	10	10	Sannantha cuss.	1	3						
			Euc. creb.	1	4						

Ferns and Allies	C	A	Monocots (Other)	C	A
Cheil. sieb.	2	50	Lepido. "tussock"	5	20
			Gahnia asp.	3	10
			Dianella "long tube"	1	10
			Dianella cae. prod.	<1	2
			D. revol.	<1	1
			Lomand. fil. fil.	<1	10
			Caladon. cal.	<1	3
			Lomand. multi.	3	20
			Aneilema acumin.		

Climbers/Vines	C	A
Geitono. cymos.	<1	3
Eustrephus lat.	<1	2
Desmod. var.	<1	10
Desmod. rhytid.	1	10
Desmod. gunn.	<1	5
Billard. scand.	<1	1
Parsons. strám.	<1	3
Glycine tab.	<1	20

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	15 - 30	10 - 15	0.5-8	0.1 - 0.3	Bare (%): –
PFC (%)	20	25	40	85	Litter (%): 10
Weeds (%)	——	15	30	<1	Rock (%): 5
					Moss (%): –

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Date: 19/8/15 Waypoint: ______ Job #: 15118 Site: ______ Q: 5

Personnel: B.F Easting: ______ Quadrat size: ☐ 20x20m ☐ 20x50m

Photo ID: ______ Northing: ______ Aspect: ______ Slope: ______

Community: ______ Soil: ______

Canopy	C	A
Euc. glauc.	15	4
Euc. mol.	2	1
Euc. siderophl.	10	4
Corymb. mac.	2	1
Adj. Euc. crebr.		
Euc. carnea		
Euc. glauc.		

Sub-canopy	C	A
~~Exocarp. cupress.~~	~~2~~	~~2~~
Euc. glauc.	2.5	2
Gloch. ferd.	1	1
Euc. sidero.	5	3

Ferns and Allies	C	A
Cheil. sieb.	1	50

Climbers/Vines	C	A
Glycine micro.	<1	20
Geiton. cym.	<1	3
Pand. pand.	<1	2
*Aspar. aspar.	<1	1

Adj. Amyema spp.(5) miqu.

Shrubs	C	A
Acacia falc.	2	3
Pitto. undul.	10	5
Jasminum vol.	10	6
Exo. cupress.	2	2
Olea europ. cusp.	3	3
Acacia implex.	5	6
Breynia obly.	2	5
Gloch. ferd.	5	3
Sannanth. crass.	1	2
Leuco. juni f.	<1	3
Alphitonia excels.	1	1
Maytenus silv.	<1	1
Pitto. rev.	5	20
Hibbert. diffus.	<1	1

Dicots	C	A
Oxalis perenn.	<1	10
Pratia purp.	3	500
~~[illegible]~~		
Hypericum japon.	<1	10
Solanum. bell.	<1	3
*Plantago lance.	1	20
*Bidens pil.	<1	20
*Cyclo. hept.	<1	20
Poranthera micro.	<1	2
Opercularia diphyll.	<1	10
*Senec. mad.	1	20
Centella asiat.	<1	20
Brunon. aust.	1	50
*Hypo. micro.	<1	3
Cerast. glom.	<1	10
Drosera pelt.		
Euchiton sphaer.		

Monocots (Grasses)	C	A
Panicum effus.	2	20
Echino. caes.	<1	10
Themeda tri.	50	2000
"Golden ~~bay leaf~~ from Glen (?)"	1	10
Cymbo. refract.	15	1000
Eragrost. lepto.	10	500
Micro. stip.	5	500
Oplis. aemu.	1	20
Capillipedium parvif.		

Monocots (Other)	C	A
Gahnia asp.	3	10
Lomandra confert.	1	10
Lomandra multi.	3	50
Caladenia cat.	<1	20
Dianella "~~long, blue~~"	<1	5
Lomand. fil. fil.	<1	20

Parameter	Tree	Small tree	Shrub	Groundcover	
Height (m)	20–35	8–20	0.4–7	0.1–0.5	Bare (%): –
PFC (%)	30	13	45	80	Litter (%): 20
Weeds (%)	–	–	5	5	Rock (%): –
					Moss (%): –

C score	A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4)
A score	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required

ID:

CUMBERLAND ECOLOGY

Plot and Transect U1
Plot and Transect U2

Umwelt

Date 19.2.19 Site No MCQ2

Job No. 3957

Recorders BW

Photo No. SW, SE, NE (984 - 986)

General Location MC Quarry North Int. TS

Specific Site Location

MGA Ref. (~~NE corner~~ TS) E 369812 N 6397668

Waypoint Name MCQ2TS

Quadrat Size (10 x 40) 20 x 20 20 x 50 Other:

Dominant land use Rd. Side.

Draft Vegetation Community CHSGIF (TEC)
Same As MCQ1

General Comments

Elevation ~70 m Slope 2 deg. Aspect N deg.

Soil Drainage- waterlogged/damp/well (moist)/ well (dry)
Texture - sand/loam/clay/peat
Depth - deep (>1m)/shallow (0.3-1m)/Skeletal (<0.3m)
Microrelief
Outcropping (% cover) —
Runoff - nil/very slow/slow/ rapid/ very rapid
Colour brown.

Disturb. grazing X logging X erosion X feral X other Road

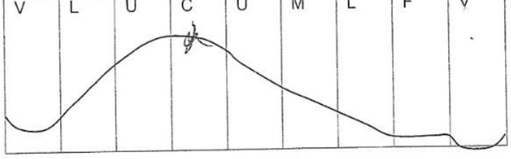
Signs of previous fire present (recent / historical) or absent

Ground % Litter 65 Rock 0 Lichen 0 Non Vas. Plants 0

Age Structure N/A ___ early regen ___ advanced regen ___
uneven age ___ mature ✓ senescent ___

Cover	Abundance
A measure or estimate of the appropriate cover measure for each recorded species; recorded from 1–5% and then to the nearest 5%. If the cover of a species is less than 1% and the species is considered important, then the estimated cover should be entered (e.g. 0.4). **Stratum (& layer)** Record as E = Emergent, T = Upper, M = Mid (if > 1 label as M1, M2, M3), L= Ground (if > 1 label as L1, L2, L3)	A relative measure of the number of individuals or shoots of a species within the plot. Use the following intervals; numbers above about 20 are estimates only: 1,2,3,4,5,6,7,8,9,10,20,50,100,500,1000 or specify a number greater than 1000 if required. **Growth Form** Refer to table 4.5 of the Native Vegetation Interim Type Standard.

Physiography



Vegetation Structure

	Stratum	Ht (m)	%	Dominant Species
1	T	25	40	C. mac. E. moll. E. crebra.
2	M	1 – 4	20	Breynia ob. Lantana A. falcata.
3	L	< 1m	30	~~Ranuncul.~~ Eremophila. Microlaena stip. Entolasia. Whisky Grass Bp21 Aristida
4				
5				

ID	Collected	Field Name	Botanical Name	Stratum (& layer)	Growth Form	Cover	Abundance	Data Entry
1		Corymbia maculata #####		T		20	6	
2		Euc. crebra. ||||		T		10	4	
3		Euc. moll. ||		T		10	2	
4		Acacia ~~salign~~ falcata		M		3	10	
5		Prickly Pear.		L		0.1	3	
6		Breynia oblongifolia		M		7	20	
7		Lantana camara.		M		10	10	
8		Microlaena stip		L		10	100	
9		Entolasia stricta				5	100	
10		Verbena bon.				1	20	
11		Dianella rev.			0.8	[illegible]	10	
12		Eremophila deb.				0.8	10	
13		Chloris gay.				0.05	5	
14		Whisky Grass				2	20	
15		~~Sida~~ Lomandra multi.				2	20	
16		Aristida ramosa.				5	100	
17		Bidens pilosa				0.04	20	
18		Plantago lanc.				0.01	5	
19		Clematis microphylla				0.8	20	
20		Paspalidium dist.				0.8	20	
21		Red Berry Asparagus				5	100	

22		Dichondra repens		L		001	20	
23		Chloris truncata				001	5	
24		Persoonia linearis		M		08	1	
25		Dianella ~~sp~~ caerulea		L		0.01	1	
26		Hydrocotyle				5	400	
27		Wahlenbergia stricta				001	1	
28		Pomaderris pimbellata		L		0.01	3	
29		E. tereticornis		T		2	3	
30								
31								
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KOALA FEED TREE SPECIES	Count
Eucalyptus tereticornis (forest red gum)	
Eucalyptus microcorys (tallowwood)	
Eucalyptus punctata (grey gum)	
Eucalyptus viminalis (manna gum)	
Eucalyptus camaldulensis (river red gum)	
Eucalyptus haemastoma (broad-leaved stringybark)	
Eucalyptus signata (scribbly gum)	
Eucalyptus albens (white box)	
Eucalyptus populnea (poplar box)	
Eucalyptus robusta (swamp mahogany)	
Total number of trees in plot	

CONDITION – within plot (Plot size 10×40)	
No. trees with hollows	0
Woody debris (lineal metres)	
Regen of canopy species (list below)	Y/N
Sp. 1 AM	
Sp. 2	
Sp. 3	
Sp. 4	
Tree health (circle)	
no dieback	branchlets dead
small branches dead	main branches dead
trees dead	

BIOBANKING WORKSHEET

Job no: 3457 **Site/Location:** Martins Creek Int **Site name:** MCQ2 **Date:** 19-2-19 **Recorder:** BW

Native Overstorey (percent foliage cover at 10 points along 50 m transect)

30	40	50	30	40	25	10	20	15	40	Average	%

Native mid-storey (>1m to <overstorey) (percent foliage cover at 10 points along 50 m transect)

20	5	5	10	5	0	5	10	10	30	Average	%

Groundcover (50 points along 50 m transect)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Grass	I	I			I		I	I		I			I	I		I	I	I						I	I				I		I	I		I		I	I	I				I				I	I			I
Shrub														I																														I						
Other				I													I																I					I									I	I		I
Exotic						I	I	I				I			I	I		I		I	I								I			I											I							
Nil			I						I		I								I			I	I			I	I	I		I					I				I	I	I				I				I	
Misc 1																																																		
Misc 2																																																		
Misc 3																																																		
Misc 4																																																		
Misc 5																																																		

Species	Field description	Identification	Groundcover type
Misc 1			other / grass / shrub / exotic
Misc 2			other / grass / shrub / exotic
Misc 3			other / grass / shrub / exotic
Misc 4			other / grass / shrub / exotic
Misc 5			other / grass / shrub / exotic

Results	Total Count	Total %
Grass		
Shrub		
Other		
Exotic		

Number of trees with hollows (count of number of trees in 20 x 50 m plot with at least one hollow) Total 0

Regeneration
DBH <5cm

Canopy species	Regeneration present
E. crebra	(Y) / N
E. mol.	(Y) / N
C. mac.	(Y) / N

Canopy species	Regeneration present
	Y / N
	Y / N
	Y / N

Length of fallen logs (min. 10 cm diam. x 50 cm long) (in 20 x 50 m plot)

										Total 7 m

Page ______ of ______

APPENDIX 3
DATES AND TIMES OF FAUNA SURVEYS COMPLETED

The dates and times of fauna surveys completed by *Conacher Consulting* are listed in Table A3.1.

TABLE A3.1
FAUNA SURVEY DATES AND TIMES

Survey Type	Date	Time
Diurnal Surveys	20 August 2014	1hr 1145-1245 (2 persons)
	21 August 2014	7hrs 0900-1400 / 1530-1730 (2 persons)
	5 September 2014	3hrs 20 min / 0930-1250 (2 persons)
	30 September 2014	2hrs 30 min 0940-1210 (2 persons)
	18 February 2015	8hrs 1100-1930 (2 persons)
	19 February 2015	12hrs 0830-1330 / 1430-1930 (2 persons)
	20 February 2015	2hrs 0740-0940 2 persons)
	10 June 2015	5hrs 15min 1130-1645 (2 persons)
	11 June 2015	5hrs 0730-1230 (2 persons)
	17 August 2015	8hrs 1000-1800 (2 persons)
	18 August 2015	8hrs 15min 0815-1630 (2 persons)
	19 August 2015	8hrs 30min 0800-1830 (2 persons)
	20 August 2015	8hrs 45min 0815-1700 (2 persons)
	21 August 2015	2hrs 45min 0815-1100 (2 persons)
	15 September 2015	5hrs 1100-1600 (2 persons)
	16 September 2015	9hrs 0730-1630 (2 persons)
	17 September 2015	8hrs 0745-1145 / 1400-1800 (2 persons)
	18 September 2015	2 hrs 30min 0740-1010 (2 persons)
	14 October 2015	4hrs 30min 1000-1200 / 1300-1530
	25 July 2018	5.5hrs 0945-1315 (2 persons)
	3 October 2018	7hrs 0830-1530 (2 persons)
	9 October 2018	7.5hrs 0830-1600 (3 persons)
	13 March 2019	7hrs 0800-1500 (2 persons)
Nocturnal Surveys	20 August 2014	2hrs1730-1930 (2 persons)
	21 August 2014	2hrs 1730-1930 (2 persons)
	18 February 2015	2hrs 1930-2130 (2 persons)
	19 February 2015	2hrs 1930-2130 (2 persons)
	17 August 2015	1hr 1830-1930 (2 persons)
	19 August 2015	1hr 1830-1930 (2 persons)
	17 September 2015	1hr 1800-1900 (2 persons)
Trapping / Remote Detection Surveys	21 August – 4 September 2014	14 nights of camera surveys (2 arboreal and 2 terrestrial cameras x 14 nights)
	21 August – 4 September 2014	Hair tube survey (10 hair tubes x 14 nights) (preliminary / supplementary survey only)
	21 August – 30 September 2014	40 nights of nest box surveys (preliminary / supplementary survey only)
	5 September – 30 September 2014	25 nights of songmeter recording
	18 & 19 February 2015	2 nights of harp trapping (2 traps x 2 nights)
	11 June 2015 -21 August 2015	71 nights of Arboreal camera survey (8 cameras x 71 nights)
	17 August – 21 August 2015	4 nights of terrestrial Elliot trapping

TABLE A3.1 FAUNA SURVEY DATES AND TIMES		
Survey Type	**Date**	**Time**
		(9 transects of 10 traps each x 4 nights)
	15 September – 17 September 2015	3 nights of arboreal Elliot trapping (9 transects of 6 traps each x 3 nights)
	20 & 21 August 2014 (2 nights x 2 devices) 18-19 February 2015 (2 nights x 2 devices) 17-20 August 2015 (2 devices x 4 nights) 15-17/September 2015 (3 nights x 2 devices)	22 Anabat ultrasonic call recording nights

