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Environmental & Social Consultants

NEW ENGLAND HIGHWAY BYPASS OF SINGLETON

Supplementary Biodiversity Assessment Report

FINAL

April 2023

NEW ENGLAND HIGHWAY BYPASS OF SINGLETON

Supplementary Biodiversity Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Transport for New South Wales

Project Director: Ryan Parsons
Project Manager: Rhys Osborne
Report No. 21501/R01
Date: April 2023

Environmental & Social Consultants

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

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Executive Summary

The New England Highway bypass of Singleton Project was approved August 2020 by Transport for New South Wales (Transport). The project is a two-lane highway bypass located to the west of Singleton and connects the New England Highway in Whittingham, to the south of Singleton, and to the north of Singleton near McDougalls Hill.

A Biodiversity Assessment Report (BAR) was prepared by Umwelt to accompany the Review of Environmental Factors (REF) (AECOM 2019) for the Singleton Bypass (BAR). The BAR (Umwelt 2019) was based on survey work by Umwelt and other consultants, however one of the key limitations of the surveys was land access. The BAR (Umwelt 2019) and the submissions report (AECOM 2020) summary of environmental safeguards and management measures Number B4 identified that, prior to the commencement of construction, ground-truthing surveys be undertaken between the Hunter River and the southern extent of the area surveyed by Umwelt (2019), north of the New England Highway near Gowrie Gates (referred to as the 2021 survey area). Since the REF was published in 2019, the approved project area and impact area have also been revised. The revised project area is approximately 268.56 ha (an increase of 10.86 ha) and the revised impact area is approximately 147.49 ha (an increase of 37.8 ha).

Given the overlap of the approved project and proposed modification, these areas are hereafter referred to collectively as the "project" unless explicitly stated.

This supplementary BAR provides the results of the additional survey and assessment of the land to identify the biodiversity values present and update the initial impacts as provided in the BAR (Umwelt 2019), as required. The results of the supplementary BAR include a consistency review of the surveys and impact assessment with the findings from 2019.

Key modifications since 2019:

- Minor adjustments to existing property acquisitions in response to property owner consultation and to facilitate general project constructability.
- Additional and modified public utility works required following further consultation with utility providers.
- Change in alignment of the northern property access off Rix's Creek Lane following further consultation and agreement with the property owners.

Threatened species, populations and threatened ecological communities recorded within the 2021 survey area include:

- Three threatened fauna species listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) confirmed present during the 2021 surveys included grey-crowned babblers (eastern subspecies) (*Pomatostomus temporalis temporalis*), grey-headed flying-fox (*Pteropus poliocephalus*) and southern myotis (*Myotis macropus*). Each species had been recorded during previous surveys to inform the BAR (Umwelt 2019). A total of 17 southern myotis were recorded in a harp trap set at one of the four culverts west of the current alignment of the Main North railway line (ranging between 20 m and 120 m from the revised impact area). The presence of pregnant females as well as one female carrying a young pup confirms that the culverts support a maternal roost for this species.

- One endangered population was confirmed present, outside of the revised impact area, comprising a total of 39 river red gum (*Eucalyptus camaldulensis*) in the Hunter Catchment endangered population (BC Act).

- Three threatened ecological communities (TEC) as listed under the BC Act were recorded, comprising Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC (BC Act) and Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act) which were previously recorded in 2019, as well as Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act).

- One TEC as listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) was recorded, comprising *Central Hunter Valley Eucalypt Forest and Woodland* CEEC (EPBC Act). This TEC was recorded previously during the 2019 surveys.

Summary of likely impacts on biodiversity values:

- The project may result in the removal of up to 42.89 ha of native vegetation and 101 hollow-bearing trees at the maximum extent of impact (including McDougalls Hill ancillary facility).

- Potential impact to ecological values includes removal of up to 21.13 ha of TECs. This would include 1.21 ha of *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregion* EEC (BC Act) (decrease of 0.01 ha compared to Umwelt 2019), 15.41 ha of *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC (BC Act) (increase of 1.44 ha), 0.37 ha of *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC (BC Act) and 19.55 ha of *Central Hunter Valley Eucalypt Forest and Woodland* CEEC (EPBC Act) (increase of 2.66 ha).

- The potential impacts have been assessed prior to the implementation of mitigation measures including restrictions on clearing for certain activities and design solutions to reduce the clearing footprint.

Summary of Significance Assessments

Threatened ecological communities and species with the potential to be impacted by the project were reviewed as a part of the consistency review outlined in this supplementary BAR. Previous assessments of significance have been revised for *Eucalyptus camaldulensis* endangered population in the Hunter Catchment (BC Act), southern myotis (*Myotis macropus*) (BC Act), *Central Hunter Valley Eucalypt Forest and Woodland* CEEC (EPBC Act). An additional assessment of significance was conducted for *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC* listed under the BC Act.

It is likely that the project would significantly impact the *Central Hunter Valley Eucalypt Forest and Woodland* CEEC (EPBC Act), consistent with the assessment of significance completed as part of the BAR (Umwelt 2019).

- A review of key mitigation measures to minimise impact to biodiversity identified the following:
    - Minimisation of vegetation removal through further detailed design. Upon completion of the final road design the smaller impact footprint will be assessed to refine the offset liability.
    - A specific microbat management plan will be prepared by a microbat specialist where a maternal roost of threatened southern myotis (*Myotis macropus*) was recorded in proximity to the impact area.
    - Mitigation measure outlined in BAR (Umwelt 2019) completed by the preparation of this consistency review comprise detailed surveys of previously inaccessible land as well as targeted surveys for river red gum (*Eucalyptus camaldulensis*) (endangered population – BC Act) and *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* (EEC – BC Act) along tributaries of the Hunter River.

All remaining mitigation measures outlined in the BAR (Umwelt 2019) continue to be required to adequately reduce impacts from the project.

Limitations and Assumptions

- Seasonal effects of floristic sampling, where most of the surveys were completed in winter.
- The 2021 survey was undertaken within the remaining portion of the revised project area comprising native vegetation. Non-native vegetation occurring on agricultural land south-east of the Hunter River did not require ground-truthing for floristic sampling based on outcomes of the desktop review of aerial imagery and known land management practices.
- A small patch of native vegetation occurring in an extended portion of the revised project area was unable to be inspected at the time of these surveys. The extended portion is located to the south of Waterworks Lane along the Hunter River.
- The McDougalls Hill ancillary facility was not surveyed for inclusion in this supplementary BAR. The site has recently been cleared by the landowner for existing industrial land use purposes.
- A total of four culverts were found during the targeted microbat survey where:
- Three of the six culverts from the project REF were located during the field survey (including a dual passage box culvert previously identified as two separate structures).

- two of the six culvert locations from the project REF could not be found during the field survey.
- an additional culvert was located during a search of the broader area around 300 m north of the nearest culvert location provided in the project REF (AECOM 2019).

None of the limitations outlined above were expected to substantially change the outcomes identified in this supplementary BAR.

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1.0 Introduction

1.1 Background

The New England Highway bypass of Singleton (the project) was approved in August 2020 by Transport for New South Wales (Transport). The project is a two-lane highway bypass located to the west of Singleton in the Singleton local government area (LGA) in the Hunter Valley, about 75 km inland from Newcastle, 47 km south-east of Muswellbrook and 200 km from Sydney (**Figure 1.1**).

The project has been assessed under Part 5, Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A Review of Environmental Factors (REF) has been completed for the project (AECOM 2019) including a biodiversity impact assessment prepared by Umwelt (Australia) Pty Limited (Umwelt 2019b). The project REF was publicly displayed, and a submissions report was published in August 2020 (AECOM 2020), that summarises the results of consultation, issues raised and provides responses to issues. The submissions report includes a summary of environmental safeguards and management measures. The project was determined by Transport in August 2020.

Transport is currently undertaking detailed design for the project and have identified changes that are not consistent with the project as approved and therefore have carried out an assessment of the potential environmental impacts of those changes (the proposed modification). This assessment is in the form of an addendum REF.

Transport have engaged Umwelt to undertake a supplementary Biodiversity Assessment Report (BAR) of those areas that were unable to be surveyed in 2019 due to access restrictions and to assess the additional areas that form the proposed modification to the project.

Given the overlap of the approved project and proposed modification, these areas are hereafter referred to collectively as the “project” unless explicitly stated.

1.2 Singleton Bypass

1.2.1 The Project

The Singleton bypass would depart the New England Highway near Newington Lane in Whittingham then head west over the Main North railway line across the Hunter River floodplain over Putty Road. It would continue over the Hunter River, west of Singleton, before crossing the New England Highway to the west of the Gowrie Gates and continue north before re-joining the highway north of McDougalls Hill (refer to **Figure 1.2**).