APPENDIX 4
WEATHER CONDITIONS DURING THE SURVEY PERIODS

Paterson, New South Wales
August 2014 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	6.1	20.5	0	6.0		NW	59	13:48	19.3	20	0	NW	26		17.6	35		W	31	
2	Sa	7.1	15.9	0	4.6		WNW	41	00:05	10.7	43	0	W	13		14.9	40		SSE	9	
3	Su	3.2	16.4	0.2	1.8					8.5	79	7	NE	9		15.0	60		ESE	11	
4	Mo	2.4	20.1	0	3.2		SSE	20	15:20	7.6	93	6	ENE	7		18.3	49		S	9	
5	Tu	4.7	21.1	0	1.6		W	26	12:47	11.9	81	1	ENE	4		20.0	36		WNW	11	
6	We	2.6	20.5	0	2.6					9.2	87	0	ENE	7		19.6	33		WNW	13	
7	Th	8.1	18.5	0	1.8		W	26	03:20	13.0	54	1	WNW	13		17.4	47		SE	7	
8	Fr	3.0	20.1	0	1.8		SSE	24	15:03	9.5	88	7	NNE	4		19.0	52		S	13	
9	Sa	3.7	21.9	0.2	3.6		NW	30	14:25			7	ENE	6		20.8	27		WNW	17	
10	Su	4.7	21.4	0	2.8					14.9	43	6	WNW	17		19.2	26		WNW	15	
11	Mo	4.9	16.4	0	7.6		SE	31	13:41	11.4	50	1	ESE	6		14.1	50		SSE	17	
12	Tu	3.2	16.5	0	0.7		SE	28	12:13	11.5	63	3	WNW	9		14.9	59		SE	13	
13	We	5.3	15.9	0	1.1		SSE	26	14:46	10.0	90	6	NE	7		15.4	52		S	9	
14	Th	1.2	19.1	0	0.9					7.7	87	0	ENE	9		18.9	40		S	11	
15	Fr	5.3	19.7	0	1.0		SE	28	13:34	11.1	80	0	NE	9		17.8	57		ESE	15	
16	Sa	5.0	18.1	0	1.0		ESE	22	12:26	8.2	99	8		Calm		16.5	78		SE	7	
17	Su	8.2	19.9	14.4	1.0					13.6	97	8	N	2		19.1	34		WNW	24	
18	Mo	9.8	17.1	0	4.0		W	52	21:21	13.0	70	8	NW	20		13.4	96		W	15	
19	Tu	11.7	17.1	15.6	2.5		SW	48	14:49	13.2	94	8	WSW	13		15.6	67		SSW	26	
20	We	11.0	17.9	2.0			SSE	30	14:43	13.4	62		WSW	11		14.9	66		S	15	
21	Th	6.5	15.9	0.2	3.8					11.2	97	8		2		14.0	92		NE	7	
22	Fr	11.2	19.9	4.2	1.0		SE	28	15:22	13.7	94	5	SE	2		17.3	65		ESE	13	
23	Sa	7.3	17.4	0	4.0		SE	26	11:48	12.9	96	4	NE	4		15.4	93		E	7	
24	Su	8.9	19.4	2.6	0.6					13.8	94	5	N	7		17.1	80		ESE	7	
25	Mo	7.4	20.5	0.8			SSE	24	15:09				NNE	7		20.3	54		SSE	9	
26	Tu	8.3	17.7	0.2	2.8		SE	20	11:21	13.4	96	8		Calm		16.1	82		S	9	
27	We	12.4	19.4	25.4	0.6					17.6	64	2	SE	17		14.1	93		S	9	
28	Th	11.5	18.6	14.8	1.4		SSE	43	13:20	14.3	89	4	SW	9		17.4	57		SSE	13	
29	Fr	8.9	17.9	4.2	1.0		SSW	41	14:33	13.2	73	4	W	15		15.7	71		SW	13	
30	Sa	12.3	17.6	0.4	1.3		SW	31	14:35	14.0	71	8	WSW	13		16.9	70		SW	15	
31	Su	13.2	22.4	0	2.2					16.7	68	4	W	11		21.2	49		W	11	
Statistics for August 2014																					
	Mean	7.1	18.7		2.4					12.4	76	4		9		17.0	58			12	
	Lowest	1.2	15.9		0.6					7.6	20	0		Calm		13.4	26		#	7	
	Highest	13.2	22.4	25.4	7.6		NW	59		19.3	99	8	NW	26		21.2	96		W	31	
	Total			85.2	68.3																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
September 2014 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	6.8	23.8	0	1.8		NW	39	12:35	13.6	84	0	ENE	9		23.6	33		NW	19	
2	Tu	10.8	18.9	0			SW	50	23:06	15.8	58	7	NW	4		16.4	63		WNW	13	
3	We	9.1	17.6	3.8	1.0		SW	54	13:05	13.4	46	7	WSW	28		17.3	34		SW	26	
4	Th	9.8	17.8	0	4.0		SSW	41	15:09	13.9	47	1	WSW	20		16.6	41		SSW	19	
5	Fr	10.1	18.6	0.4	1.6		S	48	14:49	13.1	69	8	W	11		13.8	74		SSW	17	
6	Sa	9.3	19.0	3.6			SE	30	12:12	13.1	86	8	WSW	9		18.4	54		SE	15	
7	Su	8.9	18.8	1.6	2.9					13.9	88	7	NNE	7		17.6	65		SE	15	
8	Mo	5.3	20.8	0	1.6		ESE	35	14:31	14.8	83	1		Calm		19.6	54		ENE	19	
9	Tu	7.8	24.7	0	2.0		NNE	17	00:23	15.9	73	0	ENE	7		24.1	45		SE	7	
10	We	12.8	24.2	3.8	2.8					14.6	86	5	N	13		22.9	33		WNW	26	
11	Th	11.0	24.2	0.2	4.0		NW	31	15:26	17.7	46	0	WNW	15		23.9	31		NW	17	
12	Fr	9.3	19.1	0			ESE	30	14:16	16.5	73	7	SW	11		17.5	64		ESE	15	
13	Sa	11.1	21.8	0	1.2		S	28	15:58	17.8	72	4	SE	11		20.7	62		SSE	15	
14	Su	9.1	26.0	0	1.0					13.8	100	8	NE	9		25.6	30		WNW	15	
15	Mo	12.0	23.4	0			S	28	14:55	17.7	73	5	SW	11		22.2	47		S	19	
16	Tu	11.7	26.1	0	3.4		W	48	15:34	17.4	76	3	NNW	7		25.9	29		NW	19	
17	We	13.5	23.3	0	6.4		NNW	43	14:46	17.6	40	2	W	17		22.8	24		NW	20	
18	Th	9.0	22.1	0	8.0					16.3	34	0	WNW	22		18.7	37		SE	20	
19	Fr	4.6	19.4	0	4.0		NW	20	09:16	14.1	56	6	NE	6		19.0	32		NNW	9	
20	Sa	3.3	20.9	0	5.8		SSE	43	13:00	13.6	64	1	E	7		19.5	47		SE	19	
21	Su	7.2	20.4	0.2	1.2					15.7	78	2	NE	7		19.4	52		ESE	15	
22	Mo	6.7	21.9	0.2	2.4		S	28	12:57	14.8	78	5	NE	7		20.4	44		SE	17	
23	Tu	4.8	23.6	0	2.6		SE	30	14:49	14.5	70	0	ESE	6		22.0	52		SSE	17	
24	We	6.9	26.5	0	2.6		SE	22	13:35	16.9	72	0	NE	9		26.0	36		SE	9	
25	Th	12.4	24.6	0.2	4.2					18.4	73	8	ESE	2		19.9	72		N	13	
26	Fr	13.9	21.9	9.4	4.0		W	26	08:40	16.9	70	8	W	15		20.6	56		SSE	13	
27	Sa	12.1	20.8	0	1.5		SE	31	12:34	16.2	78	7	ENE	4		19.6	53		SE	13	
28	Su	7.2	25.1	0	1.4					16.2	75	0	NNE	7		23.9	32		NNW	9	
29	Mo	8.1	30.6	0	5.6		NNW	41	13:08	21.5	49	0	ENE	7		29.9	21		NW	19	
30	Tu	12.0	32.9	0	6.4		NW	41	13:21	22.5	52	4	NE	9		30.5	21		NNW	28	
Statistics for September 2014																					
	Mean	9.2	22.6		3.2					15.9	68	3		9		21.3	44			16	
	Lowest	3.3	17.6		1.0					13.1	34	0		Calm		13.8	21		SE	7	
	Highest	13.9	32.9	9.4	8.0		SW	54		22.5	100	8	WSW	28		30.5	74		NNW	28	
	Total			23.4	83.4																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
February 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	16.1	27.4	0	4.4					19.9	89	8	NE	7		26.3	59		SE	19	
2	Mo	17.8	25.9	0	7.2		SE	39	13:52	20.8	82	4	SW	2		24.8	61		SE	24	
3	Tu	15.5	25.7	5.4	8.0		ESE	31	12:04	17.9	89	6	SW	9		23.5	54		SSE	17	
4	We	13.3	25.6	0.2	4.0					19.4	80	1	NE	7		24.6	55		S	13	
5	Th	15.7	24.3	1.2	1.6		SE	35	12:45	19.1	94	8	SE	2		24.1	56		SE	13	
6	Fr	13.8	25.6	1.4	1.6		ESE	31	16:13	19.0	83	2	ENE	6		24.7	47		SE	17	
7	Sa	16.3	28.4	0	6.4					20.4	77	7	SE	11		27.5	52		SSE	13	
8	Su	15.3	34.5	0	3.0		W	20	13:59	21.3	83	2	NE	11		33.7	28		WNW	11	
9	Mo	17.7	29.0	0	6.4		SE	35	13:42	25.8	79	4	SSE	13		27.5	62		SE	20	
10	Tu	18.9	29.5	0						24.3	84	1	S	7		29.0	54		E	20	
11	We	16.7	30.1	0	1.8		SE	30	16:09	23.4	80	1		Calm		29.1	52		ESE	13	
12	Th	16.4	31.6	0	7.4					22.5	78	0	N	7		30.9	49		S	17	
13	Fr	19.3	28.6	0	4.0					22.8	82	6		Calm		27.2	56		SE	19	
14	Sa	15.9	30.3	0	3.4					22.2	76	0		Calm		28.6	41		NE	15	
15	Su	16.9	32.7	0	4.6					22.3	73	3		Calm		31.3	40		SSE	11	
16	Mo	16.2	32.2	0.4	8.8		ESE	33	16:56	21.7	81	0	E	2		30.7	39		SSW	7	
17	Tu	18.2	31.4	0.2	7.2		E	39	16:48	24.0	65	1	ENE	15		30.8	37		NE	20	
18	We	17.9	29.5	0	10.1		NE	39	12:15	24.5	61	1	ENE	11		28.3	47		ENE	20	
19	Th	16.2	27.9	0	4.0		NE	35	11:10	21.6	81	7	W	2		24.9	63		ENE	17	
20	Fr	17.2	26.4	0	2.2					21.3	89	8		Calm		24.9	77		SSE	9	
21	Sa	20.0	25.7	12.4	4.8		NE	30	23:27	21.3	86	7	NE	7		24.0	79		ENE	13	
22	Su	19.8	27.4	2.0	3.4		ESE	31	15:33	22.1	93	7	S	6		26.2	68		SE	19	
23	Mo	20.4	28.8	1.4	1.4					22.4	91	7	SSE	6		27.3	66		SE	17	
24	Tu	19.3	29.2	0.2	4.2		S	37	14:20	21.1	95	7		Calm		26.4	68		SSE	19	
25	We	20.0	28.2	2.0	3.8		SSW	33	15:14	21.3	89	8	SSW	7		26.8	59		SSE	13	
26	Th	19.9	28.5	4.0						21.9	87	8	SSW	4		27.6	57		ENE	9	
27	Fr	19.0	28.9	2.4			SE	28	15:26	22.1	89	6	SSW	6		28.1	57		S	15	
28	Sa	16.5	30.8	0			SE	24	17:13	19.3	97	0	NNW	6		29.1	54		NNW	7	
Statistics for February 2015																					
Mean		17.4	28.7		4.7					21.6	83	4		5		27.4	54			15	
Lowest		13.3	24.3		1.4					17.9	61	0		Calm		23.5	28		#	7	
Highest		20.4	34.5	12.4	10.1		#	39		25.8	97	8	ENE	15		33.7	79		SE	24	
Total				33.2	113.7																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
June 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	10.9	17.4	1.4	0.6		WSW	52	11:17	15.1	54	1	WNW	17		15.7	24		SW	22	
2	Tu	5.0	15.2	0	0.8		NW	24	12:14	10.5	50	0	NW	13		14.4	46		W	11	
3	We	2.9	16.5	0	1.0		WSW	19	11:05	8.8	78	0	NNE	9		15.3	53		WSW	7	
4	Th	1.2	16.8	0			W	24	14:14	7.3	91	0	NE	7		15.9	41		W	11	
5	Fr	4.1	14.4	0.6			NW	31	04:49	10.2	76	8	WNW	11		13.8	59		WNW	11	
6	Sa	6.3	19.4	0						10.8	78	1	NNE	6		18.2	58		WNW	7	
7	Su	4.4	21.4	0.2	1.4		NW	28	14:29	8.7	95	0	NE	7		20.8	49		NNW	15	
8	Mo	6.6	21.7	0	1.6		NW	41	12:18	9.8	95	7		Calm		21.0	40		NNW	24	
9	Tu	8.1	22.8	0			NNW	44	14:21	10.4	89		WSW	4		21.8	36		WNW	22	
10	We	9.3	16.7	0	7.2		S	24	13:28	12.2	75	7	NE	7		14.1	96		S	9	
11	Th	11.0	16.8	3.6	0.2		SSW	19	12:59	12.6	97	7	NNW	9		15.4	81		ENE	6	
12	Fr	11.2	18.4	0.2			SSE	13	07:34	13.1	97	8		Calm		16.9	68		SE	7	
13	Sa	11.7	20.1	0	0.2		N	19	12:22	13.3	88	6	NE	6		18.5	56		SSW	6	
14	Su	6.6	19.4	0	0.1		WSW	15	12:40	10.9	94	3	NNE	6		18.3	63		SE	7	
15	Mo	6.9	18.7	0.2	1.0					10.4	100	8		Calm		18.1	73		E	9	
16	Tu	10.3	18.0	0	1.0		NNE	37	08:57	17.1	76	6	NE	26		15.3	97			Calm	
17	We	13.3	17.4	14.4	0.6		NW	44	23:43	13.7	100	8		Calm		16.9	91			Calm	
18	Th	12.3	18.6	4.0	0.8					16.2	62	1	NW	9		16.9	60		WNW	13	
19	Fr	10.9	13.3	0	1.3		WSW	26	05:21	11.4	85	8	W	13		13.1	84		W	13	
20	Sa	7.8	14.3	5.4	0.8		W	19	12:15	10.8	78	8	WNW	6		13.6	61		NNW	11	
21	Su	4.3	16.5	0	1.1					8.2	87	6	ENE	7		15.4	61		SW	9	
22	Mo	2.7	17.3	0.2	2.4		ESE	15	12:29	6.5	95	0	NE	9		16.6	58		NE	7	
23	Tu	4.1	20.1	0	1.6		NE	17	14:12	9.3	86	0	NE	2		19.9	48		NNE	13	
24	We	7.3	15.3	0.2	4.6					10.9	85	4		Calm		14.8	76		NE	7	
25	Th	9.4	19.5	0.2	0.3		S	28	15:35	13.4	87	7	NE	11		18.7	57		SSW	9	
26	Fr	8.9	18.1	2.8	0.8		SSE	22	12:36	12.6	92	2	NE	2		17.2	52		S	9	
27	Sa	4.1	18.7	0.2	3.2		E	13	11:37	8.9	95	1	NE	9		17.8	58		NNE	7	
28	Su	2.5	18.1	0.2	2.2		SW	20	14:29	8.5	88	1	ENE	7		17.1	51		SW	9	
29	Mo	4.5	18.3	0	0.2		SE	17	13:45	8.4	92	2	NE	7		17.3	66		ESE	7	
30	Tu	5.6	15.3	0.2	0.2		NE	13	06:15	7.4	100	8	NE	9		15.2	80			Calm	
Statistics for June 2015																					
Mean		7.1	17.8		1.4					10.9	85	4		7		16.8	61			9	
Lowest		1.2	13.3		0.1					6.5	50	0		Calm		13.1	24			Calm	
Highest		13.3	22.8	14.4	7.2		WSW	52		17.1	100	8	NE	26		21.8	97		NNW	24	
Total				34.0	35.2																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
July 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	7.4	17.3	1.2	0.4		WNW	19	23:41	13.1	93	7	ENE	6		16.7	71		NE	9	
2	Th	7.3	14.7	0.2	1.0		WNW	41	12:56	9.5	64	4	WNW	9		14.2	44		NW	15	
3	Fr	6.0	16.2	0	1.0		WSW	24	05:45	9.4	53	7	NW	11		14.6	54		WSW	9	
4	Sa	2.0	17.3	0	1.4		WNW	43	12:21	7.3	90	4	NE	7		16.4	40		WNW	17	
5	Su	1.7	18.8	0	1.2		W	31	12:48	7.7	76	2		Calm		17.7	42		WNW	13	
6	Mo	4.0	17.1	0	2.4					13.3	54	0	NW	20		16.2	33		WNW	19	
7	Tu	7.1	17.5	0	4.0		W	31	10:33	12.5	52	0	WNW	13		15.0	54		SSE	13	
8	We	5.4	16.9	0.2	1.2		SE	22	13:15	10.0	88	1	NE	6		14.6	68		SE	11	
9	Th	2.7	17.4	0.2	1.2		ESE	17	14:35	7.1	95	0	N	2		16.6	53		SE	6	
10	Fr	4.4	18.6	0	4.2		W	26	18:43	7.4	100		E	6		17.9	58		NNE	7	
11	Sa	3.7	18.7	0.4	2.2		N	48	20:49	9.3	95	0	NE	4		18.4	59		E	7	
12	Su	7.6	13.0	2.2	1.5					9.0	61	6	WNW	28		10.8	60		NW	30	
13	Mo	8.3	16.4	0	2.2		NW	61	07:11	11.4	66	8	NW	30		16.1	48		WNW	24	
14	Tu	8.9	16.9	0.8	4.2		WNW	54	13:44	12.8	59	1	WNW	22		15.0	38		NW	26	
15	We	3.4	16.1	0	4.3					8.5	75	1	NNW	4		15.2	45		SW	11	
16	Th	3.4	16.4	0			WNW	41	13:24	11.6	73	6	NE	7		13.3	51		WNW	15	
17	Fr	6.4	13.3	0			NW	46	04:29	7.8	69	8	WNW	26		12.5	59		W	17	
18	Sa	7.4	14.8	0.8						10.0	57	5	W	13		13.7	53		SSW	13	
19	Su	5.7	15.3	0.4	0.8		SW	22	14:53	10.2	84	8	NNW	6		13.9	75		SW	15	
20	Mo	6.1	17.8	0.2	1.8		SSE	22	14:16	9.7	99	1	NW	2		15.6	73		SE	11	
21	Tu	5.0	17.9	0.2	1.2		NE	24	16:18	6.5	100	8	E	4		16.5	69		SW	13	
22	We	4.8	14.9	0	1.4		ENE	11	06:10	7.3	99	8		Calm		14.6	74		ENE	2	
23	Th	7.3	17.0	2.0	0.8		NE	15	12:20	10.4	99	8	NE	9		16.2	74		NE	7	
24	Fr	8.6	18.7	0.2	0.4					11.4	100	8	NW	2		16.9	87		NE	9	
25	Sa	10.9	19.8	1.8	2.6		NW	54	12:15	15.7		1	NNW	19		19.0	33		NW	30	
26	Su	10.9	20.2	2.2	4.0		WNW	59	12:27	14.4	51	7	NW	19		19.1	36		NW	31	
27	Mo	7.8	15.5	0	2.2					10.9	47	0	WNW	17		14.7	34				
28	Tu	3.5	16.2	0	2.0		WSW	26	11:03	9.8	56	0	N	7		15.1	44		SSW	9	
29	We	3.9		0	2.4					9.1	74	3	NE	6		16.6	100		ENE	4	
Statistics for the first 29 days of July 2015																					
Mean		5.9	16.8		2.0					10.1	76	4		10		15.6	56			14	
Lowest		1.7	13.0		0.4					6.5	47	0		Calm		10.8	33		ENE	2	
Highest		10.9	20.2	2.2	4.3		NW	61		15.7	100	8	NW	30		19.1	100		NW	31	
Total				13.0	52.0																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
August 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	2.7	24.1	0			NW	37	13:21	9.3	78		ENE	4		22.9	29		WNW	17	
2	Su	6.1	27.9	0	2.0					13.2	66	1	E	9		26.5	20		NW	35	
3	Mo	11.4	19.0	0	8.0		WNW	48	12:30	13.6	75	0	WSW	15		17.6	31		NW	20	
4	Tu	4.0	15.4	0	8.0		WNW	28	20:22	10.5	58	7	WSW	6		13.7	44		W	19	
5	We	5.4	15.1	0	2.0					10.0	40	0	NW	22		14.5	34		WNW	30	
6	Th	8.0	16.7	0	3.0		WNW	39	09:30	11.2	57	0	WNW	20		15.7	31		SW	17	
7	Fr	2.7	17.2	0	2.2		W	30	11:51	10.0	66	0	ENE	7		16.2	39		W	13	
8	Sa	2.9	16.9	0	3.0					9.8	71	4	ENE	9		15.4	55		S	9	
9	Su	2.6	18.6	0	2.6		E	19	12:57	8.9	84	3	NE	7		17.7	53		ESE	13	
10	Mo	4.1	20.4	0	2.8		WNW	43	12:55	10.9	76	0	NE	9		19.7	31		WNW	17	
11	Tu	2.3	22.6	0	1.8		WNW	26	13:56	12.3	62	0	NE	7		20.1	31		W	13	
12	We	2.0	19.2	0	4.0		NW	56	20:23	8.9	72	3	NNE	4		16.5	42		WSW	15	
13	Th	8.8	18.7	0	3.8		NW	50	01:37	12.8	52	0	WNW	22		18.1	33		NW	20	
14	Fr	5.9	18.4	0	2.4					12.8	55	0	NNE	2		17.6	40		WNW	17	
15	Sa	2.4	18.3	0	1.6		SSE	22	15:15	9.1	81	1	NE	13		17.3	60		SSE	11	
16	Su	9.0	21.4	0.2	1.0		E	19	12:02	12.4	95	8	WSW	6		20.9	45		ESE	7	
17	Mo	5.6	19.9	0.2	4.0					14.6	54	0	WNW	15		18.9	33		NW	19	
18	Tu	6.4	18.4	0	4.0		W	31	09:37	13.6	55	0	WNW	15		17.4	33		W	9	
19	We	2.6	19.4	0	2.0		ESE	30	12:45	10.1	77	0	ENE	7		18.1	42		SSE	6	
20	Th	4.6	21.2	0	2.0					11.5	82	0	NNE	6		20.3	43		ESE	9	
21	Fr	5.4	23.6	0	2.4		NE	20	14:18	11.9	85	0	ENE	7		22.4	35		NE	11	
22	Sa	8.6	27.8	0	3.4		NW	33	13:55	17.5	57	3	NE	2		27.4	31		NW	13	
23	Su	11.3	16.7	8.8			NNE	28	12:39	14.0	97	8	NW	6		15.4	96		NNE	15	
24	Mo	13.8	18.1	30.2	4.0		NE	35	00:49	15.0	97	8	ENE	2		17.8	87		S	6	
25	Tu	13.8	20.7	2.8	1.0		NW	50	21:31	16.8	75	4	W	17		18.9	57		WNW	20	
26	We	13.3	19.8	0	2.2		NW	48	00:07	15.0	61	8	NW	24		18.7	55		WNW	17	
27	Th	11.2	18.5	0	4.0					16.1	66	7	WNW	13		17.1	54		NW	17	
28	Fr	10.6	19.6	0	1.8		W	46	10:45	14.4	53	0	WNW	22		19.1	37		WNW	22	
29	Sa	5.0	19.8	0	2.2					12.5	70	0	ENE	7		19.3	37		WNW	19	
30	Su	4.6	19.1	0	2.4					12.6	53	1	W	13		18.7	37		W	9	
31	Mo	6.8	19.8	0	7.0		W	26	10:13	14.3	66	2	NNE	7		18.8	41		W	13	
Statistics for August 2015																					
Mean		6.6	19.8		3.1					12.4	68	2		10		18.7	43			15	
Lowest		2.0	15.1		1.0					8.9	40	0	#	2		13.7	20		#	6	
Highest		13.8	27.9	30.2	8.0		NW	56		17.5	97	8	NW	24		27.4	96		NW	35	
Total				42.2	90.6																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
September 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	7.4	20.1	0	1.4					14.0	52	0	WNW	17		19.9	27		WNW	19	
2	We	3.8	20.4	0	4.0		NE	19	20:23	11.0	69	6	E	7		20.1	30		ENE	11	
3	Th	10.7	18.5	8.6	4.8		WSW	61	13:32	17.7	41	1	NW	22		14.4	70		NW	19	
4	Fr	11.4	15.6	2.4	2.8		W	33	00:38	13.7	86	8	WSW	7		14.7	93		E	6	
5	Sa	8.7	21.3	3.0	4.8		SSE	28	15:49	10.9	100	7	NE	9		20.8	41		WSW	11	
6	Su	10.9	18.9	7.2	1.2		SSE	24	12:15	14.1	94	6	NE	9		17.6	69		SE	13	
7	Mo	7.7	24.5	0.2	1.0		WNW	44	11:56	14.9	61	0	NE	9		23.6	31		NNW	20	
8	Tu	7.1	19.8	0	4.0		WNW	41	09:03	13.3	39	0	WNW	24		19.3	30		NW	17	
9	We	7.1	20.8	0	4.0		NW	31	00:40	15.9	51	0	W	17		20.4	35		W	13	
10	Th	9.2	18.7	0.4	4.6					13.3	88	3	NE	11		17.8	54		SE	15	
11	Fr	7.6	22.2	0	2.2		SE	22	16:36	14.0	74	1	ENE	6		21.8	38		WSW	6	
12	Sa	7.0	26.1	0	1.6		WSW	39	12:21	15.7	76	0	NE	6		25.4	32		NNW	9	
13	Su	8.0	25.4	0	1.2					17.3	71	0	NE	2		24.8	38		S	9	
14	Mo	8.3	25.8	0	8.0		ESE	24	17:17	17.1	72	0	NNE	6		25.6	34		ENE	9	
15	Tu	9.2	27.9	0	4.0		NNW	52	13:24	19.6	67	0	NE	7		27.4	31		NW	26	
16	We	9.1	23.2	0	6.0					17.6	45	0	SE	11		21.3	42		SSE	15	
17	Th	12.2	20.7	0	7.0		SW	35	15:39	18.2	69	6	N	7		18.2	58		S	19	
18	Fr	11.6	19.5	16.0	6.0		SSE	37	14:03	16.6	66	6	SSW	9		17.8	58		SE	17	
19	Sa	11.2	19.4	2.4	2.8					15.3	88	7	W	6		18.2	65		SE	19	
20	Su	13.0	20.5	3.0	3.0		SE	26	14:34	15.4	89	8	SSE	7		17.6	86		SE	13	
21	Mo	9.5	24.1	0	1.6					16.5	80	1	N	7		23.4	40		WSW	13	
22	Tu	11.3	21.9	0	2.2							7				17.3	56		SSE	17	
23	We	8.9	16.6	0.6	4.2		S	46	12:36	12.3	57	8	SW	11		15.1	48		SSW	15	
24	Th	8.8	17.3	0.2	4.0		SSW	44	14:30	12.6	52	5	WSW	17		15.5	46		SW	24	
25	Fr	9.7	15.7	8.0	2.0					12.4	88	8	W	7		14.9	76		SSW	17	
26	Sa	11.0	19.5	9.0			SSE	33	14:14	13.9	83	7	N	7		17.3	59		SSE	15	
27	Su	10.7	18.5	2.0	2.4		SSW	39	10:48	14.2	80	8	SW	20		17.7	59		SE	17	
28	Mo	6.6	21.9	0	4.0					16.3	62	0	W	11		20.8	48		SW	9	
29	Tu	6.4	25.8	0	4.0		N	30	14:44	15.7	72	0	NNE	7		25.5	21		WNW	9	
30	We	8.7	23.8	0	4.0		SE	31	14:20	18.8	52	1	N	4		21.2	63		SE	19	
Statistics for September 2015																					
Mean		9.1	21.1		3.5					15.1	70	3		10		19.8	49			14	
Lowest		3.8	15.6		1.0					10.9	39	0	NE	2		14.4	21		#	6	
Highest		13.0	27.9	16.0	8.0		WSW	61		19.6	100	8	WNW	24		27.4	93		NW	26	
Total				63.0	102.8																

Observations were drawn from Paterson (Tocal AWS) [station 061250]

Paterson, New South Wales
October 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Th	11.9	27.3	0	3.6					17.0	90	0	NNE	7		26.9	40		ENE	11	
2	Fr	12.5	25.7	0	4.0		SE	31	12:32	19.0	75	5	NNE	7		22.5	55		SSE	15	
3	Sa	10.4	31.5	0	6.2		NNW	31	13:21	19.8	76	1	NNE	2		30.8	26		NW	15	
4	Su	12.5	34.3	0	2.0					20.2	59	3	E	7		33.7	16		NNW	22	
5	Mo	11.5	35.9	0	3.8		WNW	37	11:57	20.4	57	0	NNE	2		34.6	14		NNW	13	
6	Tu	12.6	35.5	0	10.2		ESE	22	16:36	20.0	55	0	NE	7		35.0	21		ENE	11	
7	We	13.3	22.2	0	8.0					21.5	73	0	S	19		19.1	73		SSE	15	
8	Th	13.0	20.4	0	2.6		E	33	12:23	16.0	88	8		Calm		19.2	70		E	13	
9	Fr	12.2	25.8	0	1.8		NNE	26	08:42	18.7	59	0	NE	15		25.5	44		SSW	9	
10	Sa	10.0	27.9	0.2	2.0					17.8	80	0	NE	15		27.3	39		SE	11	
11	Su	11.2	30.2	0	2.8		S	35	16:22	17.9	83	4	ENE	9		28.7	30		W	15	
12	Mo	13.3	33.0	1.0	9.0		NNW	39	14:49	19.7	79	0	NE	9		32.6	21		NW	17	
13	Tu	17.9	24.4	0	5.6					21.1	82	7	SSW	13		23.1	67		SE	19	
14	We	14.2	26.0	0	4.0		SE	31	15:48	20.5	75	4	N	2		25.3	53		E	17	
15	Th	12.2	28.4	0	4.0		NE	17	11:17	16.5	91	8	NE	6		27.5	38		ENE	11	
16	Fr	11.6	33.0	0	4.0					18.9	66	0	NE	7		32.2	19		NNW	13	
17	Sa	14.7	28.8	0	11.4		SE	30	13:13	22.2	62	1	SE	2		27.4	58		ESE	17	
18	Su	19.2	21.5	0	5.6		SE	30	10:53	20.2	92	8	SSE	9		20.0	81		SSE	11	
19	Mo	16.0	29.8	0	0.8					20.1	85	6	E	7		29.4	35		SE	7	
20	Tu	13.0	33.8	0	4.0		WSW	33	21:14	20.9	70	0	ENE	7		32.3	29		SE	11	
21	We	16.1	35.1	0	5.6					24.8	58	1	ESE	6		34.1	20		WNW	13	
22	Th	17.6	26.6	2.6	7.0					17.9	96	8	S	2		24.9	46		N	9	
23	Fr	14.1	22.0	5.2	5.0		SW	37	23:09	16.6	76	8	SW	13		19.9	50		SSE	13	
24	Sa	9.1	25.0	0	1.8		ENE	26	09:52	16.6	74	1	E	9		23.8	52		ESE	17	
25	Su	10.5	29.7	0	3.2		ESE	26	16:07	18.4	75	3	ENE	4		28.8	35		E	9	
26	Mo	13.6	33.8	1.0	8.0		W	76	14:26	21.4	73	0	NE	6		30.2	30		W	15	
27	Tu	16.3	18.2	1.8	6.8		SSW	41	03:55	16.8	86	8	SSW	15		17.5	59		S	15	
28	We	11.3	21.6	1.6	3.2					18.0	61	1	ESE	7		20.5	44				
29	Th	11.3	24.4	0.2	4.0		E	37	13:29	19.0	64	5	NE	4		22.8	48		E	19	
30	Fr	8.6	26.0	0	4.0		ESE	33	13:28	17.7	73	0	NE	6		24.8	43		SSE	17	
31	Sa	12.5	26.0	0	2.0					20.8	64	4	ESE	6		21.6	69		W	9	
Statistics for October 2015																					
Mean		13.0	27.9		4.7					19.2	74	3		7		26.5	42			13	
Lowest		8.6	18.2		0.8					16.0	55	0		Calm		17.5	14		SE	7	
Highest		19.2	35.9	5.2	11.4		W	76		24.8	96	8	S	19		35.0	81		NNW	22	
Total				13.6	146.0																

Observations were drawn from Paterson (Tocal AWS) [station 061250]

Paterson, New South Wales
July 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	3.0	15.3	0	0.2					9.3	76	2		Calm		14.6	62			Calm	
2	Mo	9.1	16.6	0.2			S	19	12:58	11.9	92	8	ENE	9		16.0	63		SE	11	
3	Tu	8.5	16.7	0.2			WSW	13	11:38	10.4	100	7		Calm		16.2	76		NE	6	
4	We	7.1	19.8	0.4						10.4	100	8		Calm		19.2	72		E	6	
5	Th	9.6	22.8	0.2			ENE	11	08:56	11.4	100	0	NE	9		22.0	64		SE	7	
6	Fr	8.6	25.0	0.2			NW	63	13:13	14.0	94			Calm		24.3	37		NW	22	
7	Sa	7.5	17.3	0	0.2		NNW	61	14:29	13.5	40	0	WNW	24		16.1	34		WNW	26	
8	Su	9.1	15.6	0			NW	57	14:14	11.8	48		NW	28		14.1	46		NW	30	
9	Mo	8.6	17.6	0	14.0		NW	37	00:09	13.7	56	0	NW	7		16.0	43		SW	9	
10	Tu	6.1	16.7	0						9.0	81	7	NE	6		16.1	55		ESE	9	
11	We	2.7	18.4	0			SE	13	16:23	7.1	99	1	NE	7		17.3	53		S	6	
12	Th	2.4	19.5	0	4.2		NW	30	15:52	8.4	87	1		Calm		18.8	31		NNW	17	
13	Fr	3.1	18.0	0	1.2					10.6	50	0	WNW	13		15.7	35		NW	15	
14	Sa	4.1	16.4	0	0.2		W	22	10:49	8.9	66	0	NE	7		15.3	35		W	11	
15	Su	-0.9	17.8	0	2.0		W	33	12:22	6.2	68	0	ENE	7		16.9	19		NW	13	
16	Mo	0.4	16.6	0						11.0	43	0	W	11		16.2	20		NW	15	
17	Tu	6.1	21.6	0	19.0		NW	43	14:11	12.8	43	0	NW	6		20.5	16		NW	20	
18	We	8.7	22.0	0	6.6		W	37	14:24	14.2	41	0		Calm		20.9	24		WNW	17	
19	Th	2.5	24.0	0						8.9	71	0	NE	4		22.0	24		WSW	11	
20	Fr	2.5	22.4	0	4.4		WNW	72	12:07	18.6	33	5	NNE	13		18.9	27		WNW	33	
21	Sa	7.4	16.7	0	0.2		WNW	41	00:33	12.2	42	0	WNW	13		15.5	28		WNW	13	
22	Su	-0.3	17.0	0	3.0		SE	15	13:53	6.1	74	1		Calm		15.9	29		SSW	6	
23	Mo	0.5	19.3	0	17.6					6.9	75	0		Calm		18.0	29		NE	6	
24	Tu	3.6	24.4	0			NNW	44	12:55	10.9	56	0		Calm		23.2	14		WNW	20	
25	We	5.0	22.8	0			NNW	33	12:36	12.8	47		E	9		21.9	22		NW	13	
26	Th	3.3	21.4	0						11.4	64		NE	4		20.7	28		WNW	13	
27	Fr	2.5	20.2	0			SSW	19	16:13	9.3	80	0	NE	9		19.3	33		SSW	6	
28	Sa	4.9	21.4	0	0.2		ENE	26	22:32	11.2	74	7	WNW	2		20.8	40		ESE	9	
29	Su	9.7	23.3	0	3.2					13.4	77	7	SW	9		21.7	43		NNW	24	
30	Mo	8.7	18.4	0	19.0		WNW	50	11:05	13.3	38	0	WNW	20		17.9	26		NW	22	
31	Tu	8.4	20.4	0	16.2		NNW	48	11:05	13.6			W	9		19.2			NNW	22	
Statistics for July 2018																					
Mean		5.2	19.5		6.6					11.1	67	2		7		18.4	37			14	
Lowest		-0.9	15.3		0.2					6.1	33	0		Calm		14.1	14			Calm	
Highest		9.7	25.0	0.4	19.0		WNW	72		18.6	100	8	NW	28		24.3	76		WNW	33	
Total				1.2	111.4																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

IDCJDW2106.201807 Prepared at 13:00 UTC on 16 Nov 2018

Paterson, New South Wales
September 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	9.9	20.8	4.2	1.4					17.1		1	NW	19							
2	Su	10.5	18.1		0.8					15.4		2	WSW	13		15.6			SSE	17	
3	Mo	7.0	17.2	0	7.0					13.5		6	ESE	7		14.1			SSE	17	
4	Tu	10.7	16.8	10.2	2.2		ESE	28	13:45	11.2		7		Calm		15.4			SSE	9	
5	We	7.2	17.7	1.4	1.2		ESE	30	15:52	11.2			NNE	7		16.7			SE	17	
6	Th	7.9	22.7	2.6	5.6					15.6		5	SSW	6		22.1			E	9	
7	Fr	13.4	19.6	6.0	2.6		NE	26	07:31	17.9		2	NE	11		17.5			SSW	9	
8	Sa	11.6	16.9	1.8	0.4		SW	20	11:16	16.4		8	S	11		16.2			S	11	
9	Su	10.3	22.2	0						15.8		3	W	13		21.3			NNW	19	
10	Mo	9.3	21.1	0	18.4		ESE	24	11:19	18.5		0	WSW	9		20.4			ESE	9	
11	Tu	6.4	23.9	0			NE	26	18:01	13.8		0	N	2		23.6			NNE	11	
12	We	7.9	29.2	0	17.9					15.8		1	NE	7		28.8			NNW	15	
13	Th	12.8	21.5	0	2.9		ESE	30	13:02	16.1		7	SE	7		19.7			SE	17	
14	Fr	14.5	27.9	0			SE	22	15:27	18.5		3	ENE	7		27.7			SE	9	
15	Sa	8.6	32.3	0	1.0					18.5		0	NE	7		31.8			NW	22	
16	Su	11.5	17.7	0	5.6		ESE	35	14:26	14.8		0	SW	13		16.1			SE	17	
17	Mo	4.0	19.4	0	12.0		SE	30	14:56	12.8		1	ENE	9		18.5			ESE	19	
18	Tu	4.6	26.0	0	3.0					14.8		0	NNE	4		25.7			NE	15	
19	We	8.8	29.7	0	4.0		NW	50	12:21	20.6		1	SSW	9		26.8			W	13	
20	Th	8.1	14.8	0	4.0		SE	19	11:00	11.8			E	11		12.8			ENE	7	
21	Fr	4.1	21.3	6.2	3.3					12.9		0	NNE	6		20.3			SSE	11	
22	Sa	5.4	25.2	0	0.2		NW	22	15:20	15.1		1	S	4		23.9			NW	11	
23	Su	8.7	23.1	0	1.0		SE	33	13:47	18.0		0	NE	7		20.7			SE	20	
24	Mo	12.1	15.1	3.8	10.4					13.4		8	SSW	11		14.0			ESE	9	
25	Tu	9.5	19.3	3.2	1.0		ESE	26	13:55	15.0		5	WSW	7		18.9			E	11	
26	We	6.7	18.7	0	2.8		WSW	28	10:40	15.1		3	SW	7		13.4	85		SE	11	
27	Th	7.7	21.5		1.7					11.5	92	8	NNE	6		20.9	43		NNE	9	
28	Fr	6.1	30.2	0.2			N	41	19:43	16.7	58		E	7		29.6	16		NNW	13	
29	Sa	14.9	25.7	0.4	2.2		SE	48	14:01	19.3	61	2	NW	9		20.4	38		SE	20	
30	Su	6.7	20.2	0	3.4					16.1	50	1	S	9		18.5	50		SSE	13	
Statistics for September 2018																					
Mean		8.9	21.9		4.5					15.4	65	2		8		20.4	46			13	
Lowest		4.0	14.8		0.2					11.2	50	0		Calm		12.8	16		ENE	7	
Highest		14.9	32.3	10.2	18.4		NW	50		20.6	92	8	NW	19		31.8	85		NW	22	
Total				40.0	116.0																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

IDCJDW2106.201809 Prepared at 16:00 UTC on 16 Nov 2018

Paterson, New South Wales
October 2018 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	5.7	22.3	0	4.8		ESE	30	15:58	16.6	67	1	N	6		21.7	45		ESE	13	
2	Tu	5.1	25.6	0	12.0		SE	28	13:44	17.6	61	1	S	2		24.0	44		SE	19	
3	We	8.4	28.7	0	4.0					17.1		5	NE	7		27.3	23		W	15	
4	Th	15.4	18.8	0	4.3		WSW	26	08:21	18.2	86	8	S	11		18.0	92		SSE	9	
5	Fr	14.3	17.0	39.0	2.8		SSW	46	11:10	16.1	97	8	SSW	20		15.0	99		SW	17	
6	Sa	12.8	19.2	43.4	8.4		SSW	50	13:40	14.0	97	8	WSW	13		16.5	81		S	17	
7	Su	11.0	20.2	1.4	2.0		SW	37	15:10	15.3	64	8	WNW	13		19.1	65		W	11	
8	Mo	13.0	24.2	2.6			W	31	07:47	18.3	63		W	17		21.3	62		SE	11	
9	Tu	10.7	26.2	0.2						16.5	87		NE	7		25.4	47		ESE	11	
10	We	13.6	19.0	0			SSW	31	13:23	18.9	85		WSW	11		16.4	87		S	13	
11	Th	12.2	16.6	26.0			SE	37	14:01	13.3	93			Calm		15.4	69		SE	15	
12	Fr	11.5	19.3	3.0	16.7					14.6	88	7	SSW	7		17.4	67		ESE	15	
13	Sa	10.1	21.0	0	0.4		ENE	39	12:45	14.5	84	5	ENE	6		19.0	73		E	11	
14	Su	13.8	23.0	2.4	2.9					18.9	79	3	E	13		21.9	58		ESE	17	
15	Mo	11.3	24.2	0.4			ESE	44	13:26	16.5	98	8	ESE	11		21.0	73		E	24	
16	Tu	15.3	24.9	0.6			NE	39	09:19	19.7	76	7	NE	11		23.6	58		ENE	20	
17	We	18.0	26.4	0	17.6		NE	37	19:26	21.4	77	8	NE	7		24.8	63		ENE	13	
18	Th	18.2	27.1	0.6						19.5	88	7		Calm		24.3	68		NE	17	
19	Fr	16.1	30.9	2.0			WSW	28	13:14	18.5	99	5	NNE	6		29.5	34		WNW	9	
20	Sa	16.3	30.2	0	1.2					21.6	80	7	ENE	9		29.5	48		NE	15	
21	Su	17.2	18.3	8.4	5.4		SSE	26	13:56	17.4	97	8	SSE	7		18.0	81		SE	13	
22	Mo	16.6	24.9	0.2	4.1		SE	24	14:06	18.0	91	8	SE	7		24.4	63		SE	15	
23	Tu	13.3	30.4	0	3.2		NE	28	18:20	18.0	91	4	NE	9		29.8	46		NE	7	
24	We	15.9	22.1	0	4.0		SE	33	13:49	18.6	77	8	WSW	9		19.8	70		SE	17	
25	Th	15.3	23.7	0.2	4.4		ENE	26	17:47	17.0	80	7	SE	6		22.1	59		E	11	
26	Fr	12.5	24.2	0	2.4					20.5	64	3	WSW	11		23.1	59		SE	20	
27	Sa	15.5	26.8	0	2.0		E	20	11:08	19.6	68	1	NE	7		26.0	45		S	11	
28	Su	15.9	18.3	0.6	4.6		SSE	35	08:00	15.9	89	8	SSE	19		16.5	78		SE	11	
29	Mo	10.9	23.3	0	5.4		SE	30	11:57	18.3	65	6	ESE	13		23.0	52		ESE	15	
30	Tu	10.0	29.0	0	4.0		NE	30	19:22	18.8	70	0	NE	6		27.8	45		NE	7	
31	We	15.5	31.0	0	6.1		SE	35	14:52	23.0	70	2	E	6		28.1	56		SSE	19	
Statistics for October 2018																					
	Mean	13.3	23.8		5.3					17.8	80	5		8		22.2	61			14	
	Lowest	5.1	16.6		0.4					13.3	61	0		Calm		15.0	23		NE	7	
	Highest	18.2	31.0	43.4	17.6		SSW	50		23.0	99	8	SSW	20		29.8	99		E	24	
	Total			131.0	122.7																