Most of the clearance of native vegetation would occur in the northern end of the project to the north of the Gowrie Gates. Clearing trees along the Hunter River for the new bridge and some clearing of isolated paddock trees south of the Hunter River would also be required.

The project described in November 2019 covered a total of 257.7 ha (Umwelt 2019).

1.2.2 Summary of the Biodiversity Assessment Report 2019

A Biodiversity Assessment Report (BAR) was prepared by Umwelt to accompany the project REF (AECOM 2019). The BAR (Umwelt 2019) was based on survey work by Umwelt and other consultants.

The BAR (Umwelt 2019) identified that the project area provided habitat for threatened species, populations and ecological communities as listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), NSW *Fisheries Management Act 1994* (FM Act) and Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act), including:

- Nine threatened fauna species as listed under the BC Act were confirmed present within the project area through targeted fauna surveys, comprising little eagle (*Hieraaetus morphnoides*), grey-crowned babbler (*Pomatostomus temporalis temporalis*), eastern coastal free-tailed bat (*Micronomus norfolcensis*), little bent-winged bat (*Miniopterus australis*), large bent-winged bat (*Miniopterus orianae oceanensis*), southern myotis (*Myotis macropus*), squirrel glider (*Petaurus norfolcensis*), brush-tailed phascogale (*Phascogale tapoatafa*) and grey-headed flying-fox (*Pteropus poliocephalus*). An additional four species were recorded as potentially occurring, being masked owl (*Tyto novaehollandiae*), eastern false pipistrelle (*Falsistrellus tasmaniensis*), greater broad-nosed bat (*Scoteanax rueppellii*) and eastern cave bat (*Vespadelus troughtoni*).

- One endangered population was recorded in the project area, outside of the impact area, comprising river red gum (*Eucalyptus camaldulensis*) in the Hunter Catchment endangered population (BC Act).

- Two Threatened Ecological Communities (TEC) as listed under the BC Act were recorded within the project area, comprising *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions Endangered Ecological Community* (EEC) (BC Act) and *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC* (BC Act).

- One TEC as listed under the EPBC Act was recorded in the project area, comprising *Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community* (CEEC) (EPBC Act).

- Two TECs were predicted to occur in the project area based on regional vegetation mapping where access was not possible, comprising the *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregion* EEC (BC Act) and *Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* EEC.

The Singleton bypass project was estimated to disturb up to 31.93 ha of native vegetation (Umwelt 2019). Potential impact to ecological values included removal of up to 1.22 ha of *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregion* EEC (BC Act), 13.98 ha of *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC (BC Act) and 16.89 ha of *Central Hunter Valley Eucalypt Forest and Woodland* CEEC (EPBC Act).

1.3 Purpose of this Report

One of the key limitations of the surveys to inform the BAR (Umwelt 2019) was land access. Where vegetation within the project area was not surveyed and mapped by Umwelt or others, the State Vegetation Type Map: Upper Hunter (OEH 2019) was used to inform the report. The BAR (Umwelt 2019) and the Submissions Report, summary of environmental safeguards and management measures Number B4 identified that, prior to the commencement of construction, ground-truthing surveys be undertaken between the Hunter River and the southern extent of the area surveyed by Umwelt (2019), north of the New England Highway near Gowrie Gates, would be required prior to the commencement of construction.

Of the 31.93 ha of native vegetation communities about six ha of land was unable to be accessed and regional vegetation mapping was used. The six ha of previously unable to be accessed land is the subject of this supplementary BAR. This report provides the results of the additional survey and assessment of the land to identify the biodiversity values present and update the initial impacts as provided in Umwelt (2019), as required.

The structure of this supplementary BAR aims to review impacts associated with the Singleton Bypass by:

- identifying the biodiversity values within the 2021 survey area (previously limited to regional vegetation mapping outlined in the BAR (Umwelt 2019)) (outlined in **Section 3.1**)
- evaluating the biodiversity values within the total revised project area compared to 2019 (**Section 3.2**)
- evaluating the impacts to biodiversity values within the total revised impact area compared to 2019 (**Section 4.0**)
- identify revisions to the environmental safeguards and management measures based on the outcomes of this consistency review (**Section 5.0**), and
- review the offset liability of the project based on the design changes.

Specifically, the supplementary BAR addresses a number of key mitigation and management measures from the BAR (Umwelt 2019). This report includes the results of:

- targeted surveys to confirm the presence of threatened biodiversity within previously inaccessible areas impacted by the project including:
    - River red gum (*Eucalyptus camaldulensis*) endangered population as listed under the BC Act.
    - Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions Endangered Ecological Community as listed under the BC Act.
    - River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria Critically Endangered Ecological Community as listed under the EPBC Act.
    - Fauna habitat assessment within the previously inaccessible areas.
    - Targeted micro-bat surveys.

1.4 Proposed Modification

1.4.1 Design Change

Transport for NSW (Transport) proposes to modify the New England Highway bypass of Singleton by adjusting the proposal area following consultation and to facilitate general constructability (proposed modification). Key features of the proposed modification would include:

- Minor adjustments to existing property acquisitions in response to property owner consultation and to facilitate general project constructability.
- Additional and modified public utility works required following further consultation with utility providers.
- Change in alignment of the northern property access off Rix's Creek Lane following further consultation and agreement with the property owners.

1.4.2 Study Area for This Assessment

The study area for this report includes previously inaccessible land in the project area between the Hunter River and the southern extent of the area surveyed to the north of the New England Highway near the Gowrie Gates, as well as a section of the project area along the north-west boundary (hereafter referred to as the revised project area) (refer to **Figure 1.2**).

The total extent remaining to be surveyed of the revised project area included around 179.30 ha, which included 86.57 ha of native vegetation which was subject to survey and 90.05 ha identified as non-native vegetation occurring on agricultural land southeast of the Hunter River by regional vegetation mapping. Areas constituting non-native vegetation as confirmed by desktop review of aerial imagery and known land management practices, were not surveyed.

Since 2019, the impact area has been revised and are referred hereafter to as the revised impact area. The revised impact area includes the maximum perceived extent of construction including ancillary sites and enabling work such as utility relocations, however the actual extent of works within this area is expected to be less once the design has been finalised. Restrictions on the extent of clearing for ancillary sites and enabling work will be imposed that will minimise the clearing impact from that assessed in this supplementary BAR.

The boundaries identified in this supplementary BAR have been defined as:

- **2019 project area** – the broader study area considered by the project REF and assessed in the BAR (Umwelt 2019) was 257.73 ha (refer to **Figure 1.2**).
- **Revised project area** – the broader study area considered by the proposed modification (described in **Section 1.4.1**) is 268.56 ha (refer to **Figure 1.2**).
- **2019 survey area** – the northern portion of the 2019 project area which was ground-truthed and assessed by the BAR (Umwelt 2019) was 86.57 ha.

- **2021 survey area** – the remaining extent of the revised project area identified as native vegetation by regional vegetation mapping and verified by surveys in 2021 for the supplementary BAR is 89.25 ha.
- **2019 impact area** – the impact footprint considered by the project REF and assessed in the BAR (Umwelt 2019) was 109.69 ha (refer to **Figure 1.2**).
- **Revised impact area** – the impact footprint of the project including the MDHF for the supplementary BAR is 147.49 ha (refer to **Figure 1.2**).

The MDHF was not surveyed for the inclusion in this supplementary BAR and has recently been cleared of woody vegetation by the landowner for use as an industrial site. Based on recent aerial imagery (Nearmaps, May 2022) the MDHF comprises non-woody vegetation and will require further assessment if works are confirmed.

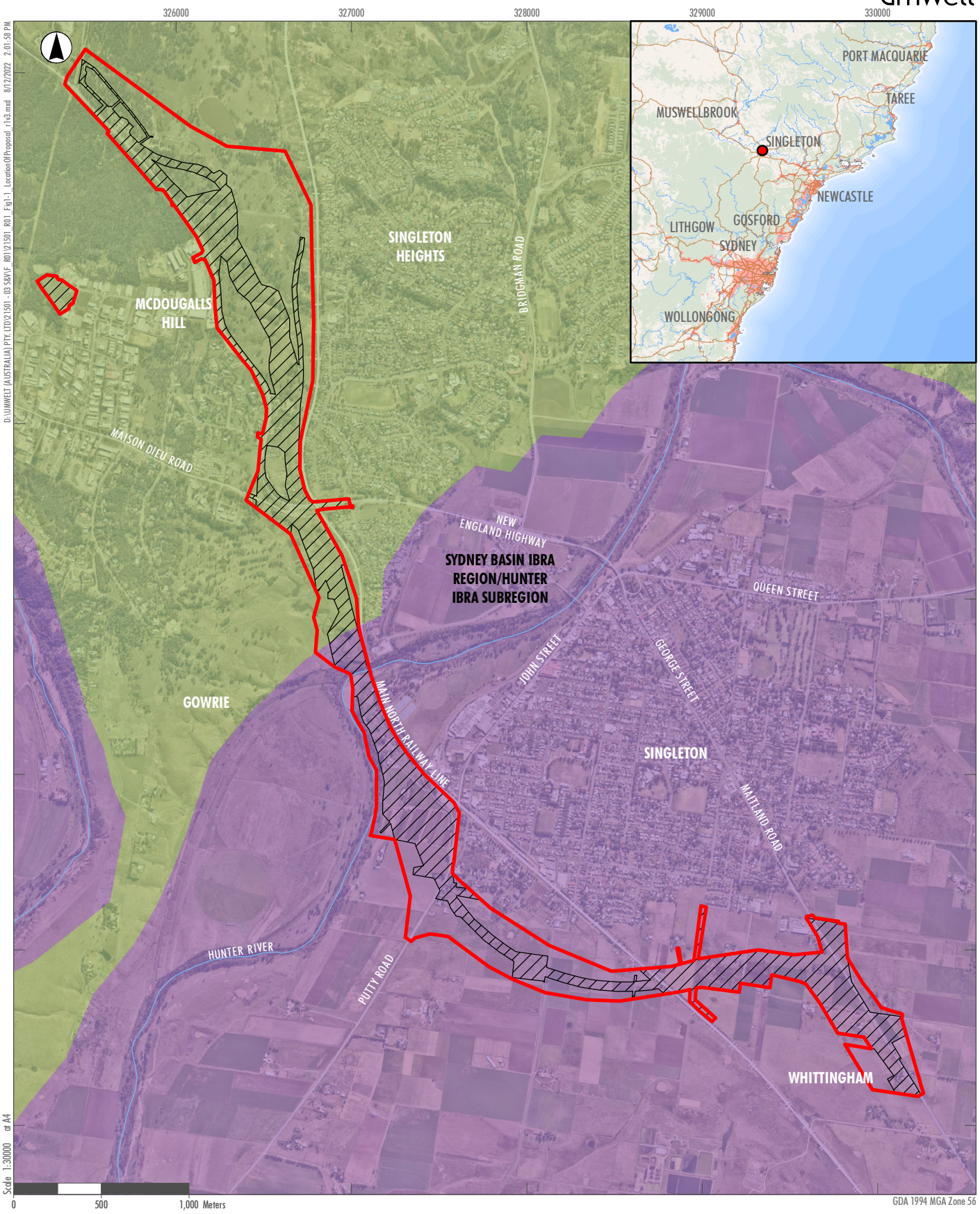
The project and impact areas for the BAR (Umwelt 2019) and the revised project area and revised impact areas assessed in this supplementary BAR are shown in **Figure 1.2**.

1.5 Terms and Definitions

The following terms are used in this report:

- **Project** – is a two-lane highway bypass located to the west of Singleton and connects the New England Highway in Whittingham, to the south of Singleton, and in the north of Singleton near McDougalls Hill. The Project was approved in August 2020. It includes bridges over the Hunter River, Hunter River floodplain, Main North railway line, local roads, and connections to the New England Highway in the north and south of the bypass as well as connections to the Putty Road.
- **Construction area** – the area to be directly impacted by the project. This comprises the construction footprint of the proposed two-lane highway, bridge crossing of the Hunter River, Hunter River floodplain and local roads. Includes all roadside cut and fill and ancillary (construction compound) areas.
- **2019 project area** – the broader study area considered by the project REF and assessed in the BAR (Umwelt 2019) was 257.73 ha (refer to **Figure 1.2**).
- Revised project area – the broader study area considered by the proposed modification (described in **Section 1.4.1**) is 268.56 ha (refer to **Figure 1.2**).
- **2019 survey area** – the northern portion of the project area which was ground-truthed and assessed by the BAR (Umwelt 2019) was 86.57 ha.
- **2021 survey area** – the remaining extent of the revised project area identified as native vegetation by regional vegetation mapping and verified by surveys in 2021 for the supplementary BAR is 89.25 ha.
- **2019 impact area** – the impact footprint considered by the REF and assessed in the BAR (Umwelt 2019) was 109.69 ha (refer to **Figure 1.2**).
- **Revised impact area** –the impact footprint of the project including the MDHF for the supplementary BAR is 147.49 ha (refer to **Figure 1.2**).

- **Locality** – the area within 10 km of the project.
- **BAR (Umwelt 2019)** – the Biodiversity Assessment Report prepared to assess the impact of the project on biodiversity values. The BAR (Umwelt 2019) supported the review of environmental factors (REF) approved in August 2020.
- **Supplementary BAR** – this Biodiversity Assessment Report assessing the impact of the modifications to the project as described in **Section 1.4.1** and verifying assumptions included in the BAR (Umwelt 2019) for those areas that were not accessible at the time.



Legend

- Revised Project Area
- Revised Impact Area

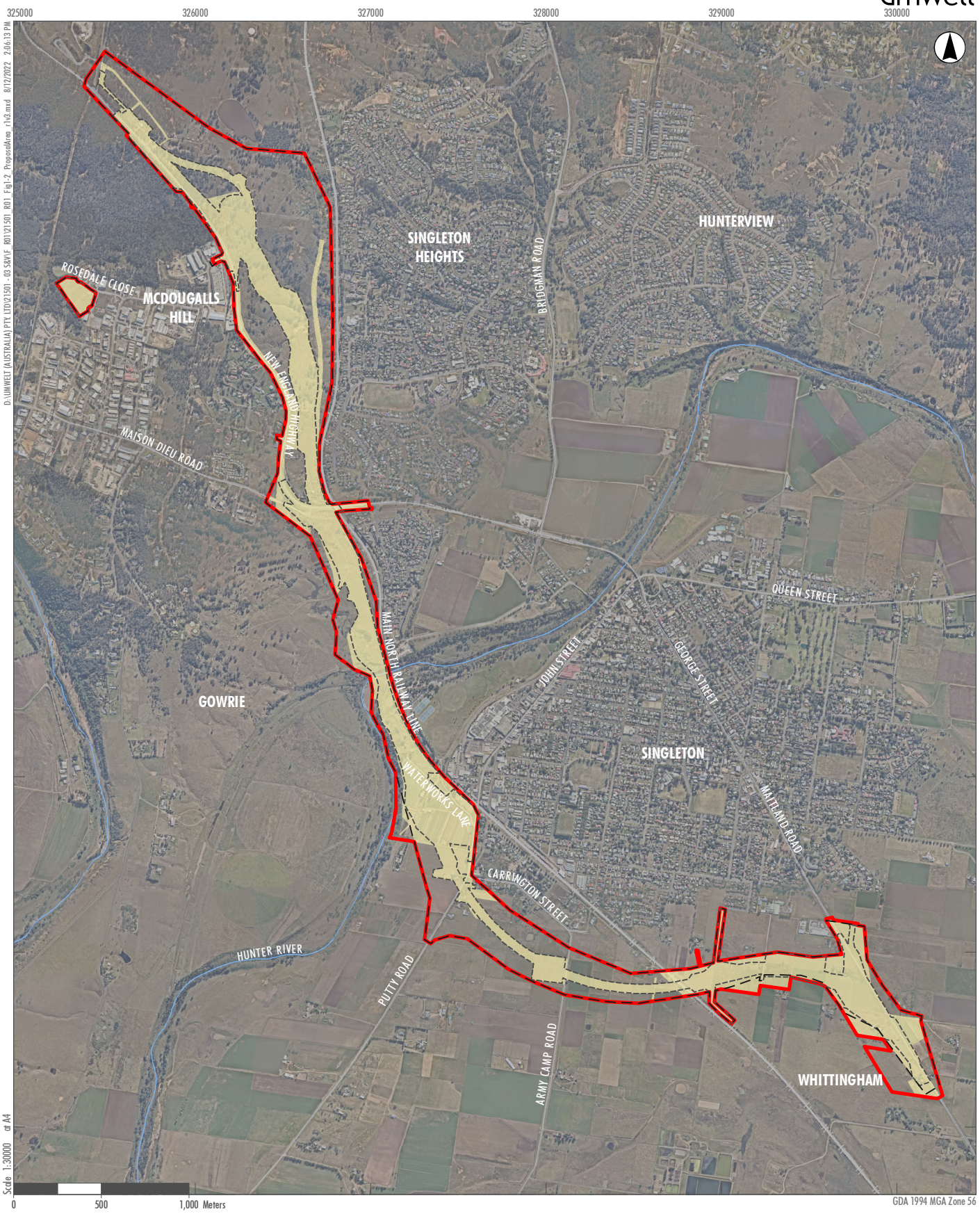
Mitchel Landscape

- Central Hunter Alluvial Plains
- Central Hunter Foothills

FIGURE 1.1

Location of the Project

Image Source: Nearmap (Dec 2021) Data source: NSW DSFI (2021); NSW OEH (2021); AECOM (2019), ELA (2019)



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area
- 2019 Impact Area

FIGURE 1.2

The Project Area

Image Source: Nearmap (Dec 2021) Data source: NSW DSFI (2021) AECOM (2019)

2.0 Methodology

2.1 Personnel

Eco Logical Australia (ELA) Ecologist Tom Schmidt and Principal Ecologist Martin Sullivan conducted flora and fauna surveys within the 2019 Project Area between February 2018 and May 2019.