Observations were drawn from Paterson (Tocal AWS) (station 061250)

Paterson, New South Wales
March 2019 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	15.8	31.3	0						22.1	73	4	WSW	4		29.4	46		ESE	24	
2	Sa	16.2	30.2	0	5.8		SSE	35	14:44	21.7	71	6		Calm		28.2	51		SE	19	
3	Su	16.8	32.3	0	2.2		ESE	37	16:02	23.7	64	0	NE	11		30.9	33		NE	11	
4	Mo	15.8	34.8	0						22.1	73	0	NNE	6		33.2	30				
5	Tu	15.9	35.9	0	17.8		E	30	17:13	21.9	76	0	ENE	7		34.3	26		NW	7	
6	We	18.2	39.2	0	18.0		NNW	52	15:46	26.5	56	4	ENE	6		36.7	22		NW	22	
7	Th	19.8	23.5	1.6	19.6					20.1	64	8	SE	19		20.2	69		E	15	
8	Fr	17.4	32.8	0			E	31	17:28	23.5	64	0	NNE	13		31.5	40		NE	9	
9	Sa		33.8		2.4							6									
10	Su	20.7	34.0	44.8	4.3					22.5	92	8	SSW	6		32.2	45		NW	11	
11	Mo	20.0	31.2	0.2			ESE	31	13:04	26.9	52	0		Calm		28.8	53		SE	19	
12	Tu	21.5	36.1	0	16.4		NW	46	12:31	25.2	72	1	W	11		34.6	24		NW	20	
13	We	19.8	26.9	0	9.7					23.2	69	8	SE	13		25.1	63		ESE	24	
14	Th	21.9	30.5	0			ESE	33	15:25	24.4	73	3	ENE	11		29.4	56		E	15	
15	Fr	19.2	26.4	0	5.2		S	35	23:32	20.6	79	8	WSW	9		26.1	59		S	15	
16	Sa	18.4	23.4	1.4	1.8					20.0	81	8	NNW	4		19.4	95			Calm	
17	Su	18.5	24.8	29.0	5.8		SW	31	11:40	20.5	86	7	NW	11		23.7	68		SW	15	
18	Mo	18.1	25.9	5.2	11.7		SW	41	14:19	20.8	90	8	NNE	9		25.0	61		SW	20	
19	Tu	19.0	27.5	2.4	2.2		SW	31	15:10	20.3	83	8	NW	9		25.4	58		SSW	11	
20	We	17.2	27.6	13.4	2.2		SE	22	13:14	19.8	96	2	N	6		24.4	71		ESE	11	
21	Th	18.0	28.9	0.2	4.2		S	30	15:40	21.7	87	2	NW	7		26.0	64		S	15	
22	Fr	19.2	28.7	3.2						21.3	92	6		Calm		27.6	60		SSE	11	
23	Sa	14.5	30.6	0.4	1.8		WSW	37	21:08	17.9	88	1		Calm		29.3	50		SSE	9	
24	Su	17.9	34.6	7.0	0.0					22.3	87	0	NE	9		34.1	37		WSW	9	
25	Mo	20.9	27.2		10.4					22.5	84	8	WSW	4		26.4	57		NNW	26	
26	Tu	19.9	27.5		4.0		WNW	33	08:06	20.5	74	6	W	19		26.2	39		W	17	
27	We	13.3	25.9	0	16.8					18.2	79	3	NE	6		24.6	49		ESE	20	
28	Th	12.3	27.5	0			ENE	31	12:05	17.2	83	0		Calm		26.8	44		ESE	13	
29	Fr	13.1	29.6	0			NE	31	22:57	17.8	83	1	ENE	7		28.7	42		W	7	
30	Sa	17.8	26.9	52.2	5.0		WNW	63	16:48	18.3	96	8	NNE	7		25.4	61		W	24	
31	Su	12.9	22.4	4.6	6.2		WNW	43	08:49	14.9	47	0	WNW	20		20.8	34		W	20	
Statistics for March 2019																					
	Mean	17.7	29.6		7.5					21.3	77	4		7		27.8	50			15	
	Lowest	12.3	22.4		0.0					14.9	47	0		Calm		19.4	22			Calm	
	Highest	21.9	39.2	52.2	19.6		WNW	63		26.9	96	8	WNW	20		36.7	95		NNW	26	
	Total			165.6	173.5																

Observations were drawn from Paterson (Tocal AWS) {station 061250}

IDCJDW2108.201903 Prepared at 13:00 UTC on 14 Apr 2019

Paterson, New South Wales
June 2020 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	8.3	23.0	0	0.0		NNW	54	12:06	14.2	86	6		Calm		21.8	43		NNW	19	
2	Tu	8.4	14.9	0						10.6	63	8	WNW	22		13.7	53		WNW	28	
3	We	9.6	18.6	0			NW	41	07:14	13.7	59		W	17		17.2	43		SSW	13	
4	Th	6.6	16.6	0			SSW	19	11:05	13.3	59	4	W	9		15.8	59		S	11	
5	Fr	4.3	18.6	0						9.3	91	3		Calm		18.1	52		NW	13	
6	Sa	4.3	18.4	0			E	13	11:42	9.6	87	3	NE	2		17.5	60		SE	6	
7	Su	3.5	16.9	0			E	13	12:14	7.9	97	6	NE	7		16.1	67		SSE	6	
8	Mo	5.8	18.3	0						12.4	95	3	W	9		17.3	59		SSW	15	
9	Tu	9.7	17.8	10.0	2.4		SSE	20	13:27	12.4	97	6	WNW	2		16.6	90		SSE	9	
10	We	12.4	18.1	7.4			SE	17	16:31	15.4	96	8		Calm		17.3	85		SE	6	
11	Th	13.9	20.0	12.6	3.0					15.1	97	8	NW	7		19.2	66		SW	9	
12	Fr	12.4	20.3	0			S	19	13:12	15.5	86	6	N	4		18.2	77		ESE	9	
13	Sa	9.7	17.7	0			NE	15	11:01	13.4	97		NE	7		17.4	85			Calm	
14	Su	11.5	21.4	13.0						14.0	96	0	ESE	2		20.2	48		WNW	20	
15	Mo	10.9	19.0	0	8.0		WNW	39	05:54	13.7	61	0	WSW	11		17.5	50		W	11	
16	Tu	4.5	20.3	0			NNW	28	12:09	10.8	81		ENE	7		19.2	55		NNW	13	
17	We	6.1	19.5	0	0.0					12.3	79	2	NE	7		16.7	81		SSW	11	
18	Th	11.8	18.8	2.2	2.0		SE	24	11:07	15.8	78	3	S	7		16.8	62		SE	9	
19	Fr	4.8	18.8	0			ENE	19	15:33	9.8	97	7	N	2		17.7	67		SW	4	
20	Sa	4.9	20.1	0.2						7.4	97	8	NE	7		19.1	58		NNE	2	
21	Su	7.0	16.0	0			NW	33	21:25	11.0	91	6	E	6		13.5	91		SE	4	
22	Mo	5.0	15.9	7.8	4.5		NW	50	12:05	14.0	64	3	NW	19		14.9	58		NW	20	
23	Tu	7.9	14.9	0			NW	44	11:19	12.5	66		WNW	17		14.2	56		NW	17	
24	We	10.4	17.0	0			NNW	52	08:52	13.4	61		NW	26		16.0	53		WNW	15	
25	Th	10.1	17.2	0			NW	43	14:37	13.0	67		W	15		16.0	58		NW	17	
26	Fr	6.6	17.4	0	5.4					12.1	69	0	NE	7		16.6	54		WSW	7	
27	Sa	8.6	17.2	0			SE	26	14:26	11.5	94	4		Calm		15.4	72		SE	9	
28	Su	7.6	18.1	0			SE	24	15:15	11.0	96	3	ENE	9		16.0	57		S	11	
29	Mo	6.5	17.2	0						8.9	95		NE	6		16.1	67		SSW	6	
30	Tu	4.6	17.6	0	0.0		ESE	11	13:42	7.3	97	8	NNE	2		16.7	60		SSE	2	
Statistics for June 2020																					
	Mean	7.9	18.2		2.8					12.0	83	4		7		17.0	62			10	
	Lowest	3.5	14.9		0.0					7.3	59	0		Calm		13.5	43			Calm	
	Highest	13.9	23.0	13.0	8.0		NNW	54		15.8	97	8	NW	26		21.8	91		WNW	28	
	Total			53.2	25.3																

Observations were drawn from Paterson (Tocal AWS) {station 061250}

IDCJDW2108.202006 Prepared at 13:00 UTC on 18 Oct 2020

APPENDIX 5
LIST OF FAUNA SPECIES OBSERVED

A list of the fauna species observed during surveys is provide in Table A5.1.

TABLE A5.1
FAUNA OBSERVED WITHIN AND ADJOINING THE PROJECT AREA

Common Name	Scientific Name	Observation Type
Amphibians		
Dusky Toadlet	*Uperoleia fusca*	X
Brown-striped Frog	*Limnodynastes peronii*	W
Bibron's Toadlet	*Pseudophryne bibronii*	X
Red-backed Toadlet	*Pseudophryne coriacea*	OW
Common Eastern Froglet	*Crinia signifera*	OW
Eastern Dwarf Tree Frog	*Litoria fallax*	W
Broad-palmed Frog	*Litoria latopalmata*	O
Peron's Tree Frog	*Litoria peronii*	X
Leaf-green Tree Frog	*Litoria phyllochroa*	OW
Lesueur's Tree Frog	*Litoria wilcoxii*	X
Reptiles		
Burton's Snake-lizard	*Lialis burtonis*	O
Southern Rainbow-skink	*Carlia tetradactyla*	X
Eastern Water Dragon	*Physignathus lesueurii*	O
Lace Monitor	*Varanus varius*	O
Dark-flecked Garden Sunskink	*Lampropholis delicata*	O
Eastern Water-skink	*Eulamprus quoyii*	O
Common Tree Snake	*Dendrelaphis punctulatus*	O
Eastern Water Dragon	*Physignathus lesueurii lesueurii*	O
Diamond Python	*Morelia spilota spilota*	X
Birds		
Australian Brush-turkey	*Alectura lathami*	O K
Brown Cuckoo-Dove	*Macropygia amboinensis*	OW
Common Bronzewing	*Phaps chalcoptera*	X
Bar-shouldered Dove	*Geopelia humeralis*	O
Wonga Pigeon	*Leucosarcia melanoleuca*	OW Q
Topknot Pigeon	*Lopholaimus antarcticus*	OW
Tawny Frogmouth	*Podargus strigoides*	X
White-throated Nightjar	*Eurostopodus mystacalis*	O W
Australian Owlet-nightjar	*Aegotheles cristatus*	W
Black Kite	*Milvus migrans*	O
Wedge-tailed Eagle	*Aquila audax*	O E
Masked Lapwing	Vanellus miles	OW
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	OW
Rainbow Lorikeet	Trichoglossus haematodus	OW
Little Lorikeet[TS1]	***Glossopsitta pusilla***	OW
Australian King-Parrot	*Alisterus scapularis*	OW
Crimson Rosella	*Platycercus elegans*	OW
Eastern Rosella	*Platycercus eximius*	X
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	OW Q
Brush Cuckoo	*Cacomantis variolosus*	X
Powerful Owl[TS1]	***Ninox strenua***	W E

TABLE A5.1 FAUNA OBSERVED WITHIN AND ADJOINING THE PROJECT AREA		
Common Name	**Scientific Name**	**Observation Type**
Southern Boobook	*Ninox novaeseelandiae*	OW
Laughing Kookaburra	*Dacelo novaeguineae*	OW
Sacred Kingfisher	*Todiramphus sanctus*	X
Dollarbird	*Eurystomus orientalis*	X
White-throated Treecreeper	*Cormobates leucophaea*	OW
Satin Bowerbird	*Ptilonorhynchus violaceus*	OW
Superb Fairy-wren	*Malurus cyaneus*	O Q
Variegated Fairy-wren	*Malurus lamberti*	X
Pilotbird	*Pycnoptilus floccosus*	X
White-browed Scrubwren	*Sericornis frontalis*	OW Q
Large-billed Scrubwren	*Sericornis magnirostris*	OW
Speckled Warbler[TS1]	***Chthonicola sagittata***	X
Brown Gerygone	*Gerygone mouki*	OW
Striated Thornbill	*Acanthiza lineata*	OW
Yellow Thornbill	*Acanthiza nana*	OW
Brown Thornbill	*Acanthiza pusilla*	OW
Buff-rumped Thornbill	*Acanthiza reguloides*	OW
Spotted Pardalote	*Pardalotus punctatus*	OW
Striated Pardalote	*Pardalotus striatus*	X
Eastern Spinebill	*Acanthorhynchus tenuirostris*	OW
Lewin's Honeyeater	*Meliphaga lewinii*	OW Q
Yellow-faced Honeyeater	*Lichenostomus chrysops*	OW
Yellow-tufted Honeyeater	*Lichenostomus melanops*	OW
Bell Miner	*Manorina melanophrys*	X
Noisy Miner	*Manorina melanocephala*	X
Red Wattlebird	*Anthochaera carunculata*	OW
Scarlet Honeyeater	*Myzomela sanguinolenta*	OW
Brown-headed Honeyeater	*Melithreptus brevirostris*	X
White-naped Honeyeater	*Melithreptus lunatus*	OW
Noisy Friarbird	*Philemon corniculatus*	OW
Eastern Whipbird	*Psophodes olivaceus*	W
Varied Sittella [TS1]	***Daphoenositta chrysoptera***	OW
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	OW
Cicadabird	*Coracina tenuirostris*	X
Golden Whistler	*Pachycephala pectoralis*	OW
Rufous Whistler	*Pachycephala rufiventris*	OW
Grey Shrike-thrush	*Colluricincla harmonica*	OW Q
Australasian Figbird	*Sphecotheres vieilloti*	OW
Olive-backed Oriole	*Oriolus sagittatus*	OW
Pied Butcherbird	*Cracticus nigrogularis*	OW
Australian Magpie	*Cracticus tibicen*	OW
Pied Currawong	*Strepera graculina*	OW
Rufous Fantail[M]	***Rhipidura rufifrons***	OW
Grey Fantail	*Rhipidura fuliginosa*	OW Q
Australian Raven	*Corvus coronoides*	OW

TABLE A5.1 FAUNA OBSERVED WITHIN AND ADJOINING THE PROJECT AREA		
Common Name	**Scientific Name**	**Observation Type**
Leaden Flycatcher	*Myiagra rubecula*	X
Black-faced Monarch [M]	***Monarcha melanopsis***	OW
Magpie-lark	*Grallina cyanoleuca*	X
White-winged Chough	*Corcorax melanorhamphos*	X
Eastern Yellow Robin	*Eopsaltria australis*	OW
Silvereye	*Zosterops lateralis*	OW
Common Myna	*Sturnus tristis*	X
Mistletoebird	*Dicaeum hirundinaceum*	OW
Double-barred Finch	*Taeniopygia bichenovii*	OW
Red-browed Finch	*Neochmia temporalis*	OW
Mammals		
Short-beaked Echidna	*Tachyglossus aculeatus*	O
Brown Antechinus	*Antechinus stuartii*	T Q
Northern Brown Bandicoot	*Isoodon macrourus*	H
Long-nosed Bandicoot	*Perameles nasuta*	X
Common Brushtail Possum	*Trichosurus vulpecula*	O H Q
Common Ringtail Possum	*Pseudocheirus peregrinus*	O Q
Squirrel Glider [TS1]	***Petaurus norfolcensis***	O Q
Sugar Glider	*Petaurus breviceps*	Q
Brush-tailed Phascogale [TS1]	***Phascogale tapoatafa***	Q
Koala [TS1 / TS2]	***Phascolarctos cinereus***	OW
Swamp Wallaby	*Wallabia bicolor*	Q
Red-necked Wallaby	*Macropus rufogriseus*	O
Eastern Grey Kangaroo	*Macropus giganteus*	O
Common Wallaroo	*Macropus robustus*	X
Bush Rat	*Rattus fuscipies*	T
Black Rat *	*Rattus rattus*	Q
Brown Rat *	*Rattus norvegicus*	X
Rabbit *	*Oryctolagus cuniculus*	H
Brown Hare *	*Lepus capensis*	X
European cattle *	*Bos taurus*	P
Fox *	*Vulpes vulpes*	O Q
Cat *	*Felis catus*	O
Dog *	*Canis lupus familiaris*	F
Large Forest Bat	*Vespadelus darlingtoni*	X
Grey-headed Flying-fox [TS1 / TS2]	***Pteropus poliocephalus***	OW
Eastern Horseshoe-bat	*Rhinolophus megaphyllus*	U
Yellow-bellied Sheathtail-bat [TS1]	***Saccolaimus flaviventris***	U
White-striped Freetail-bat	*Tadarida australis*	U
Eastern Coastal Free-tailed Bat [TS1]	***Micronomus norfolkensis***	X
Undescribed Freetail Bat	*Mormopterus "Species 2"*	X
Undescribed Freetail Bat	*Mormopterus "Species 4"*	X
Gould's Long-eared Bat	*Nyctophilus gouldi*	X
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	X

TABLE A5.1
FAUNA OBSERVED WITHIN AND ADJOINING THE PROJECT AREA

Common Name	Scientific Name	Observation Type
Long-eared Bat	*Nyctophilus sp. (gouldi or geoffroyi)*	U
Little Bent-winged Bat [TS1]	***Miniopterus australis***	U
Large Bent-winged Bat [TS1]	***Miniopterus orianae oceanensis***	T U
Gould's Wattled Bat	*Chalinolobus gouldii*	U
Chocolate Wattled Bat	*Chalinolobus morio*	U
Southern Myotis [TS1]	***Myotis macropus***	T
Greater Broad-nosed Bat [TS1]	***Scoteanax rueppellii***	X
Eastern Broad-nosed Bat	*Scotorepens orion*	U
Central Eastern Broad-nosed Bat	*Scotorepens sp.*	X
Eastern Forest Bat	*Vespadelus pumilus*	U
Little Forest Bat	*Vespadelus vulturnus*	T

Key to Observation Type

E - Nest / Roost
F - Tracks / Scratchings / Chew Marks
FB - Burrow
G - Crushed Cones
H - Hair / Feathers / Skin
K - Dead
M - Miscellaneous Record
O - Observed
OW - Observed and Heard Call
P - Scat
Q - Camera
T - Trapped
U - Ultrasonic Recording
W - Heard
X – Previous site survey record (Ecotone 2010 / Umwelt 2009)
Note: * indicates introduced species. [TS1] indicates threatened species BC Act
[TS2] indicates threatened species EPBC Act

APPENDIX 6
NSW ROYAL BOTANIC GARDENS IDENTIFICATION ADVICE

The Royal
BOTANIC GARDENS
& Domain Trust

National Herbarium of New South Wales

P.A. CONACHER
Conacher Consulting
PO Box 4082
East Gosford, NSW 2250
AUSTRALIA

Enquiry No: 19565
Botanical.Is@rbgsyd.nsw.gov.au
Fax No: (02) 9251 1952
Ph No: (02) 9231 8111
Date: 13 April 2016

Dear P.A. CONACHER,

Thank you for your enquiry of 18-Mar-16. We are happy to provide the following information:

Eucalyptus glaucina det S.F. McCune. We would like to keep this specimen for our herbarium collection. Please provide a precise a precise locality for this specimen. An estimate of the size of the tree would also be helpful as *E. glaucina* differs from *E. tereticornis* in its' habit.

An invoice for $44.00 (incl. GST) will be forwarded to you separately by our finance section to cover cost of identification.

Thank you for your enquiry.

Yours sincerely

Barbara Wiecek
Identification Botanist
Botanical Information Service

The Botanical Information Email address is Botanical.Is@rbgsyd.nsw.gov.au
Mrs Macquaries Road Sydney NSW 2000 Australia • Telephone (02) 9231 8111 • Fax (02) 9251 1952

The Royal
BOTANIC GARDENS
& Domain Trust

National Herbarium of New South Wales

Jacob MANNERS
Conacher Consulting
PO Box 4082
East Gosford, NSW 2250

Enquiry No: 20706
Botanical.Is@rbgsyd.nsw.gov.au
Fax No: (02) 9251 1952
Ph. No: (02) 9231 8111
Date: 8th August 2018

Dear Jacob,

Re: plant identification – Red Gums from Martins Creek – your ref. 8031

Your specimens have been determined as the following:

EG1. ***Eucalyptus glaucina*** - det. S.F. McCune & A.E. Orme 7th Aug 2018 - specimen retained for herbarium

EG2. ***Eucalyptus*** **probably** ***glaucina*** - det. S.F. McCune & A.E. Orme 7th Aug 2018 - fertile material needed for a positive identification – cautious of windfall fruit - specimen discarded

EG3. ***Eucalyptus glaucina*** - det. S.F. McCune & A.E. Orme 7th Aug 2018 - specimen discarded

EG4. ***Eucalyptus*** **probably** ***glaucina*** - det. S.F. McCune & A.E. Orme 7th Aug 2018 - more fertile material needed to be certain - specimen discarded

EG5. ***Eucalyptus tereticornis*** - det. S.F. McCune & A.E. Orme 7th Aug 2018 - no obvious signs of influence from *E. glaucina* - specimen retained

EG6. ***Eucalyptus glaucina*** - det. S.F. McCune & A.E. Orme 7th Aug 2018 - specimen retained for herbarium

An invoice for $136.50 (incl. GST) will be forwarded to you separately by our finance section to cover cost of identification.

Thank you for your enquiry.
Yours sincerely

Andrew Orme
Identification Botanist
Botanical Information Service

PlantNET

Go to our online Botanical Information Services at plantnet.rbgsyd.nsw.gov.au to find out more about plants of New South Wales

NSW GOVERNMENT Office of Environment & Heritage

APPENDIX 7
BIODIVERSITY CREDIT REPORT

Biodiversity credit report

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

Date of report: 22/04/2021 Time: 3:42:12PM Calculator version: v4.0

Major Project details

Proposal ID:	132/2016/4133MP
Proposal name:	Revised Martins Creek Quarry Extension Project 2021
Proposal address:	Station Street Martins Creek NSW
Proponent name:	Buttai Gravel Pty Ltd
Proponent address:	PO BOX 401 Beresfield NSW 2322
Proponent phone:	02 4938 5261
Assessor name:	Jacob Manners
Assessor address:	PO Box 4300 East Gosford NSW 2250
Assessor phone:	(02)4324 7888
Assessor accreditation:	132

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	13.43	830.00
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	2.15	166.00
Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	2.22	166.17
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	3.33	249.00
Total	21.13	1,411

Credit profiles

1. Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River, (HU755)

Number of ecosystem credits created	166
IBRA sub-region	Upper Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River, (HU755) Sandpaper Fig - Whalebone Tree warm temperate rainforest, (HU739)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798)

Number of ecosystem credits created	249
IBRA sub-region	Upper Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798) Tallowwood - Small-fruited Grey Gum - Kangaroo Grass grassy tall open forest on foothills of the lower North Coast, (HU762) Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast, (HU770) Pink Bloodwood - Thin-leaved Stringybark - Grey Ironbark shrub - grass open forest on ranges of the lower North Coast, (HU772)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619)

Number of ecosystem credits created	830
IBRA sub-region	Upper Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815)	Upper Hunter and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816)

Number of ecosystem credits created	166
IBRA sub-region	Upper Hunter

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816) Melaleuca decora low forest of the central Hunter Valley, Sydney Basin Bioregion, (HU564) Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619) Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast, (HU802) Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast, (HU803) Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest, (HU804) Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter, (HU806) Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter, (HU807) Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter, (HU814) Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter, (HU815) Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter, (HU822)	Upper Hunter 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
Koala	Phascolarctos cinereus	21.13	549
Slaty Red Gum	Eucalyptus glaucina	2,887.00	40,418
Southern Myotis	Myotis macropus	13.80	304
Brush-tailed Phascogale	Phascogale tapoatafa	21.13	423

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	132/2016/4133MP
Proposal name :	Revised Martins Creek Quarry Extension Project 2021
Assessor name :	Jacob Manners
Assessor accreditation number :	132
Tool version :	v4.0
Report created :	22/04/2021 15:39

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
Circle 1	17.40	HU798_Moderate/Good	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Moderate/Good	Yes	1	3.33	93.75	0.00	93.75	0	249	Barking Owl	80.95	3.00	249
Circle 1	17.40	HU816_Moderate/Good	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Moderate/Good	No	1	2.15	96.88	0.00	96.88	0	166	Barking Owl	88.89	3.00	166
Circle 1	17.40	HU755_Moderate/Good	Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	Moderate/Good	Yes	1	2.22	94.00	0.00	94.00	166	166	Barking Owl	71.43	3.00	166
Circle 1	17.40	HU619_Moderate/Good	Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Moderate/Good	Yes	1	13.43	76.56	0.00	76.56	0	830	Barking Owl	100.00	3.00	830

BioBanking Credit Calculator

Species credits

Proposal ID :	132/2016/4133MP
Proposal name :	Revised Martins Creek Quarry Extension Project 2021
Assessor name :	Jacob Manners
Assessor accreditation number :	132
Tool version :	v4.0
Report created :	22/04/2021 15:39

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
Eucalyptus glaucina	Slaty Red Gum	1.40	No		2,887.00	0.00	No	40,418
Myotis macropus	Southern Myotis	2.20	No		13.80	0.00	No	304
Phascogale tapoatafa	Brush-tailed Phascogale	2.00	No		21.13	0.00	No	423
Phascolarctos cinereus	Koala	2.60	No		21.13	0.00	No	549

APPENDIX 8
COMPLIANCE WITH FBA INFORMATION REQUIREMENTS

An assessment the compliance of this Report with the minimum information requirements identified in Table 20 of the FBA is provided in Table A8.1.

TABLE A8.1
ASSESSMENT OF COMPLIANCE WITH FBA TABLE 20 REQUIREMENTS

Report Section	Information requirements	Map & data requirements	Section where Provided in this Report
Introduction	Introduction to the biodiversity assessment including: • identification of development site footprint, including: - operational footprint - construction footprint indicating clearing associated with temporary construction facilities and infrastructure • general description of development site • sources of information used in the assessment, including reports and spatial data.	• Site Map (as described in Section 3.2) • Location Map (as described in Section 3.2) • Digital shape files for all maps and spatial data	An introduction to the assessment is provided in Section 1.1. The proposed disturbance area is described in Section 1.2 & 1.3 and mapped in Figure 1.1. The sources of information used are listed in the References section of the Report and specific relevant documents are listed in Section 1.5 Various site and locations maps are provided in Figures 2.1 to 2.7 in Section 2.
Landscape features	Identification of landscape features at the development site, including: • IBRA bioregions and subregions, • NSW landscape region and area (ha) • native vegetation extent in the outer assessment circle or buffer area • cleared areas • evidence to support differences between mapped vegetation extent and aerial imagery • rivers and streams classified according to stream order	• IBRA bioregions and subregions (as described in Paragraphs 4.1.1.3–4) • NSW landscape regions (as described in Paragraphs 4.1.1.5–6) • Rivers and streams (as described in Paragraphs 4.1.1.8–10 • Wetlands (as described in Paragraphs 4.1.1.11–13) • Other landscape features (as required by SEARs)	IBRA Bioregion and Subregion see Section 2.1. NSW Landscape Region see Section 2.2 Native Vegetation extent and cleared areas see Section 2.3 Rivers and streams see Section 2.5

TABLE A8.1 ASSESSMENT OF COMPLIANCE WITH FBA TABLE 20 REQUIREMENTS			
Report Section	**Information requirements**	**Map & data requirements**	**Section where Provided in this Report**
	• wetlands within, adjacent to and downstream of development site • landscape value score components, including: - identification of method applied (i.e. linear or site-based) - percent native vegetation cover in the landscape - connectivity value - patch size - area to perimeter ration • landscape value score.	• Native vegetation extent (as described in Paragraphs 4.1.1.12–15) • State, regional and local biodiversity links (as described in Paragraphs 4.1.1.16–17) • Regional vegetation used to calculate patch size	Wetlands see Section 2.6 Landscape value score components see Section 2.7 & 2.8 See Figures 2.1 to 2.8
Native vegetation	• Identify native vegetation extent within the development site, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery. Describe PCTs within the development site, including: • vegetation class • vegetation type • area (ha) for each vegetation type • species relied upon for identification of vegetation type and relative abundance • justification of evidence used to identify a PCT (as outlined in Paragraph 5.2.1.8) • EEC status (as outlined in Subsection 5.2.1) • estimate of percent cleared value of PCT. Describe vegetation zones within the development site, including: • condition class and subcategory (where relevant)	Map of native vegetation extent within the development site (as described in Section 5.1) • Map of PCTs within the development site • Map of condition class and subcategory (where relevant) • Map of plot and transect locations relative to PCTs and condition class • Map of EECs • Plot and transect field data (MS Excel format) • Plot and transect field data sheets • Table of current site value scores for each vegetation zone within the development site • Map of vegetation zones with a current site value score of <17.	Native vegetation extent within the proposed disturbance area see Section 3.1. PCT descriptions and vegetation zones see Section 3.2 See Figures 3.1 to 3.4 Field data see Appendix 1 and Appendix 2 Excel data provided as separate documentation/file.

TABLE A8.1 ASSESSMENT OF COMPLIANCE WITH FBA TABLE 20 REQUIREMENTS			
Report Section	**Information requirements**	**Map & data requirements**	**Section where Provided in this Report**
	• area (ha) for each vegetation zone • survey effort as described in Paragraphs 5.2.1.5–7 (number of plots/transects). Where use of local data is proposed: • identify relevant vegetation type • identify source of information for local benchmark data • justify use of local data in preference to database values.		
Threatened species	Identify ecosystem credit species associated with PCTs on the development site as outlined in Section 6.3, including: • list of species derived • justification for exclusion of any ecosystem credit species predicted above. Identify species credit species on the development site as outlined in Sections 6.5 and 6.6, including: • list of candidate species • justification for inclusions and exclusions based on habitat features • indication of presence based on targeted survey or expert report • details of targeted survey technique, effort, timing and weather • species polygons • species that cannot withstand a further loss. Where use of local data is proposed: • identify relevant species or population • identify aspect of species/population data • identify source of information for local data	• Table of vegetation zones and landscape Tg values, particularly indicating where these have changed due to species exclusion • Targeted survey locations • Table detailing the list of species credit species and presence status on site as determined by targeted survey, indicating also where presence was assumed and/or where presence was determined by expert report • Species credit species polygons (as described in Paragraph 6.5.1.19) • Table detailing species and habitat feature/component associated with species and its abundance on site (as described in Paragraph 6.5.1.19) • Species polygons for species that cannot withstand a loss	Ecosystem credit species details see Section 4.2 Species credit species details see Section 4.3 and Table 4.3 No local data or expert reports utilised Targeted survey details and locations see Section 4.4 and 4.5 Species credit species polygons see Section 4.6.1 and 4.6.2

TABLE A8.1 ASSESSMENT OF COMPLIANCE WITH FBA TABLE 20 REQUIREMENTS			
Report Section	**Information requirements**	**Map & data requirements**	**Section where Provided in this Report**
	• justify use of local data in preference to database values. Where expert reports are used in place of targeted survey: • identify the relevant species or population • justify the use of an expert report • indicate and justify the likelihood of presence of the species or population and information considered in making this assessment • estimate the number of individuals or area of habitat (whichever unit of measurement applies to the species/individual) for the development site, including a description of how the estimate was made • identify the expert and provide evidence of their expert credentials.		
Avoid and minimise impacts	Demonstration of efforts to avoid and minimise impact on biodiversity values in accordance with Section 8.3. Identification of final project footprint during construction and operation in accordance with Subsection 8.3.3. Assessment of direct and indirect impacts unable to be avoided at the development site in accordance with Sections 8.3 and 8.4. The assessment would include but not be limited to: type, frequency, intensity, duration and consequence of impact. Statement of onsite measures proposed to avoid and minimise direct and indirect impacts of the Major Project.	Table of measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility • Map of final project footprint, including construction and operation • Maps demonstrating indirect impact zone	Impact avoidance and minimisation measures see Section 5.1 and Table 5.1 Final project footprint see Section 5.2 and Figure 5.1. Direct and indirect impact assessment see Section 5.3 Statement of onsite measures to avoid and minimise impacts see Section 5.4

TABLE A8.1 ASSESSMENT OF COMPLIANCE WITH FBA TABLE 20 REQUIREMENTS			
Report Section	**Information requirements**	**Map & data requirements**	**Section where Provided in this Report**
Impact summary	Identification of areas not requiring assessment in accordance with Section 9.5. Identification of areas not requiring offset in accordance with Section 9.4. Identification of PCTs and species polygons requiring offset in accordance with Section 9.3. Identification of impacts that require further consideration in accordance with Section 9.2, including: • the entity and/or impact for which further consideration is necessary • supporting information relevant to the impact, as outlined in Subsection 9.2.2. Ecosystem credits and species credits that measure the impact of the Major Project on biodiversity values at the development site, including: • future site value score for each vegetation zone at the development site • change in landscape value score • number of required ecosystem credits for the impact of development on each vegetation zone at the development site • number of required species credits for the impact of development on each threatened species that occurs on the development site.	• Map of areas not requiring assessment • Map of PCTs and species polygons not requiring offset • Map of PCTs and species polygons requiring offset • Map of the occurrence of the entity or impact that requires further consideration • Table of PCTs requiring offset and the number of ecosystem credits required • Table of species and populations requiring offset and the number of species credits required • Full biodiversity Credit Calculator output • Submitted proposal in the Credit Calculator	Areas not requiring offsets See Section 6.1 and Figure 6.1. Map of PCTs requiring an offset see Figure 6.2 Maps of Threatened Species Requiring Species Credits see Figures 4.5 & Figures 4.7 to 4.9. Impacts which require further consideration see Section 6.5 Table of PCTs and species requiring offset and number of credits see Tables 6.1 and 7.1 Full biodiversity credit calculator output / report see Appendix 7
Biodiversity credit report	Credit profiles for ecosystem credits and species credits at the development site.	• Table of credit type and matching credit profile • Biodiversity credit report from the Credit Calculator	See Section 7, Table 7.1. For Biodiversity credit report see Appendix 7

BIODIVERSITY OFFSET STRATEGY

PREPARED FOR
THE REVISED MARTINS CREEK QUARRY EXTENSION PROJECT

MARTINS CREEK

MAY 2021
REF: 20123

BIODIVERSITY OFFSET STRATEGY

PREPARED FOR
THE REVISED MARTINS CREEK QUARRY
EXTENSION PROJECT

MARTINS CREEK

MAY 2021

Conacher Consulting Pty Ltd

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TABLE OF CONTENTS

SECTION 1

INTRODUCTION

1.1 BACKGROUND

Conacher Consulting has been engaged to prepare a Biodiversity Offset Strategy for the revised Martins Creek Quarry Extension Project as part of the Amended Development Application and Response to Submissions (ADA & RTS) for the Project.

The Martins Creek Quarry Extension Project is a State Significant Development under the *Environmental Planning and Assessment Act* (1979) (Application Number SSD 6612) and this Biodiversity Offset Strategy has been prepared by *Conacher Consulting* to address the Secretary's Environmental Assessment Requirements in relation to biodiversity offsets.

Through an iterative process the Proponent has optimised the Project layout and footprint to avoid and minimise ecological impacts at the Project planning stage. The offset requirements for the Project, as calculated in accordance with the Framework for Biodiversity Assessment (FBA), are identified in the Biodiversity Assessment Report (Conacher Consulting 2020) and summarised in Section 1.2 of this Report. The Proponent is committed to delivering a biodiversity offset strategy that appropriately compensates for the unavoidable loss of ecological values as a result of the Project.

The impact assessment for the Project has been completed using the FBA (a previous assessment methodology in NSW), as required under the SEARs and in accordance with the provisions of the *Biodiversity Conservation (Savings & Transitional) Regulation* 2017. The NSW biodiversity legislation and policy has since changed and the project will be offset in accordance with the current requirements under the *Biodiversity Conservation Act 2016* (BC Act), together with the *Biodiversity Conservation Regulation* 2017. This legislation provides the current framework for offsetting biodiversity impacts from development and clearing through the NSW Biodiversity Offsets Scheme and the Biodiversity Assessment Methodology (BAM) (DPIE 2020).

The biodiversity offsets for the Project will be delivered in consultation with DPIE, BCD and the Biodiversity Conservation Trust (BCT). A formal credit equivalency assessment will be undertaken once the project is approved, which will require an application to have the FBA credit requirement converted to BAM credits through an *Assessment of Reasonable Equivalence*. The following credit retirement options are available to satisfy the Project offset requirements under the Biodiversity Offsets Scheme:

- Securing (purchasing) credits from the establishment of Biodiversity Stewardship Site/s (and subsequent retirement of credits) or by retiring credits from already established Stewardship Sites, in accordance the offset rules documented in section 6.3 and 6.4 of the BC Regulation.

- Funding a *Biodiversity Conservation Action* in accordance with section 6.2 of the BC Regulation, and/or

- Paying into to the Biodiversity Conservation Fund (BCF).

A comprehensive Biodiversity Offset Strategy (BOS) for the Project has been under development for several years as the Project was subject to environmental assessment. The work completed to date for the biodiversity offset strategy has included desktop assessment,

extensive field surveys (including targeted surveys and FBA Biometric plots) across five potential sites, application of the FBA Credit Calculator using FBA Biometric plots, GIS analysis of native vegetation extent and habitat connectivity (as per the FBA), GIS mapping and reporting. The five potential offset sites occur directly adjacent to the proposed project and were found to support suitable PCTs and threatened species habitat required for the Project. While the BOS has not currently been updated to capture the requirements of BAM, the information provided presents a summary of the work completed to date and an indication of the potential credit yields from local candidate land-based offsets under the FBA.