Niche Senior Ecologist, Radika Michniewicz (Bachelor of Science (Hons), PhD) and Ecologist Rhidian Harrington (Bachelor of Science (Hons), MSc, PhD, accredited Biodiversity Assessment Method (BAM) Assessor) conducted habitat surveys and BAM surveys adjacent to the 2019 Project Area in August 2019.

Umwelt (Australia) Pty Ltd (Umwelt) Principal Ecologist Ryan Parsons (Bachelor of Environmental Science and Management (Hons), accredited BAM Assessor) and Senior Ecologist Trish Robinson (Bachelor of Science (Hons), accredited BAM Assessor) conducted vegetation surveys across the central northern portion of the 2019 project area on 21, 24, 25 and 27 June 2019. Technical direction and review were provided by Umwelt's National Ecology Leader Travis Peake (Bachelor of Natural Resources Hons, accredited BAM Assessor) and Umwelt's Principal Ecologist/Environmental Scientist, Naomi Buchhorn (Bachelor of Science (Hons)).

In 2021, Umwelt Senior Ecologist Rhys Osborne, (Bachelor of Science (Biology), Bachelor of Environmental Science and Management (Hons), accredited BAM Assessor), Senior Ecologist James Garnham (Bachelor of Environmental Science and Management (Hons), PhD, accredited BAM Assessor) and Ecologist Brayden Luke (Bachelor of Science (Ecology and Marine Biology)) conducted surveys the remaining portion of the revised project area where access was limited previously. Floristic surveys (including habitat assessment) were undertaken by Rhys and Brayden in September 2021. Targeted microbat surveys were undertaken by Rhys and James during the breeding period for the southern myotis (*Myotis macropus*) in October 2021 to confirm the presence of microbat maternity roosts in six culvert structures in the northern portion of the revised project area. Additional targeted microbat surveys were undertaken to assess utilisation of culvert structures outside of the known breeding period for southern myotis in August 2022.

2.2 Background Research

The ecological desktop assessment included a review of relevant and publicly available literature and background information to identify threatened and migratory species, endangered populations and threatened ecological communities (TECs) (or their habitats) that had previously been recorded within, or near to, the revised project area. The following searches were completed, and resources reviewed by Umwelt in 2021 for this consistency review:

- Office of Planning and Environment (DPE) Atlas of NSW Wildlife Database (DPE 2022a) within a 10 km radius of the revised project area (the locality), accessed by ELA in February 2018 and June 2019, last accessed by Umwelt 11 August 2021.
- NSW Department of Primary Industries (DPI) Fisheries Fish Records Viewer (DPI 2018), accessed by ELA in February 2018.

- Department of the Environment and Energy (DoEE), now Department of Climate Change, Energy, the Environment and Water (DCCEEW), Protected Matters Search Tool (PMST) for known/predicted EPBC Act listed TECs (DoEE 2021) within a 10 km radius of the revised project area, accessed by ELA in February 2018, last accessed by Umwelt September 2021.
- Commonwealth critical habitat register, accessed by ELA in February 2018.
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE), accessed by ELA in February 2018, last accessed by Umwelt January 2022.
- DCCEEW directory of important wetlands, accessed by ELA in February 2018, last accessed by Umwelt January 2022.
- DPI database for aquatic TECs, accessed by ELA in February 2018, last accessed by Umwelt December 2021.
- DPI Key Fish Habitat mapping, accessed by ELA in February 2018, last accessed by Umwelt December 2021.
- OEH vegetation information system (VIS) database, accessed by Umwelt in June 2019, last accessed December 2021.
- The Vegetation of the Central Hunter Valley, NSW (Peake 2006).
- Greater Hunter Native Vegetation Mapping (Sivertsen et al. 2011).
- State Vegetation Type Map: Upper Hunter (OEH 2019).
- The PMST report generated in August 2021 listed a total of 23 threatened fauna species (including 10 birds, three frogs, eight mammals and two reptiles), 11 threatened flora species, five TECs and 15 migratory species as being previously recorded or predicted to occur within a 10 km radius of the project. A total of seven Matters of National Environmental Significance (MNES) listed under the EPBC Act were predicted to occur in addition to those assessed in the BAR (Umwelt 2019).
- The Atlas of NSW Wildlife Database identified 18 threatened fauna species and three threatened flora species within a 10 km radius of the revised project area. One threatened species listed under the BC Act was identified 10 km of the revised project area in addition to those assessed in the BAR (Umwelt 2019).
- DPI Fisheries spatial data portal identified potential habitat for the southern, purple-spotted gudgeon (*Mogurnda adspersa*) in the revised project area. The species is listed as endangered in NSW under the FM Act.

No critical habitat was identified within the revised project area (DoEE 2021).

The Hunter River and Stonequarry Gully are mapped on the NSW Biodiversity Values Map (DPIE 2021).

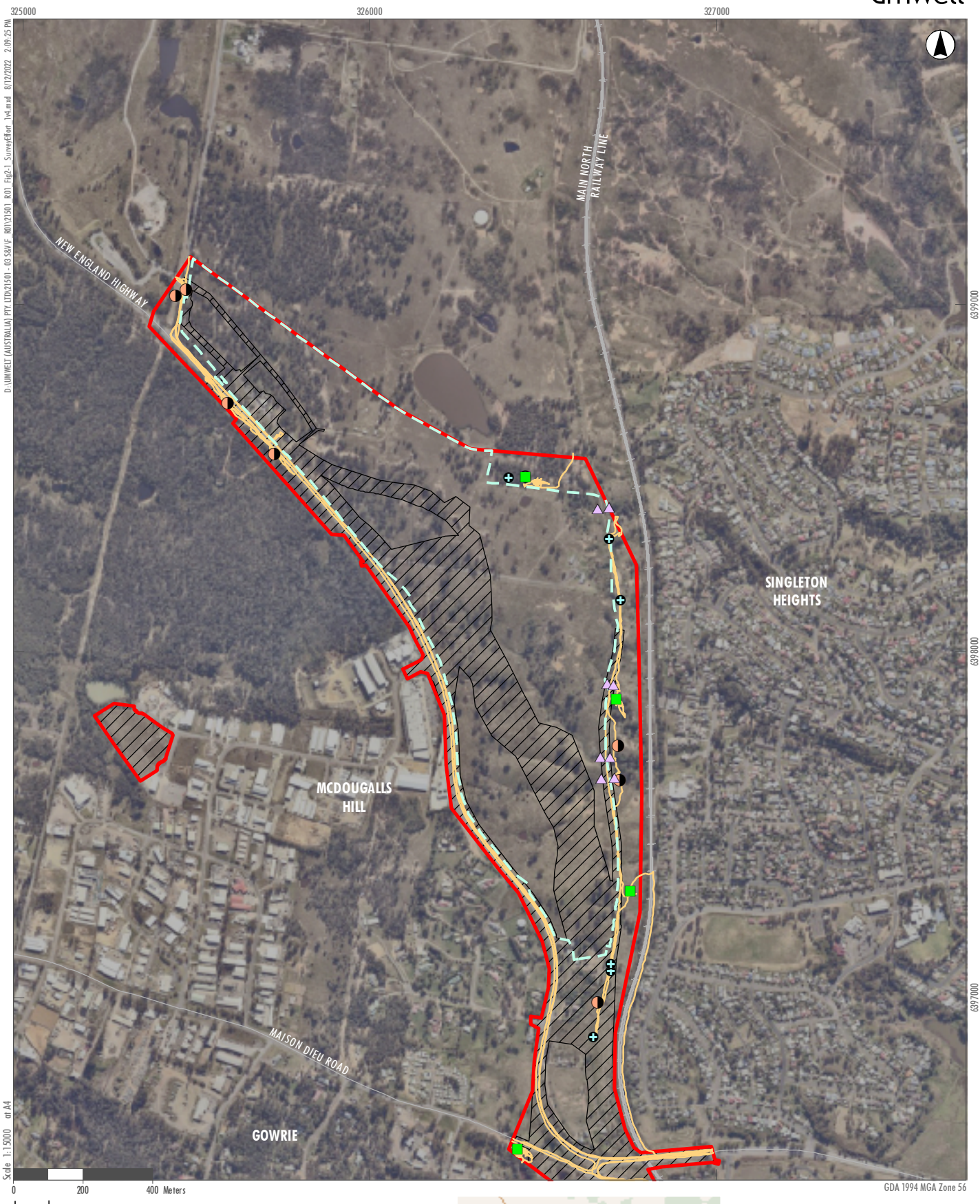
No declared areas of outstanding biodiversity value (BC Act) are located in, or near to, the revised project area.

2.3 Field Survey

Field surveys have been completed in the revised project area over multiple seasons by ELA, Niche and Umwelt. These surveys have considered the requirements of a number of survey guidelines where relevant, including:

- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities –Working Draft (DEC 2004).
- Biodiversity Assessment Method 2020 (DPIE 2020a).
- Field surveys for this supplementary BAR were undertaken within previously inaccessible areas and included vegetation surveys, targeted flora surveys, fauna habitat assessments and targeted microbat surveys. Details of survey methodology is provided below.

The locations of the 2021 surveys are shown in **Figure 2.1.1** to **Figure 2.1.3**.



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Survey Area Boundary
- Meandering Tracks
- Microbat Trapping Locations
- BAM Floristic Plot
- Rapid Assessment Points
- Photo Point Locations

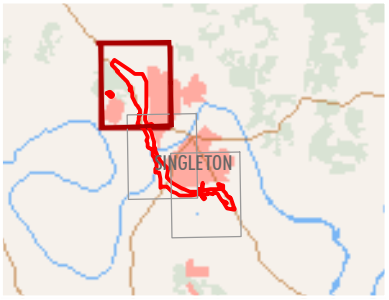
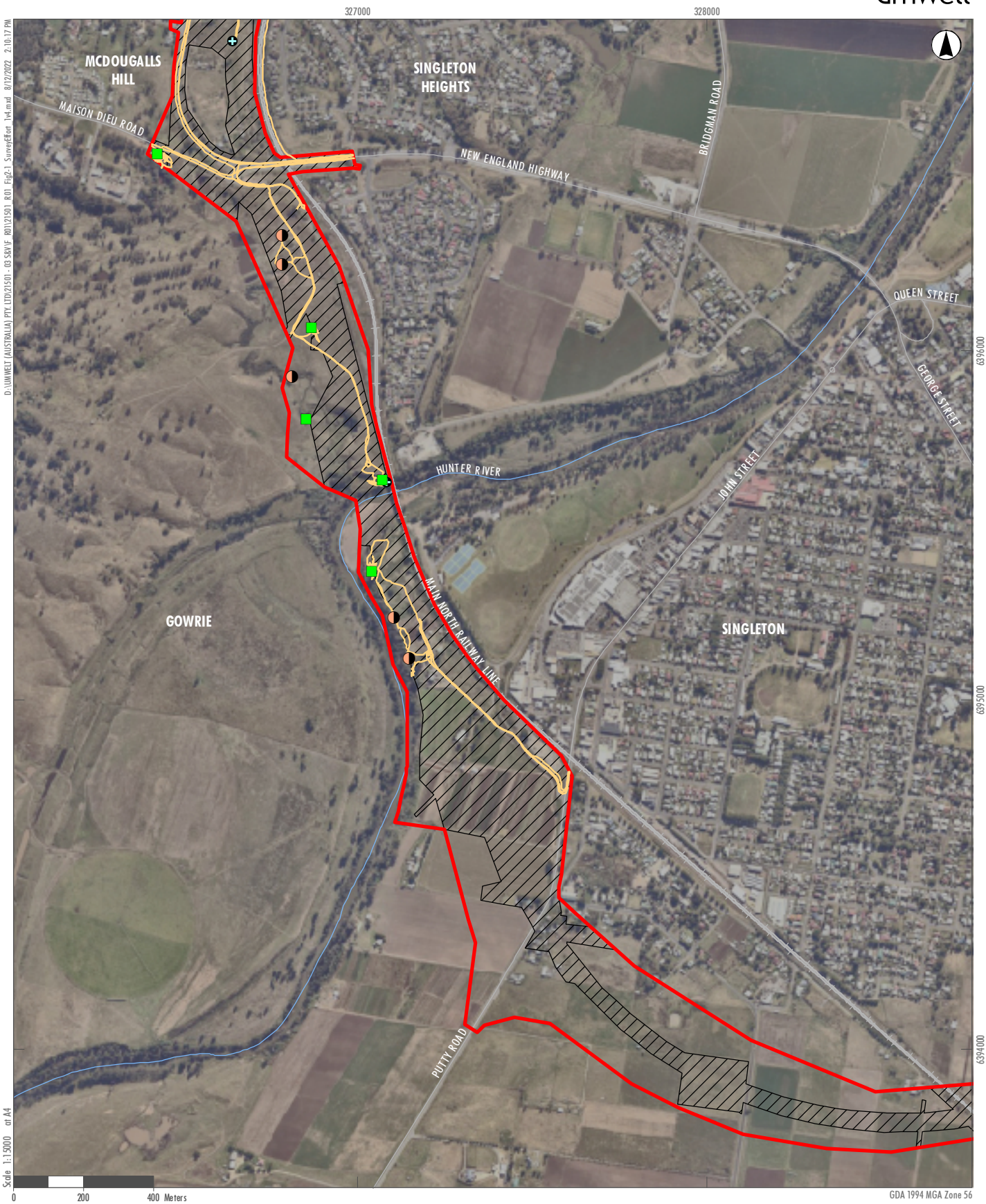


FIGURE 2.1.1

Survey Effort 2021

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)



Legend

- Revised Project Area
- Revised Impact Area
- Meandering Tracks
- BAM Floristic Plot
- Rapid Assessment Points
- Photo Point Locations

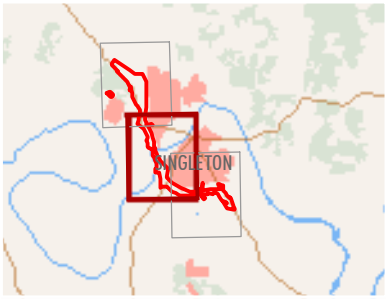


FIGURE 2.1.2

Survey Effort 2021

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

Legend

- Revised Project Area
- Revised Impact Area

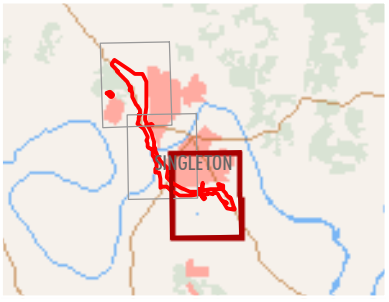


FIGURE 2.1.3

Survey Effort 2021

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

2.3.1 Vegetation Surveys

Umwelt conducted a total of nine vegetation integrity plots and 12 rapid vegetation assessment points across the 2021 survey area (refer to **Figure 2.1.1** to **Figure 2.1.3**). Vegetation integrity plots and rapid vegetation assessment points were undertaken over four days, 25–26 August and 6–8 September 2021. The location of each vegetation integrity plot was recorded using a hand-held GPS and the rapid vegetation assessment points were recorded using the Collector application for ArcGIS, with a general accuracy of ± 5 m.

At each vegetation integrity plot, data was recorded according to Section 5 of the Biodiversity Assessment Method (BAM) (DPIE 2020). This involves setting out 20 by 50 m, 20 by 20 m and one by one m plots.

At each vegetation integrity plot, approximately 45 to 60 minutes was spent searching for all vascular flora species present within the 20 by 20 m plot. Searches of each 20 by 20 m plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of any shrub, mid-story, canopy, and emergent layers were also thoroughly examined.

For each flora species recorded in the vegetation integrity plot, the following data was collected in accordance with Table 1 of the BAM (DPIE 2020):

- Stratum/layer in which the species occurs
- Growth form
- Scientific name and common name
- Cover
- Abundance.

At each vegetation integrity plot the following attributes were also recorded in accordance with Table 2 of the BAM (DPIE 2020):

- Composition – native plant species richness by growth form (within the 20 by 20 m plot).
- Structure – estimate foliage cover of native and exotic species by growth form (within the 20 by 20 m plot).
- Function – (within the 20 by 50 m plot) including number of large trees, presence or otherwise of tree stem size classes, presence or otherwise of canopy species regeneration, length of fallen logs, percentage cover for litter (recorded from five one by one m plots), number of trees with hollows and high threat exotic plant cover.