1.2 BIODIVERSITY CREDITS REQUIRED

A summary of the biodiversity credits required to offset the impacts of the proposal is provided in Table 1.1, as determined in the Biodiversity Assessment Report prepared by *Conacher Consulting* (2020).

TABLE 1.1
BIODIVERSITY CREDITS REQUIRED

Plant Community Types / Species Offset Options	Number of Credits Required
HU619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	830
HU755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter	166
HU798 White Mahogany – Spotted Gum – Grey Myrtle semi mesic shrubby open forest of the central and lower Hunter Valley	249
HU816 Spotted Gum – Narrow-leaved Ironbark shrub-grass open forest of the Central and Lower Hunter	166
Total number of ecosystem credits	**1,411**
Eucalyptus glaucina (Slaty Red Gum)	40,418
Brush-tailed Phascogale (*Phascogale tapoatafa*)	423
Koala (*Phascolarctos cinereus*)	549
Southern Myotis (*Myotis macropus*)	304
Total number of species credits	**41,694**

SECTION 2

CANDIDATE BIODIVERSITY OFFSET SITE IDENTIFICATION

2.1 CANDIDATE BIODIVERSITY OFFSET SITE LOCATIONS

Details of the proposed offset sites are provided in Table 2.1. A map showing the location of the offset sites relative to the development site, including the offset site boundaries and cadastral details is provided in Figure 2.1. Additional suitable biodiversity offset areas may be included as an addendum to this strategy at a later date.

TABLE 2.1
CANDIDATE BIODIVERSITY OFFSET SITE DETAILS

Offset Site Reference	Location	General Description	Land-use history	Lot and DP Number
Site B	Station Street Martins Creek	Residual part of proposed quarry Extension area	Rural residential	Lot 21 DP773220
Site C	Cory Street Martins Creek	Rehabilitated section of historical quarry area	Resource extraction and rehabilitation	Part Lot 1 DP1006375
Site D	12 Vogeles Road Martins Creek	Residual lands surrounding historical quarry area	Rural	Lot 102 DP882385 Lot 1 DP304266 Lot 103 DP882385
Site E	29 Station Street Martins Creek	Residual part of existing quarry and proposed Extension area	Rural	Part Lot 42 DP 815628
Site G	29 Grace Avenue Martins Creek	Allotment between Dungog Road and the North Coast Railway	Rural residential	Lot 2 DP 242210

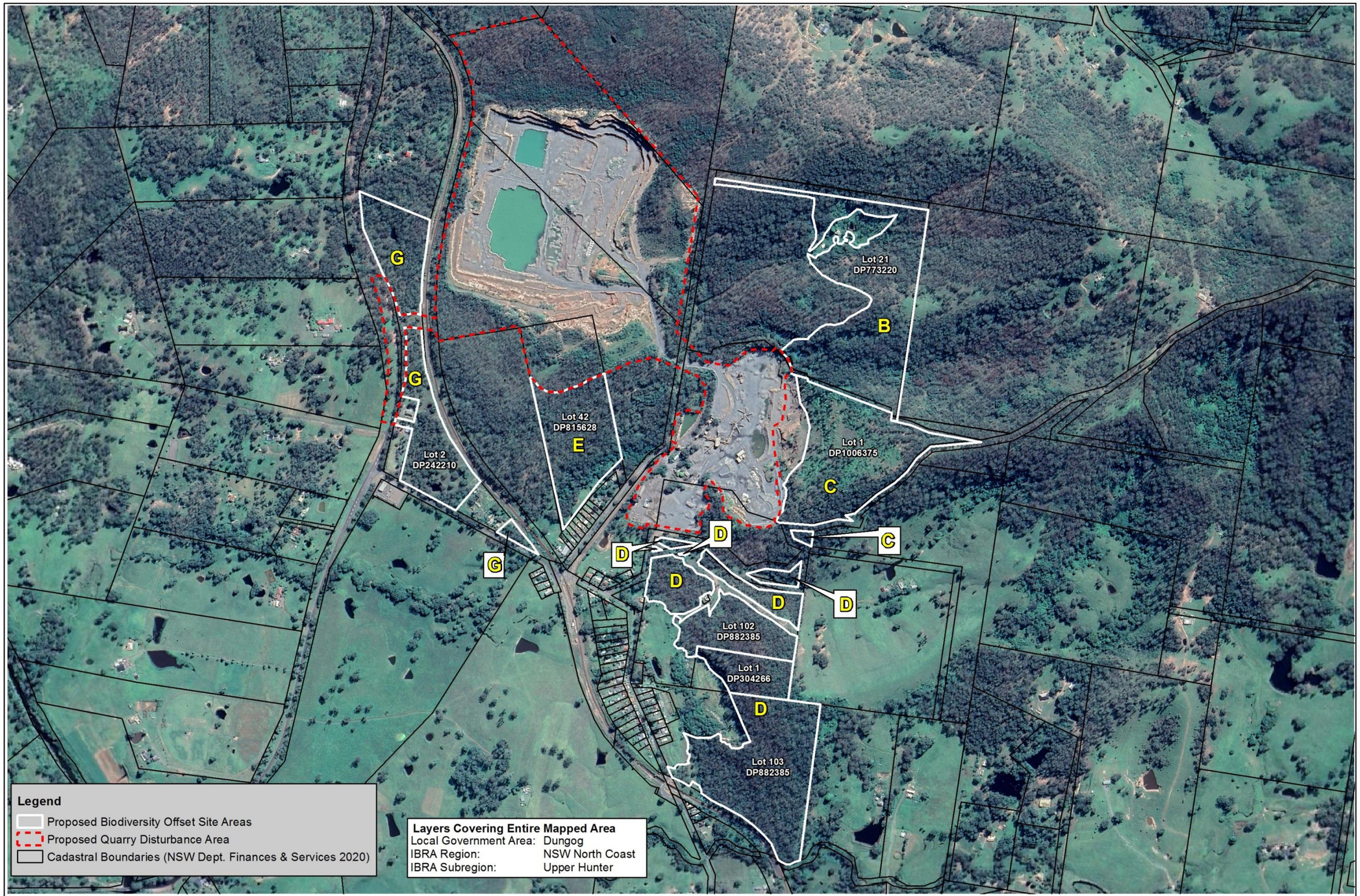

Figure 2.1
Biodiversity Offset Site Locations
Martins Creek Quarry, Martins Creek

SECTION 3

CANDIDATE BIODIVERSITY OFFSET SITE CHARACTERISTICS

3.1 PLANT COMMUNITY TYPES & ECOSYSTEM CREDITS

The total extent of native vegetation mapped within the proposed biodiversity offset sites is 58.35 hectares. The areas of native vegetation present within the biodiversity offset sites were assessed and surveyed to determine the types, extent and condition of the Plant Community Types (PCTs) present.

The plant communities present are mapped in Figure 3.1 and listed in Table 3.1. A preliminary credit calculation using the Biobanking Calculator was been completed for the candidate biodiversity offset sites, the results of the preliminary ecosystem credit calculation are provided in Table 3.1. A copy of the Biobanking Credit Calculator Report is provided in Appendix 3.

Further surveys and reporting will be completed to enable the establishment of biodiversity stewardship agreements over these sites under the *Biodiversity Conservation Act* (2016) in accordance with the requirements of the Biodiversity Assessment Method (DPIE 2020), following project approval.

TABLE 3.1
PRELIMINARY ECOSYSTEM CREDIT CALCULATION

Plant Community Type	Area (ha)	Ecosystem Credits Calculated (FBA)
HU619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	39.13	433
HU755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	1.33	14
HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	9.26	122
HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	8.63 (1.98 ha good condition / 6.65 low condition)	97

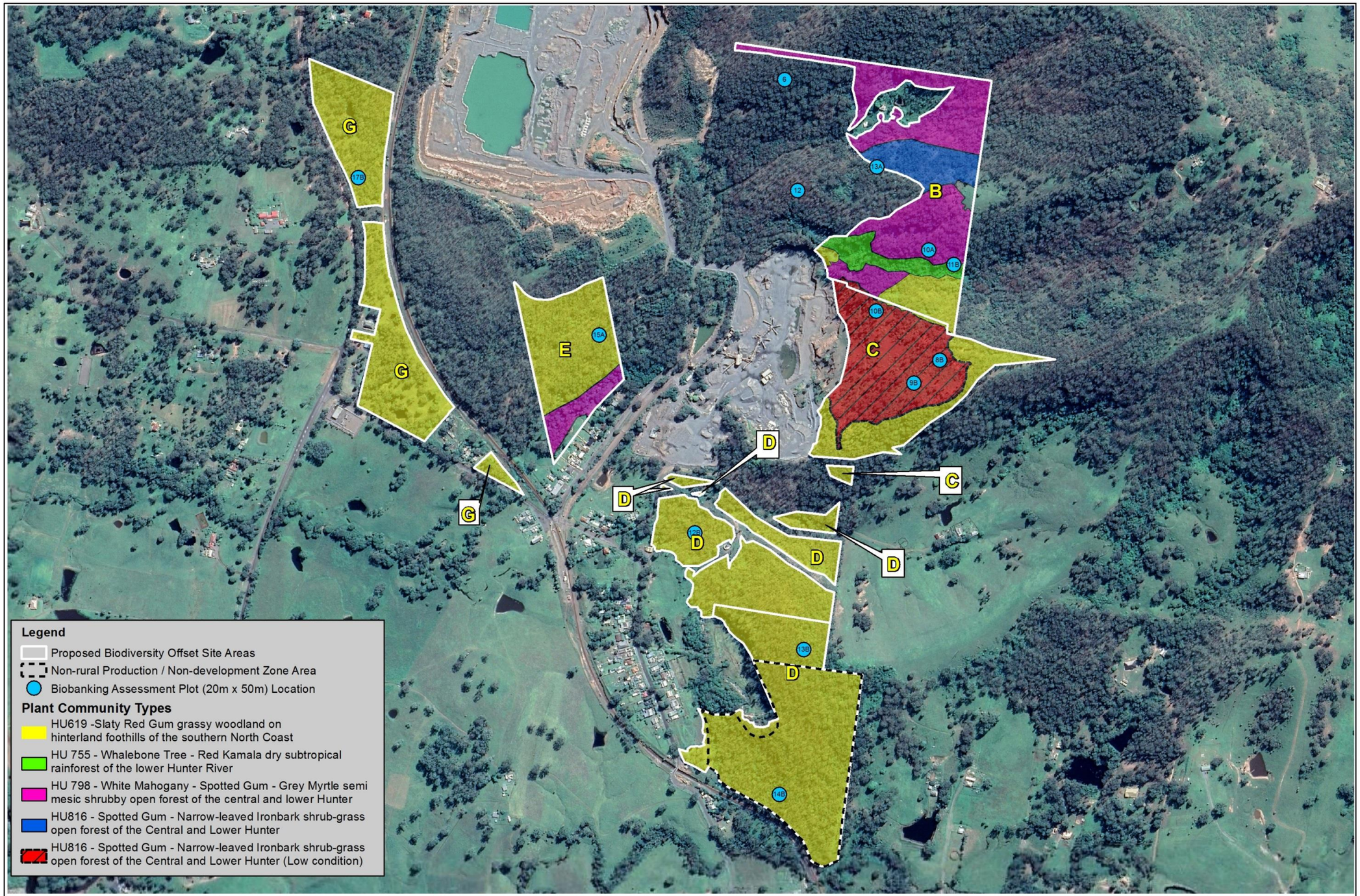

Figure 3.1
Plant Community Type Distribution & Survey Locations
Martins Creek Quarry, Martins Creek

3.2 THREATENED SPECIES AND PRELIMINARY SPECIES CREDIT CALCULATIONS

The candidate biodiversity offset sites are capable of generating species credits for the following threatened species for which species credits are required:

- Slaty Red Gum (*Eucalyptus glaucina*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Koala (*Phascolarctos cinereus)*
- Southern Myotis (*Myotis macropus*)

A copy of the Biodiversity Credit Calculator output is provided in Appendix 3.

3.2.1 Survey & Species Credit Details for Slaty Red Gum

Field surveys for this species consisted of systematic searches throughout the site to determine the area of occupancy for the Slaty Red Gum (*Eucalyptus glaucina*). The field traverses were undertaken with the assistance of a GPS device which enabled marking of the extent of this species' distribution.

The surveys for this species were undertaken by extrapolating the density by sampling over the area of occupancy in accordance with the requirements of NSW OEH (2016) for populations of >50 plants or >0.1 hectare area of occupancy.

A total of ten (10) quadrats of 20x50m (1000m^2) size were surveyed within the identified *E. glaucina* area of occupancy to count the number of *E. glaucina* individuals present. The quadrat locations and occupancy area is shown in Figure 3.2. The quadrat locations were chosen and marked on an aerial photograph prior to the counting survey to ensure representativeness and adequate sampling. The quadrat surveys for *E. glaucina* were undertaken during September 2015 and October 2016.

Each quadrat was set out in the field with a compass and measuring tape and marked with coloured flagging tape during the survey. GPS coordinates were recorded for each quadrat to enable mapping of survey quadrat locations on a map of the site. The total number of all *E. glaucina* trees and saplings present within the quadrats were counted. Each *E. glaucina* individual within the quadrats was marked within spray paint to ensure none were missed or double counted.

The total number of *E. glaucina* individuals present was determined for each quadrat which enabled the mean density of the combined quadrats to be calculated. This was utilised to extrapolate the mean density of *E. glaucina* individuals per square metre of habitat and estimate the extent of *E. glaucina* individuals present within the biodiversity offset sites.

The area of occupancy is mapped in Figure 3.2 and covers an area of 29.97 hectares. The *E. glaucina* quadrat counts and the estimate of the number of individuals present are provided in Table 3.2

TABLE 3.2 SLATY RED GUM SURVEY RESULTS & CREDITS CREATED	
Quadrat Number	**Count**
6	23
8	12
20	42
21	9
22	15
23	19
24	25
25	16
26	14
27	16
Average density in sample plots (1000m^2)	19.1
Average Density per hectare	191
Area of occupancy (ha)	29.83
Estimated number of individuals	5698
Credits created	40,456

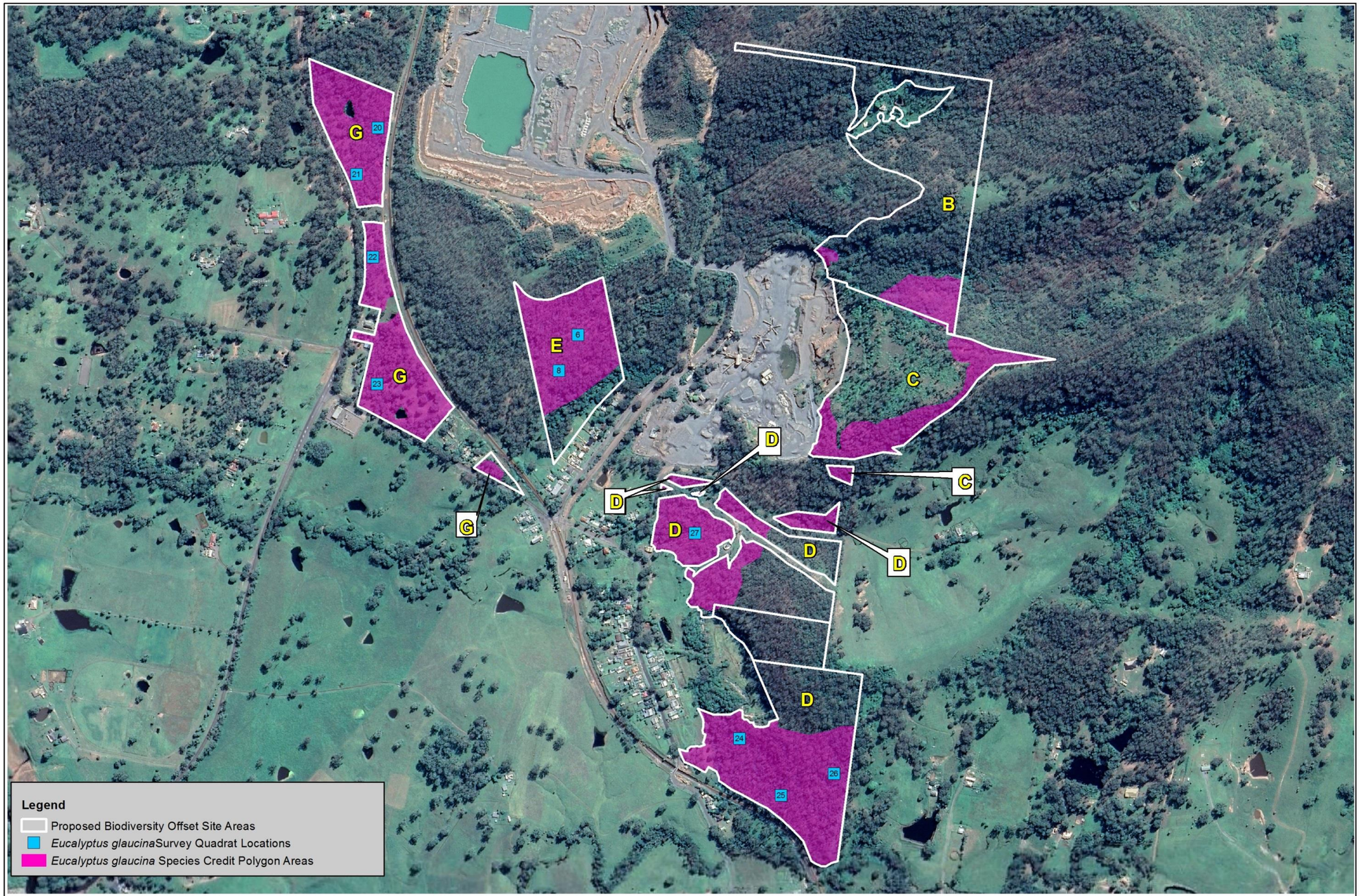

Figure 3.2
***Eucalyptus glaucina* Species Credit Polygon Extent**
Martins Creek Quarry, Martins Creek

3.2.2 Survey and Species Credit Details for the Brush-tailed Phascogale

The Brush-tailed Phascogale was observed within the proposed quarry extension area at 6 locations. The capture locations are in close proximity to the proposed biodiversity offset areas, and this species is reasonably assumed to inhabit the areas of suitable habitat within the candidate biodiversity offset sites mapped as part of the species polygon in Figure 3.3. The extent of the species polygon and credits created for the Bush-tailed Phascogale are provided in Table 3.3.