2.3.2 Targeted Flora Surveys

Targeted surveys to confirm the presence of threatened biodiversity within previously inaccessible areas targeting included:

- River red gum (*Eucalyptus camaldulensis*) endangered population as listed under the BC Act.
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC as listed under the BC Act.
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria CEEC as listed under the EPBC Act.

2.3.3 Fauna Habitat Assessment

Fauna habitat assessment were completed within the 2021 survey area focusing on:

- The habitat suitability of the four culvert structures in the rail corridor (refer to **Figure 2.1.1** to **Figure 2.1.3**) for cave roosting microbats, including the previously recorded southern myotis (*Myotis macropus*). The outcome of these assessments identified that additional surveys were needed in spring (October) as detailed in **Section 2.3.4**.
- Habitat for threatened birds to identify seasonal resources, available nesting sites and searches for characteristic nests, including large stick nests.
- Habitat for arboreal species to identify suitable hollow resources, preferred feed trees and habitat trees. It is noted that since the BAR (Umwelt 2019), the threatened grey-headed flying-fox (*Pteropus poliocephalus*) have moved their camp in Singleton from Burdekin Park to trees along the Hunter River. The survey assessed the location of the camp on the Hunter River relative to the revised project area.

2.3.4 Targeted Microbat Surveys

Targeted surveys were undertaken in to assess the potential roost status for southern myotis (*Myotis macropus*) in sandstone culverts situated throughout the northern portion of the revised project area west of the existing rail corridor. Surveys were completed during the known breeding season in October 2021, as well as a second survey conducted out of the breeding period in August 2022 to satisfy mitigation measures for the Microbat Management Plan.

A total of four culverts were confirmed within the revised project area comprising three sandstone arch culverts with a single passage and a dual passage sandstone box culvert (previously recorded in the project REF as two separate culverts) (refer to **Figure 2.1.1** to **Figure 2.1.3** and **Photo 2.1** and **Photo 2.2**). Surveys included:

- External visual inspection (including habitat assessment) to identify features (such as defects in sandstone or disused swallow nests), signs of use (piles casings across the culvert flooring), and presence.

- Trapping survey which included setting a harp trap at the entrance to each culvert while the other entrance was blocked using a tarp. Harp traps were set about one hour before dusk and monitored for up to two hours after sun set. External inspection of the culverts was undertaken during the survey to identify any microbat activity. Any microbats captured were processed (measured and weighed for species identification, and breeding status recorded – carrying young, signs of pregnancy for the females and swollen testes for the males). Captured individuals were released immediately after they were processed.

Photo 2.1 Sandstone arch culvert located within the revised project area

Photo 2.2 Sandstone box culvert located within the revised project area

2.4 Limitations and Assumptions

Floristic sampling provides a snapshot of the species composition and diversity in time that indicated the condition of target vegetation communities. Surveys undertaken throughout the year can be affected by the season which sampling was completed such that surveys completed in winter months likely demonstrate a lower species diversity compared to late spring. The majority of floristic sampling to inform this supplementary BAR were completed in late August 2021.

The desktop assessment used aerial imagery to identify areas of non-native vegetation occurring on agricultural land south-east of the Hunter River.

The field surveys outlined in this supplementary BAR aimed to ground-truth areas of native vegetation that were previously inaccessible. While most of areas of native vegetation within the 2021 survey area were able to be inspected, a small portion of land south of the Singleton Shire Council pumping station and the MDHF were inaccessible at the time of these surveys. Based on observations made during the survey, it is expected that the native vegetation within the area south of the Singleton Shire Council pumping station represents a continuation of those adjacent to the north, comprising PCT 42 along the lower banks of the Hunter River and non-native vegetation along agricultural land on the floodplain.

A review of regional vegetation mapping (OEH 2019) had been used to inform this supplementary BAR as detailed in the BAR (Umwelt 2019) for the location of the MDHF. Aerial photography shows that most of the ancillary compound to the west of McDougalls Hill had been cleared since the publication of the regional vegetation mapping, and the extent of the PCTs present in this area have been calculated based on this updated aerial photography. If this facility is to be used, further assessment will be required for approval.

Floristic sampling of PCT 42 along the southern bank of the Hunter River was completed where the vegetation community could be safely accessed. Much of this PCT occurring along the southern bank is situated along a steep slope covered by exotic balloon vine. While the canopy was less dense at the sample location, the floristic plot was placed along the northern extent of this patch where the understory was representative of the overall patch condition.

A total of six culvert structures with potential microbat habitat were identified near the 2019 survey area (AECOM 2019). During field surveys only three culvert structures could be found in the vicinity of the project REF culvert locations provided, while an additional culvert was located around 300 m north of the closest point location during a search of the broader area for the two missing culverts. A total of four culverts were confirmed within the revised project area comprising three sandstone arch culverts with a single passage and a dual passage sandstone box culvert (previously recorded in the project REF as two separate culverts).

None of the limitations outlined above were expected to substantially change the outcomes identified in this supplementary BAR.

3.0 Existing Environment

The existing environment has been separated into two stages to determine if the outcomes of the BAR (Umwelt 2019) are consistent with the findings of the 2021 survey. **Section 3.1** outlines the results of the 2021 survey which focused on areas of land that were unable to be accessed within the 2019 project area, as well as additional areas subject to the project modification.

Section 3.2 provides a comparison of the existing environment relating to the 2019 project area and the revised project area.

3.1 2021 Survey Results

The supplementary BAR vegetation mapping has focused on those areas of native vegetation that were inaccessible in 2019 (including additional areas subject to the project modification) with the aim of ground-truthing regional vegetation mapping, identifying plant community types (PCTs) and assessing the impacts to native habitats.

The total extent of the remaining revised project area includes an area of land around 179.30 ha. The portion of this described as the 2021 survey area constituted around 89.25 ha. The remaining 90.05 ha occurs on agricultural land to the south-east of the Hunter River. This area was not sampled during field surveys as the area was identified as non-native vegetation through a desktop review of aerial imagery and a review of land management practices.

The existing environment for the 2021 survey area is described in **Section 3.1**, while vegetation in the remainder of the revised project area is described in detail in the BAR (Umwelt 2019). It is referred to as the 2019 survey area.

A review of biodiversity values within the entire revised project area are presented in **Section 3.2**.

3.1.1 Verified Plant Community Types

Outcomes of the verification of regional vegetation mapping that was relied upon in Umwelt (2019) is provided in **Table 3.1**.

Of the eight PCTs predicted to occur within the project area in Umwelt (2019), based on regional vegetation mapping, four were either no longer present in the 2021 survey area or were considered to conform to another PCT. The four PCTs include:

- 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter
- 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter Derived Native Grassland (DNG)
- 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter

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

Table 3.1 identifies the PCTs and vegetation zones that the above predicted PCTs were assigned to in the supplementary BAR based on the field investigations.

Field verified PCTs and their updated extent in the revised project area are summarised in **Table 3.2** and mapped in **Figure 3.1.1** to **Figure 3.1.3**. Verified PCTs surveyed in 2021 have been applied to the same vegetation zone number as described in 2019. PCTs and condition classes not previously described in Umwelt (2019) have been assigned new vegetation zones. A total of nine vegetation zones have been identified.

Detailed descriptions of the verified vegetation zones and PCTs are provided in **Section 3.1.1.1** to **Section 3.1.1.10**.

Descriptions of regional vegetation mapping used with regards to the MDHF are provided in **Section 3.1.2**.

A full list of flora species recorded during the floristic survey is provided in **Appendix B**.