TABLE 3.3
BRUSH-TAILED PHASCOGALE SPECIES POLYGON AREA AND CREDITS CREATED

Area of Species Polygon	Credits Created
58.34 ha	414

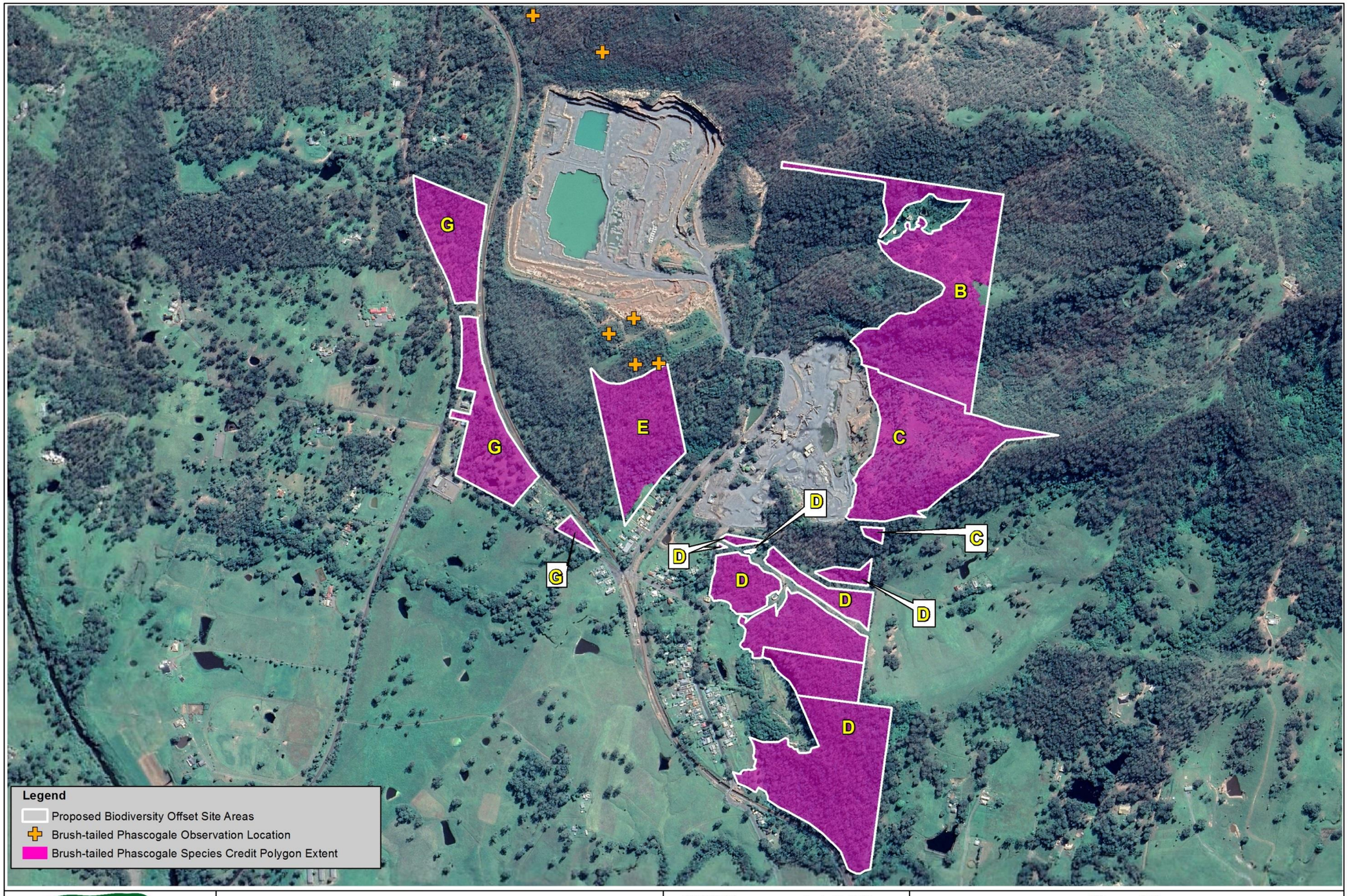

Figure 3.3
Brush-tailed Phascogale Species Credt Polygon Extent
Martins Creek Quarry, Martins Creek

3.4.3 Survey and Species Credit Details for the Koala

Details of Koalas and signs of koala use observed during targeted surveys are provided as follows:

- One Koala was observed during the spotlighting survey undertaken on 20 August 2014 within biodiversity offset area B.

- A male Koala was recorded calling on a songmeter device adjacent to biodiversity offset area B during call recording surveys on the 6th, 7th, 9th and 10th September 2014.

- A Koala was observed during the spotlighting surveys undertaken on 18 and 19 February 2015 to the west of the detention basin and the western alternate access road within biodiversity offset area E.

- A Koala was heard calling within the northern section of biodiversity offset area G in response to call playback on 26 October 2016.

- During surveys undertaken on 18-19 October and 25-27 October 2016 several trees with potential Koala scratches were observed within the biodiversity offset area B and biodiversity offset area D and a koala scat was found within biodiversity offset area D. The koala scat identification was verified by Scats About, a professional scat identification business.

The Koala species polygon is mapped in Figure 3.4 and the extent of the species polygon and credits calculated are provided in Table 3.4.

TABLE 3.4
KOALA SPECIES POLYGON AREA AND CREDITS CREATED

Area of Species Polygon	Credits Created
50.37 ha	358

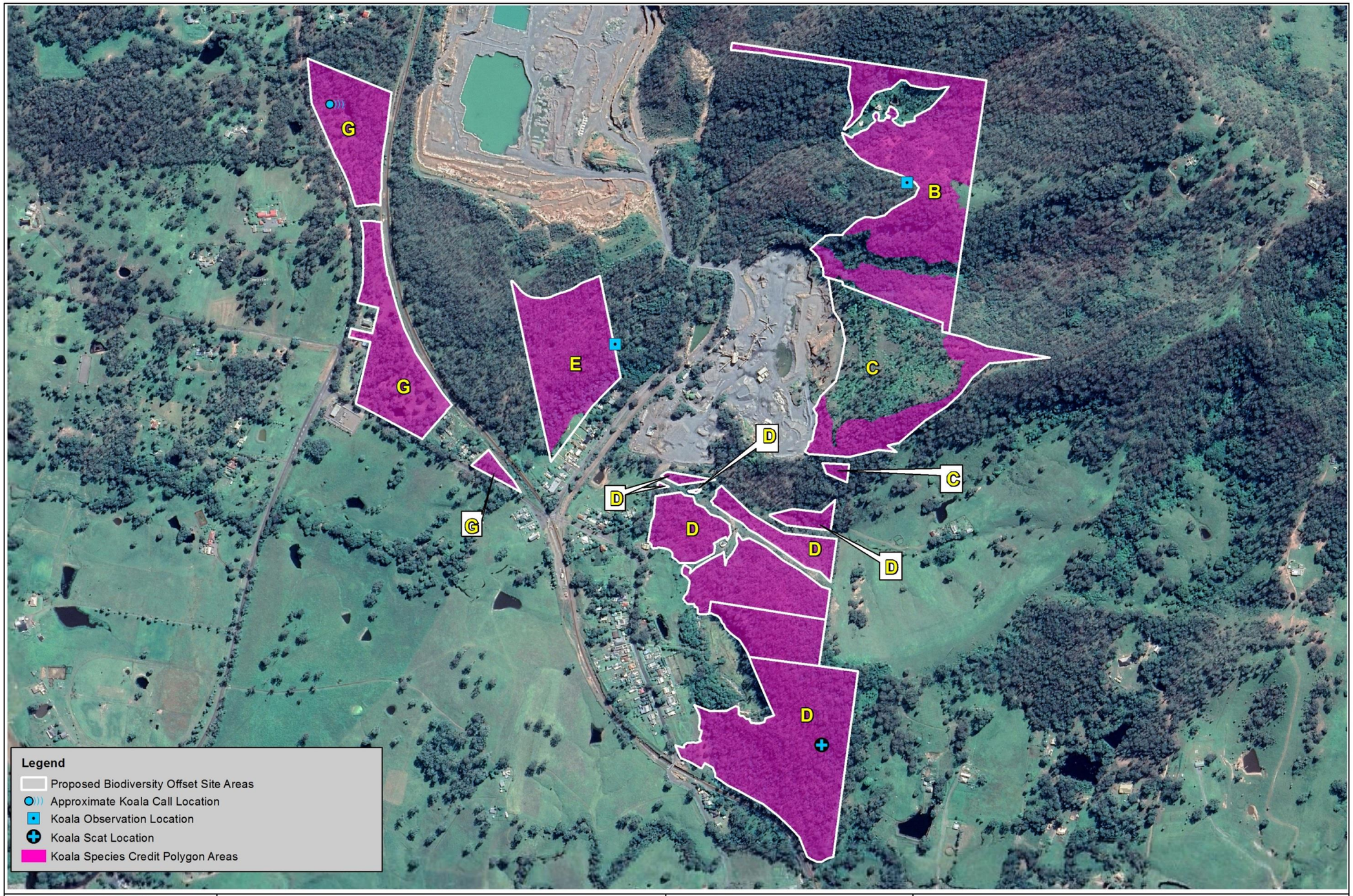

Figure 3.4
Koala Species Credt Polygon Extent
Martins Creek Quarry, Martins Creek

3.4.4 Survey and Credit Details for the Southern Myotis

Three female Southern Myotis bats were captured in a harp trap on 18 February 2015 within the creek line north of the quarry pit. The capture location is in close proximity to the proposed biodiversity offset areas. The area of occupancy for the Southern Myotis was determined by mapping the areas of suitable habitat in the candidate biodiversity sites within 200m of watercourses and waterbodies with pools or stretches 3m or wider. The Southern Myotis species polygon is mapped in Figure 3.5 and the extent of the species polygon and credits calculated are provided in Table 3.5.

TABLE 3.5
SOUTHERN MYOTIS
SPECIES POLYGON AREA AND CREDITS CREATED

Area of Species Polygon	Credits Created
44.00 ha	312

conacher consulting

N 0 100 200 300 400 500 m

Figure produced in A3 colour

Drawn By: AM
Drawing Version: 1
Drawing No: 20123
Date: 03/12/2020

* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Google Earth (2020) Air Photo Date: 04/10/2020

Figure 3.5
Southern Myotis Species Credt Polygon Extent
Martins Creek Quarry, Martins Creek

SECTION 4

SUMMARY

4.1 SUMMARY OF PROPOSED BIODIVERSITY OFFSET MEASURES

A summary of the indicative amount of biodiversity credits to be generated at the candidate biodiversity offset sites, calculated using the Biobanking Credit Calculator and the indicative extent of residual credits to be retired through other options is provided in Table 4.1.

TABLE 4.1
SUMMARY OF PROPOSED BODIVERSITY CREDIT REQUIREMENTS & OFFSET MEASURES

Credit Type	Credits Required	Indicative Extent of Credits Generated from the Candidate Biodiversity Offset Sites	Indicative Amount of Residual Credits to be Retired
HU619 Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	830	433	397
HU755 Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	166	14	152
HU798 White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	249	122	127
HU816 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	166	97	69
Slaty Red Gum (*Eucalyptus glaucina)*	40,418	40,456	Nil
Brush-tailed Phascogale (*Phascogale tapoatafa*)	423	414	9
Koala (*Phascolarctos cinereus*)	549	358	191
Southern Myotis (*Myotis macropus*)	304	312	Nil

4.2 CONCLUDING COMMENTS

The credits required to offset the impacts of the proposal under the current Biodiversity Assessment Method will be determined by a formal assessment of reasonable equivalence of biodiversity credits made by DPIE, which is only available following project approval.

The actual amount of credits to be generated at the proposed land based candidate biodiversity sites will be determined as part of a future formal biodiversity stewardship application and agreement. Any residual credit obligations not offset through land based credits at the candidate biodiversity offset sites will be met through additional land based biodiversity offsets established as biodiversity stewardship sites, purchase of credits from the market associated with existing biodiversity offset stewardship sites or through payment to the Biodiversity Conservation Trust.

REFERENCES

Conacher Consulting 2021 Biodiversity Assessment Report, Prepared for The Revised Martins Creek Quarry Extension Project, Martins Creek. Unpublished Report prepared for Buttai Gravel.

NSW Office of Environment and Heritage (2016) NSW Guide to Surveying Threatened Plants, State of NSW and Office of Environment and Heritage.

NSW Office of Environment and Heritage (2014a) Framework for Biodiversity Assessment, NSW Government, Sydney.

NSW Office of Environment and Heritage (2014b) Biobanking Assessment Methodology 2014, NSW Government, Sydney.

NSW Office of Environment and Heritage (2014c) NSW Biodiversity Offsets Policy for Major Projects, NSW Government, Sydney.

APPENDIX 1
FLORA SPECIES OBSERVED WITHIN SURVEYS PLOTS

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

Family	Scientific Name	Common Name	6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Canopy																												
Lauraceae	*Neolitsea dealbata*	White Bolly Gum											13	17									1	1				
Myrtaceae	*Acmena smithii*	Lilly Pilly											3	1														
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle	3	3	3	2																						
Myrtaceae	*Corymbia maculata*	Spotted Gum	5	2	11	6	10	4	3	1	10	2			10	4	5	1	21	9			5	2	27	21	x	x
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany			28	16									24	17	15	7	5	1			13	5	2	1		
Myrtaceae	*Eucalyptus canaliculata*	Grey Gum	15	3																			15	4				
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	X	X			6	6	2	3					16	11	15	8			21	19			18	10		
Myrtaceae	*Eucalyptus glaucina*	Slaty Red Gum													6	2	4	1	21	7	5	5					16	9
Myrtaceae	*Eucalyptus globoidea*	White Stringybark	X	X															5	8					3	1		
Myrtaceae	*Eucalyptus moluccana*	Grey Box																	X	X	X	X			x	x	28	13
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark	25	13	4	1																	20	7				
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	10	8																								
Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree																										
Myrtaceae	*Syzygium australe*	Brush Cherry											22	13														
Putranjivaceae	*Drypetes deplanchei*	Yellow Tulipwood											5	1														
Sapindaceae	*Diploglottis australis*	Native Tamarind											40	10														
Sub-canopy																												
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	X	X																								
Euphorbiaceae	*Croton verreauxii*	Green Native Cascarilla											10	5														
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle					1	2	3	5	3	4			1	20	1	5			7	11	3	10	9	116	5	7
Fabaceae (Mimosoideae)	*Acacia parvipinnula*						2	3	8	6	3	3																
Moraceae	*Ficus coronata*	Sandpaper Fig											6	5														
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn											1	2											<1	1		
Moraceae	*Streblus brunonianus*	Whalebone Tree	<1	1																			2	4				
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle											10	10									1	3				
Myrtaceae	*Melaleuca stypheloides*	Prickly-leaved Tea Tree																					3	1	2	1		
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum					<1	1			2	1			5	2	7	7	1	2			2	4	10	8	3	3
Rhamnaceae	*Alphitonia excelsa*	Red Ash					<1	1	1	3							2	1										
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart									1	1																
Shrubs																												
Apocynaceae	*Gomphocarpus fruticosus**	Narrow-leaved Cotton Bush									<1	1																
Araliaceae	*Polyscias sambucifolia* subsp. *Long leaflets*				<1	1																						
Asteraceae	*Cassinia quinquefaria*																<1	1										
Asteraceae	*Ozothamnus diosmifolius*	Rice Flower																			<1	2			<1	1		
Capparaceae	*Capparis arborea*	Native Pomegranate											2	5														
Celastraceae	*Denhamia silvestris*	Narrow-leaved Orangebark	4	20	1	3											<1	1					1	3	<1	2		
Celastraceae	*Elaeodendron australe* var. *australe*	Red Olive Plum											2	5									1	1				

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

Family	Scientific Name	Common Name	6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower			1	5																						
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower			1	10									1	20			<1	20	<1	20			<1	7		
Ebenaceae	*Diospyros australis*	Black Plum											10	20									1	4				
Ericaceae (Styphelioideae)	*Leucopogon juniperinus*	Prickly Beard-heath	<1	4											2	20	1	20			3	20			<1	3	5	20
Fabaceae (Caesalpinioideae)	*Senna pendula**																										<1	1
Fabaceae (Faboideae)	*Chorizema parviflorum*	Eastern Flame Pea													<1	5					<1	2						
Fabaceae (Faboideae)	*Daviesia genistifolia*	Broom Bitter Pea																			<1	5			x	x		
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo	X	X																								
Fabaceae (Faboideae)	*Jacksonia scoparia*	Winged Broom-pea									X	X			5	10	1	6										
Fabaceae (Faboideae)	*Podolobium ilicifolium*	Prickly Shaggy Pea																					x	x				
Fabaceae (Mimosoideae)	*Acacia falcata*	Hickory Wattle									<1	1							1	5	4	20					<1	1
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	1	2	<1	2																						
Fabaceae (Mimosoideae)	*Acacia irrorata* subsp. *irrorata*																		5	10							x	x
Fabaceae (Mimosoideae)	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle					2	3	<1	2					<1	2												
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	Prickly Moses													3	20	<1	5	1	20	1	5			<1	2	<1	1
Flacourtiaceae	*Scolopia braunii*	Flintwood											2	5														
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum			<1	2																						
Meliaceae	*Dysoxylum fraserianum*	Rosewood																										
Monimiaceae	*Wilkiea huegeliana*	Veiny Wilkiea											5	5														
Myrsinaceae	*Myrsine variabilis*		<1	2																			<1	1			
Myrtaceae	*Sannantha crassa*		X	X																								
Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant													<1	1											<1	1
Oleaceae	*Jasminum volubile*	Stiff Jasmine	5	50	2	10									<1	1	5	20	<1	2			2	10	<1	3	3	10
Oleaceae	*Notelaea longifolia**	Large Mock-olive	6	20	6	10							1	5	1	2	1	4	1	5			3	10			2	4
Oleaceae	*Olea europaea subsp. cuspidata**	African Olive			<1	1									10	10	70	200	10	20			1	1			1	1
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush	5	20	1	3			<1	5					3	10			5	20	<1	5	5	20	5	10	7	10
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree																					<1	1			x	x
Phyllanthaceae	*Phyllanthus gunnii*	Scrubby Spurge	X	X									<1	2														
Pittosporaceae	*Bursaria spinosa*	Blackthorn																	<1	1								
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	2	20									5	20									1	10				
Pittosporaceae	*Pittosporum revolutum*	Wild Yellow Jasmine	1	5	1	5											<1	3	<1	1			3	10	1	2	1	5
Pittosporaceae	*Pittosporum undulatum*	Native Daphne	2	5	10	5																						
Proteaceae	*Grevillea robusta*	Silky Oak													<1	1												
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung			<1	1	<1	2			<1	1			1	3	<1	1	1	3			1	1	1	1	1	1

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

Family	Scientific Name	Common Name	6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Rutaceae	*Correa reflexa*	Common Correa			<1	1																						
Rutaceae	*Melicope micrococca*	Hairy-leaved Doughwood																					<1	1				
Rutaceae	*Sarcomelicope simplicifolia* subsp. *simplicifolia*	Yellow Wood																										
Rutaceae	*Zieria smithii*	Sandfly Zieria	X	X																								
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart																	5	4								
Sapindaceae	*Alectryon subcinereus*	Native Quince																					1	2				
Sapindaceae	*Diploglottis australis*	Native Tamarind	5	20																								
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	X	X																								
Sapindaceae	*Elattostachys nervosa*	Beetroot Tree											2	1														
Verbenaceae	*Lantana camara**	Lantana	5	10	10	10	35	50	40	50	15	20			5	20			10	20	5	20	15	20	15	20	20	20
Ground Layer - Ferns and Allies																												
Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern																										
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern	3	200									20	2000									5	500				
Blechnaceae	*Doodia caudata*	Small Rasp Fern																										
Dennstaedtiaceae	*Pteridium esculentum*	Bracken Fern																					x	x				
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern											<1	2														
Gleicheniaceae	*Sticherus flabellatus* var. *flabellatus*												5	100														
Polypodiaceae	*Platycerium bifurcatum*	Elkhorn Fern											<1	1														
Pteridaceae	*Adiantum aethiopicum*	Common Maidenhair	5	200													<1	20					10	500				
Pteridaceae	*Adiantum formosum*	Giant Maidenhair Fern											5	50														
Pteridaceae	*Adiantum hispidulum*	Rough Maidenhair Fern	<1	1	2	100																	5	200				
Pteridaceae	*Cheilanthes distans*	Bristly Cloak Fern					<1	20	<1	50															<1	5		
Pteridaceae	*Cheilanthes sieberi*				1	50	<1	100	<1	50	<1	200			<1	50	<1	20	<1	20	<1	100			1	50	<1	20
Pteridaceae	*Pellaea falcata*	Sickle Fern							<1	3			<1	2									<1	10				
Pteridaceae	*Pellaea paradoxa*				1	20							<1	10									2	50				
Ground Layer - Dicots (Herbs)																												
Acanthaceae	*Brunoniella australis*	Blue Trumpet	3	100	1	50									<1	20	<1	10	<1	20	<1	50	1	50				
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower											<1	10									<1	5				
Apiaceae	*Centella asiatica*	Indian Pennywort													<1	5			<1	20							x	x
Apiaceae	*Daucus glochidiatus*	Native Carrot					<1	20	<1	100	<1	5											x	x				
Asteraceae	*Ageratina adenophora**	Crofton Weed							<1	1																		
Asteraceae	*Bidens pilosa**	Cobblers Pegs			<1	5	<1	50	<1	20	<1	20													<1	10	x	x
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting																			<1	10						
Asteraceae	*Conyza sumatrensis**	Tall Fleabane							<1	10	<1	5																
Asteraceae	*Epaltes australis*	Spreading Nut-heads																			<1	1						
Asteraceae	*Euchiton sphaericus*								<1	10																		
Asteraceae	*Facelis retusa**	Trampweed							<1	20																		
Asteraceae	*Gamochaeta americana**	Cudweed					<1	10																				