Table 3.1 Verification of Regional Vegetation Mapping

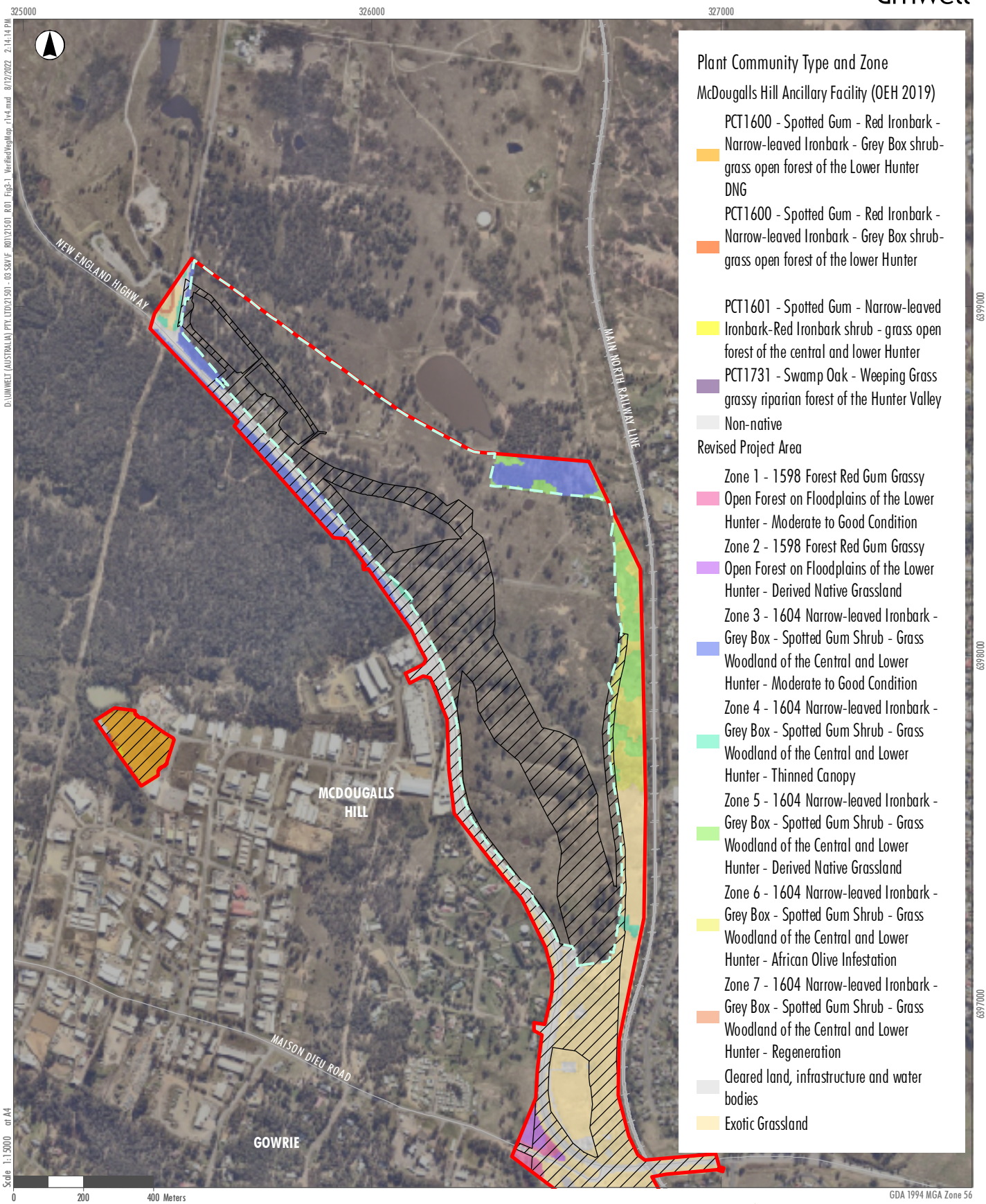
Regional vegetation mapping relied upon in Umwelt (2019)	Verified vegetation mapping in 2021 survey area*		
Plant Community Type (PCT)	**Veg Zone**	**Verified PCT**	**Condition**
42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley.	8	Confirmed as PCT 42. This PCT was not described by Umwelt (2019).	Low
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub.	3	Conforms to PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	Moderate to good
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub Derived Native Grassland.	-	Only applicable to the MHDF – area has not been verified for this supplementary BAR.	-
1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	6	Conforms to PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	African olive infestation
1603 Narrow-leaved Ironbark – Bull Oak Grey Box shrub-grass open forest of the central and lower Hunter.	1	Conforms to PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter.	Moderate to good
1604 Narrow-leaved Ironbark –Grey Box – Spotted Gum shrub-grass open forest of the central and lower Hunter.	4	Conforms to PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	Thinned canopy
1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.	-	Only applicable to the MDHF – area has not been verified for this supplementary BAR.	-
Non-native vegetation.	1, 2, 4, 5, 6, 8, 9	Portions conform to PCT 1598 (Zone 1 and 2), PCT 1604 (Zone 4, 5, 6), PCT 42 (Zone 8), PCT 1731 (Zone 9), exotic grassland, and cleared land, infrastructure, and water bodies.	Refer to **Table 3.2**

* MDHF is not included in the area calculations of verified vegetation mapping.

Table 3.2 Summary of verified Vegetation Zones and PCTs (including areas identified in 2019 surveys) within the 2021 survey area

Veg Zone	Plant Community Type (PCT)	Condition	Extent in 2021 survey area *
Vegetation Zones identified previously through 2019 surveys			
1	1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter.	Moderate to Good	0.61
2	1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter.	DNG	0.58
3	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	Moderate to Good	5.35
4	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	Thinned canopy	0.53
5	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	DNG	12.59
6	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	African olive infestation	2.80
Vegetation Zones identified in 2021 surveys			
7	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter.	Regenerating	0.13
8	42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley.	Low condition	3.99
9	1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.	Low Condition	0.42
-	Exotic grassland.	-	128.85
-	Cleared Land, infrastructure, water bodies.	-	23.44
Total area in 2021 survey area			**179.29**

* MDHF is not included in the area calculations of verified vegetation mapping.



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Survey Area Boundary

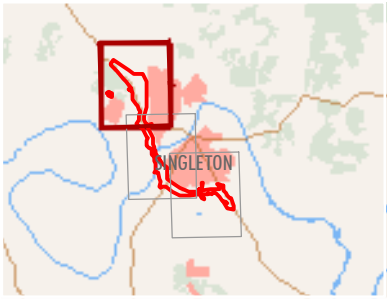


FIGURE 3.1.1

Verified Vegetation Mapping - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