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Family	Scientific Name	Common Name	6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Asteraceae	*Hypochaeris microcephala**	White Flatweed					<1	5																				
Asteraceae	*Hypochaeris radicata**	Flatweed																	<1	3							x	x
Asteraceae	*Lagenophora stipitata*	Blue Bottle-daisy																	<1	10			<1	10			<1	10
Asteraceae	*Pseudognaphalium luteoalbum*																		<1	5								
Asteraceae	*Senecio madagascariensis**	Fireweed					1	50	<1	20	<1	10			<1	5					<1	20						
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed					<1	1	<1	3	<1	2																
Asteraceae	*Sigesbeckia orientalis* subsp. *orientalis*	Indian Weed							<1	5																		
Asteraceae	*Sonchus oleraceus**	Common Sowthistle																							<1	1		
Asteraceae	*Vernonia cinerea*				<1	5															<1	5					<1	2
Campanulaceae	*Wahlenbergia communis*	Native Bluebell									<1	5			<1	2					<1	5						
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell					<1	10	<1	50	<1	50			<1	2							x	x	<1	2	x	x
Caryophyllaceae	*Petrorhagia dubia**										<1	1																
Caryophyllaceae	*Polycarpon tetraphyllum**	Four-leaf Allseed									<1	20																
Caryophyllaceae	*Stellaria flaccida*																						x	x				
Chenopodiaceae	*Einadia trigonos*	Fishweed							<1	3																		
Clusiaceae	*Hypericum gramineum*	Small St. John's Wort																			<1	50			x	x		
Convolvulaceae	*Dichondra repens*	Kidney Weed	3	200	1	200															<1	50	2	500	1	100	1	200
Crassulaceae	*Crassula sieberiana*	Austral Stonecrop					<1	500	<1	500	<1	500																
Fabaceae (Faboideae)	*Trifolium arvense*	Hairsfoot Clover					<1	100	<1	20	<1	20																
Fabaceae (Faboideae)	*Trifolium campestre*	Hop Clover							<1	5																		
Fabaceae (Faboideae)	*Swainsona galegifolia*	Smooth Darling-pea	<1	1			<1	2															<1	3				
Fabaceae (Faboideae)	*Zornia dyctiocarpa*																				<1	1						
Goodeniaceae	*Goodenia paniculata*	Branched Goodenia													<1	20												
Iridaceae	*Romulea rosea**	Onion Grass																					X	X				
Lamiaceae	*Plectranthus parviflorus*	Cockspur Flower																					<1	2	<1	1		
Lamiaceae	*Scutellaria humilis*	Dwarf Skullcap																					X	X	<1	4		
Lobeliaceae	*Pratia purpurascens*	Whiteroot	5	500	3	200					<1	20			<1	100	<1	50	<1	50	<1	200	3	200	1	100	2	200
Myrsinaceae	*Anagallis arvensis**	Scarlet Pimpernel					<1	50	<1	50	<1	100													<1	5		
Onagraceae	*Oenothera indecora subsp. bonariensis**						<1	20	<1	20	<1	5																
Oxalidaceae	*Oxalis perennans*				<1	1			<1	5									<1	10			x	x			<1	2
Phyllanthaceae	*Phyllanthus virgatus*																				<1	1						
Phyllanthaceae	*Poranthera microphylla*																										<1	1
Plantaginaceae	*Plantago debilis*																				<1	2			x	x	x	x
Plantaginaceae	*Plantago gaudichaudii*																				<1	20						
Plantaginaceae	*Plantago lanceolata**	Lamb's Tongues																							<1	3		
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell					<1	5									<1	1										

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

Family	Scientific Name	Common Name	6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Polygalaceae	*Polygala japonica*	Dwarf Milkwort																			<1	2						
Polygonaceae	*Rumex brownii*	Swamp Dock							<1	1	<1	5	<1	1														
Rubiaceae	*Galium gaudichaudii*	Rough Bedstraw			<1	2																						
Rubiaceae	*Galium leiocarpum*																						<1	1				
Rubiaceae	*Opercularia diphylla*														<1	20	<1	20	<1	20	<1	20					<1	2
Rubiaceae	*Pomax umbellata*																<1	20			<1	20					<1	5
Solanaceae	*Solanum nigrum*	Blackberry Nightshade							<1	1																		
Solanaceae	*Solanum stelligerum*	Devil's Needles	1	10																							<1	7
Scrophulariaceae	*Verbascum virgatum*	Twiggy Turnip							<1	1																		
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia																			<1	5					<1	1
Urticaceae	*Urtica incisa*	Stinging Nettle											<1	5														
Verbenaceae	*Verbena bonariensis**	Purpletop							1	100																		
Verbenaceae	*Verbena rigida**	Veined Verbena					1	100			<1	20					<1	2					<1	3	1	20		
Ground Layer - Monocots (Grasses)																												
Poaceae	*Aira caryophyllea**	Silvery Hairgrass									<1	20																
Poaceae	*Aristida ramosa*	Purple Wiregrass					2	200	5	500	5	500													5	50		
Poaceae	*Aristida vagans*	Threeawn Speargrass	X	X											1	50			5	500	1	100			1	10	5	50
Poaceae	*Briza minor**	Shivery Grass					1	100																				
Poaceae	*Bothriochloa decipiens*	Red Grass																							<1	10		
Poaceae	*Bothriochloa macra*	Redleg Grass					5	500	2	200	5	500																
Poaceae	*Capillipedium parviflorum*	Scented-top Grass																					5	50			5	50
Poaceae	*Chloris gayana**	Rhodes Grass					30	3000	30	3000																		
Poaceae	*Chloris ventricosa*	Plump Windmill Grass																							<1	10		
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	1	5	5	20	3	300	3	300	10	1000									20	2000			2	20	3	10
Poaceae	*Cynodon dactylon*	Couch					30	3000	30	3000	30	3000																
Poaceae	*Dichelachne micrantha*	Short-hair Plume Grass					2	200	5	500											<1	20						
Poaceae	*Dichelachne rara*																		<1	20								
Poaceae	*Digitaria diffusa*	Open Summer-grass							<1	50															<1	10		
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass			<1	10																	<1	2			<1	2
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog Grass															<1	10	<1	3	<1	10	1	50			1	10
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass							<1	20																		
Poaceae	*Ehrharta erecta**	Panic Veldt Grass																									<1	1
Poaceae	*Entolasia stricta*				<1	10									3	300	1	50	5	500					1	10		
Poaceae	*Entolasia marginata*	Bordered Panic			<1	2									<1	2							<1	2	<1	2		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass													<1	10	<1	20	<1	5	<1	20			1	20	1	20
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass			<1	10													<1	2					<1	3	<1	5
Poaceae	*Imperata cylindrica*	Blady Grass	15	2000	5	500																	10	1000	5	200		
Poaceae	*Melinis repens**	Red Natal Grass					5	500	5	500	20	2000																
Poaceae	*Microlaena stipoides*	Weeping Grass	5	2000			10	1000	10	1000					10	1000	5	500	5	500	10	1000	5	1000	2	50	25	2000
Poaceae	*Oplismenus aemulus*	Australian Basket Grass	2	50	<1	10													<1	20			5	1000	1	20	2	50

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

			6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
Family	**Scientific Name**	**Common Name**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**	**C**	**A**
Poaceae	*Oplismenus imbecillis*	Creeping Beard Grass	10	2000	1	50							2	200									<1	20				
Poaceae	*Panicum effusum*	Hairy Panic					<1	10							<1	10			<1	10	<1	10			4	50	x	x
Poaceae	*Panicum simile*	Two Colour Panic	1	10	<1	2																	<1	10			<1	5
Poaceae	*Paspalidium distans*														1	100			1	100	<1	100			3	100	1	20
Poaceae	*Paspalum dilatatum**																		<1	2								
Poaceae	*Poa labillardierei* var. *labillardierei*		1	10			<1	10															10	500				
Poaceae	*Rytidosperma setaceum*	Smallflower Wallaby Grass																			5	500						
Poaceae	*Sorghum leiocladum*						<1	5																				
Poaceae	*Sporobolus creber*	Western Rat-tail Grass					<1	20	1	50															<1	1		
Poaceae	*Themeda triandra*	Kangaroo Grass													30	2500	25	2500	30	3000	30	2500			5	50	20	500
Poaceae	*Vulpia bromoides**	Squirrel Tail Fescue					<1	200			<1	100																
Ground Layer - Monocots (Other)																												
Anthericaceae	*Arthropodium* sp. B		<1	10	<1	10									<1	1							<1	3			<1	1
Araceae	*Gymnostachys anceps*	Settlers' Twine	5	20									<1	2									<1	2				
Asparagaceae	*Asparagus aethiopicus**	Ground Asparagus													<1	1												
Commelinaceae	*Commelina cyanea*	Scurvy Weed									<1	5																
Cyperaceae	*Carex inversa*						<1	20	<1	50	<1	50													<1	3	<1	2
Cyperaceae	*Carex longebrachiata*																										<1	1
Cyperaceae	*Cyperus enervis*																						<1	5				
Cyperaceae	*Cyperus gracilis*														<1	20												
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge	2	2	<1	1									5	20	5	500	5	20			1	4	2	5	2	5
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge																										
Cyperaceae	*Lepidosperma laterale*	Sword-sedge	3	10	<1	5											<1	5					<1	10				
Cyperaceae	*Schoenus apogon*	Common Bog-rush																	<1	50	<1	200						
Cyperaceae	*Scleria mackaviensis*																										<1	5
Lomandraceae	*Lomandra confertifolia*	Mat-rush	5	20	45	500	<1	20							<1	10	15	1500	<1	20			3	10	40	200		
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush													1	200					1	200					25	2000
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	10	20									1	10	<1	32												
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush			<1	2									1	50	<1	20	<1	20	<1	50			1	5	3	20
Orchidaceae	*Caladenia catenata*	White Fingers	X	X																							<1	10
Orchidaceae	*Dipodium punctatum*										<1	1																
Orchidaceae	*Microtis unifolia*	Common Onion Orchid													<1	10					<1	20						
Phormiaceae	*Dianella caerulea* var. *cinerascens*		<1	2	<1	3									<1	3	<1	2	<1	1	<1	10			<1	4	<1	2
Phormiaceae	*Dianella caerulea* var. *producta*		2	10	1	5	<1	1	<1	2					1	10							1	5	2	10		
Phormiaceae	*Dianella longifolia* var. *longifolia*	Blueberry Lily															<1	2										
Phormiaceae	*Dianella revoluta*	Blue Flax-Lily																			<1	1						
Xanthorrhoeaceae	*Xanthorrhoea latifolia*				5	10																						

TABLE A1.1
FLORA SPECIES OBSERVED WITHIN SURVEY PLOTS

Family	Scientific Name	Common Name	6		12		8B		9B		10B		11B		12B		13B		14B		17B		10A		13A		15A	
			C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Climbers/Vines																												
Aphanopetalaceae	*Aphanopetalum resinosum*	Gum Vine											<1	2														
Apocynaceae	*Marsdenia flavescens*	Hairy Milk Vine																					<1	3				
Apocynaceae	*Marsdenia rostrata*	Milk Vine																					<1	3				
Apocynaceae	*Parsonsia straminea*	Common Silkpod	2	20	<1	1																	<1	3				
Asparagaceae	*Asparagus asparagoides**	Bridal Creeper																									1	20
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine	5	20	<1	3											<1	5					2	10	<1	4	<1	1
Dioscoreaceae	*Dioscorea transversa*	Native Yam											<1	20									1	20				
Fabaceae (Faboideae)	*Desmodium brachypodum*	Large Tick-trefoil									<1	10											<1	1				
Fabaceae (Faboideae)	*Desmodium gunnii*		2	50	2	100	<1	10	<1	20	<1	5			<1	20	<1	20	<1	10			1	50	1	50	1	50
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*				<1	3			<1	10															1	10		
Fabaceae (Faboideae)	*Desmodium varians*	Tick Trefoil			<1	2	<1	20	<1	10					<1	10	<1	20			<1	10			<1	10		
Fabaceae (Faboideae)	*Glycine clandestina*	Love Creeper													<1	5	<1	10							x	x		
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine			1	20					<1	20											<1	10	<1	10	<1	10
Fabaceae (Faboideae)	*Glycine tabacina*						<1	50	<1	50	<1	50			<1	50			<1	20	<1	50			<1	10	<1	5
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsparilla																			<1	2						
Fabaceae (Faboideae)	*Kennedia rubicunda*						1	20	1	20	<1	20																
Loranthaceae	*Dendropththoe vitellina*	Dusky Coral Pea					<1	2																				
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	3	20	<1	5									<1	10	<1	5					1	20				
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	2	20	1	20	<1	5			<1	5			<1	5	<1	10	<1	10	<1	1			<1	5	<1	4
Menispermaceae	*Stephania japonica* var. *japonicus*	Snake Vine																					1	4				
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry			<1	5									<1	4			<1	20					<1	3	x	x
Ranunculaceae	*Clematis aristata*	Old Man's Beard	<1	1																			<1	2	<1	1		
Rosaceae	*Rubus moluccanus*	Molucca Bramble																							<1	2		
Rosaceae	*Rubus parvifolius*	Native Raspberry	<1	2					<1	2													<1	1				
Rubiaceae	*Morinda jasminoides*	Sweet Morinda											1	50														
Smilacaceae	*Smilax australis*	Lawyer Vine																					<1	1				
Vitaceae	*Cayratia clematidea*	Native Grape			<1	5																						
Vitaceae	*Cissus antarctica*	Kangaroo Vine	3	5									1	3									5	15				
Vitaceae	*Clematicissus opaca*	Pepper Vine	1	10	1	20																	<1	10				
Vitaceae	*Tetrastigma nitens*												2	20									4	10				

APPENDIX 2
PRELIMINARY CREDIT CALCULATION / BIOBANKING CREDIT REPORTS

BioBanking credit report

NSW GOVERNMENT Office of Environment & Heritage

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 7/12/2020 Time: 12:53:01PM Calculator version: v4.0

Biobank details

Proposal ID:	132/2016/4071B
Proposal name:	Revised Martins Creek Quarry Expansion Project Biodiversity Offset Strategy
Proposal address:	Station St, Corey St, Merchants Rd, Vogels Rd and Grace Ave Martins Creek NSW 2420
Proponent name:	Buttai Gravel Pty Ltd
Proponent address:	PO Box 401 Beresfield NSW 2322
Proponent phone:	0249385261
Assessor name:	Jacob Manners
Assessor address:	PO Box 4300 East Gosford NSW 2250
Assessor phone:	(02)4324 7888
Assessor accreditation:	132

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	39.13	433.00
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	8.63	97.00
Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	1.33	14.00
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	9.26	122.00
Total	58.35	666

Credit profiles

1. Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River, (HU755)

Number of ecosystem credits created	14
IBRA sub-region	Upper Hunter

2. White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley, (HU798)

Number of ecosystem credits created	122
IBRA sub-region	Upper Hunter

3. Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast, (HU619)

Number of ecosystem credits created	433
IBRA sub-region	Upper Hunter

4. Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816)

Number of ecosystem credits created	18
IBRA sub-region	Upper Hunter

5. Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter, (HU816)

Number of ecosystem credits created	79
IBRA sub-region	Upper Hunter

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Slaty Red Gum	Eucalyptus glaucina	5,698.00	40,456
Koala	Phascolarctos cinereus	50.37	358
Southern Myotis	Myotis macropus	44.00	312
Brush-tailed Phascogale	Phascogale tapoatafa	58.34	414

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Brush-tailed Phascogale	Exclude commercial apiaries
Brush-tailed Phascogale	Exclude miscellaneous feral species
Brush-tailed Phascogale	Fox control
Koala	Exclude miscellaneous feral species
Koala	Slashing
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Exclude commercial apiaries
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Exclude miscellaneous feral species
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Feral and/or over-abundant native herbivore control
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Fox control
Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Slashing
Southern Myotis	Maintain or re-introduce natural flow regimes
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Exclude commercial apiaries
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Exclude miscellaneous feral species
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Feral and/or over-abundant native herbivore control
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Fox control
Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Slashing
Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	Exclude miscellaneous feral species
Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	Feral and/or over-abundant native herbivore control

Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	Fox control
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Exclude commercial apiaries
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Exclude miscellaneous feral species
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Feral and/or over-abundant native herbivore control
White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Fox control

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	132/2016/4071B
Proposal name :	Revised Martins Creek Quarry Expansion Project Biodiversity Offset Strategy
Assessor name :	Jacob Manners
Assessor accreditation number :	132
Tool version :	v4.0
Report created :	07/12/2020 12:52

Assessment circle name	Landscape score	TS subzone number	Vegetation zone name	Vegetation type name	Condition	Management zone name	Management zone area	Current site value	Future site value	Gain in site value	Total credit created for management zone
Circle 1	21.00	HU619_Moderate/Good_1	HU619_Moderate/Good	Slaty Red Gum grassy woodland on hinterland foothills of the southern North Coast	Moderate/Good	2	9.59	78.12	89.06	10.94	93
Circle 1	21.00	HU755_Moderate/Good_1	HU755_Moderate/Good	Whalebone Tree - Red Kamala dry subtropical rainforest of the lower Hunter River	Moderate/Good	1	1.33	92.00	96.00	4.00	14
Circle 1	21.00	HU798_Moderate/Good_1	HU798_Moderate/Good	White Mahogany - Spotted Gum - Grey Myrtle semi-mesic shrubby open forest of the central and lower Hunter Valley	Moderate/Good	1	9.26	79.17	95.31	16.14	122
Circle 1	21.00	HU816_Low_1	HU816_Moderate/Good	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Moderate/Good	1	1.98	72.40	73.96	1.56	18
Circle 1	21.00	HU816_Low_1	HU816_Low	Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter	Low	1	6.65	44.79	65.10	20.31	79

BioBanking Credit Calculator

Species credits

Proposal ID :	132/2016/4071B
Proposal name :	Revised Martins Creek Quarry Expansion Project Biodiversity Offset Strategy
Assessor name :	Jacob Manners
Assessor accreditation number :	132
Tool version :	v4.0
Report created :	07/12/2020 12:52

Scientific name	Common name	Species TG value	Biobank on identified population?	Number found?	Units	Number of credits
Eucalyptus glaucina	Slaty Red Gum	1.40	No	5,698.00	indiv	40,456
Myotis macropus	Southern Myotis	2.20	No	44.00	ha	312
Phascogale tapoatafa	Brush-tailed Phascogale	2.00	No	58.34	ha	414
Phascolarctos cinereus	Koala	2.60	No	50.37	ha	358