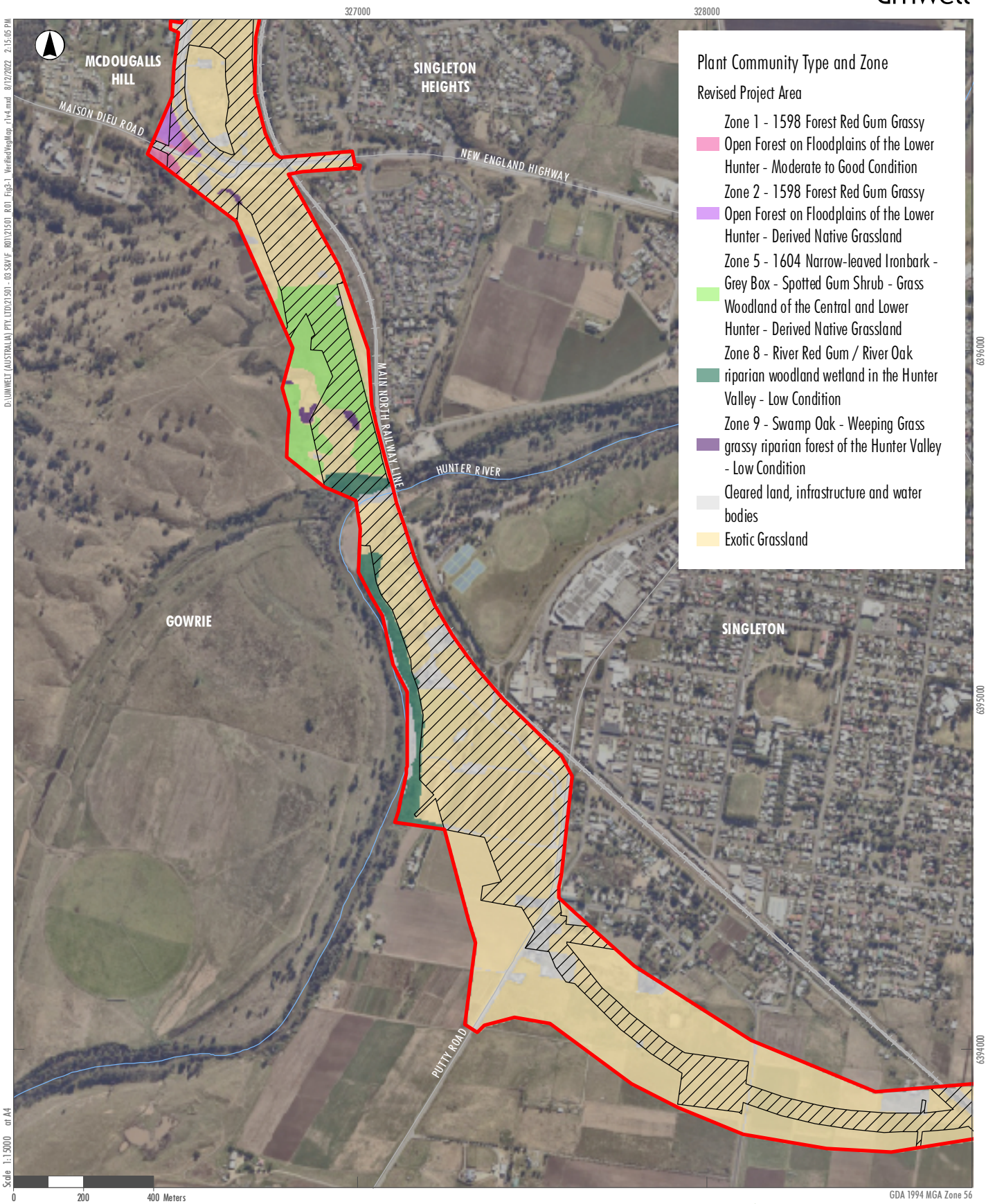
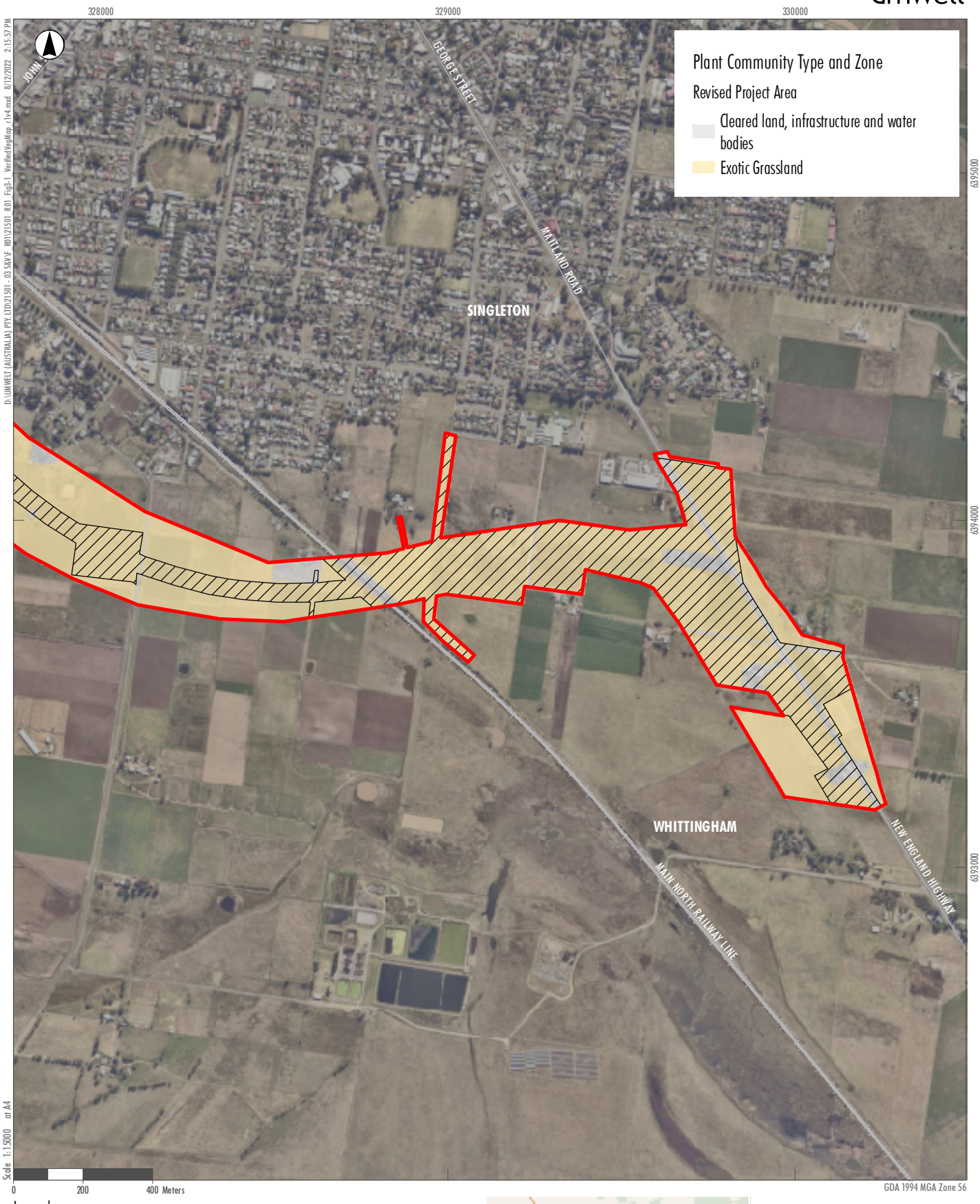


FIGURE 3.1.2

Verified Vegetation Mapping - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)



Legend

- Revised Project Area
- Revised Impact Area

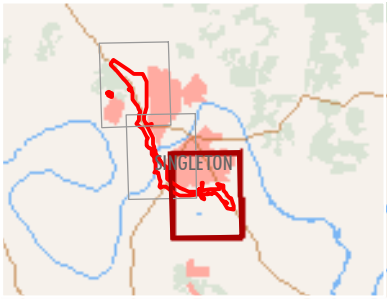


FIGURE 3.1.3

Verified Vegetation Mapping - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

3.1.1.1 PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good Condition

Vegetation Zone: 1

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Floodplain Wetlands

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Consistent with the Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC listed under the BC Act

Estimate of percent cleared: NA

Condition: Moderate to Good

Extent in the 2021 survey area: 0.61 ha

Total number of plots completed in the 2021 survey area: 1 vegetation integrity plot 2021.

Structure	Height range	Average cover (%)	Typical species
Trees	5–20	7	Dominated by forest red gum (*Eucalyptus tereticornis*).
Small Trees	2–3	2.5	Largely absent, with some regenerating forest red gum (*Eucalyptus tereticornis*) and occurrences of bulloak (*Allocasuarina luehmannii*) and cooba (*Acacia salicina*)
Shrubs	0.5–3	0.6	Largely absent with few scattered hickory wattle (*Acacia falcata*). Introduced species generally occur at low abundance and include narrow-leaved cotton bush (*Gomphocarpus fruticosus*) and black-berry nightshade (*Solanum nigrum*).
Ground Covers	0–0.5	56.5	Dominant native grasses comprise scented-top grass (*Capillipedium spicigerum*), barbed wire grass (*Cymbopogon refractus*), common couch (*Cynodon dactylon*) and slender rat's tail grass (*Sporobolus creber*). Common forbs and small shrubs, while sparse included blue trumpet (*Brunoniella australis*), caustic weed (*Euphorbia drummondii*), variable glycine (*Glycine tabacina*), cut-leaved daisy (*Brachyscome multifida*) and ruby saltbush (*Enchylaena tomentosa*). Introduced grass species co-dominate comprised African lovegrass (*Eragrostis curvula*) and Rhodes grass (*Chloris gayana*). Common exotic forb species generally occurred in low abundance, and included galenia (*Galenia pubescens*), prickly pear (*Opuntia stricta*), annual tramp weed (*Facelis retusa*), fire weed (*Senecio madagascariensis*), scarlet pimpernel (*Lysimachia arvensis*), and lambs tongue (*Plantago lanceolata*).

Vegetation description:

This vegetation zone is consistent with the extent described previously in the BAR (Umwelt 2019).

The extent of this vegetation zone in the 2021 survey area comprises a small area of forest red gum dominated forest associated with an unnamed drainage line southwest of Maison Dieu Road (refer to **Figure 3.1.1** to **Figure 3.1.3**). While this area demonstrates historically clearing, it contiguous with larger patch of more intact vegetation beyond the 2021 survey area. A small patch of mature and young forest red gums occurs in a paddock to the northeast of Maison Dieu Road. This zone has been historically thinned and disturbed by ongoing grazing, however there is active regeneration of the canopy species.

This vegetation zone is aligned with PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter given the dominance of forest red gum (*Eucalyptus tereticornis*) in the canopy and presence of several characteristic understory species. It is noted that this vegetation zone is associated with the upper reaches of an unnamed drainage line and lower slopes transitioning to floodplain. However, according to the VIS Classification Database (DPE 2022e) this PCT can also occur on the Central Hunter Foothills Mitchell landscape, which is the Mitchell landscape mapped across the revised project area. This vegetation zone is considered to be at the upper limit in the landscape of PCT 1598 and as a result has influences from the surrounding PCT 1604.

Photo 3.1 PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good Condition

3.1.1.2 PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Derived Native Grassland

Veg Zone: 2

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Floodplain Wetlands

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Not listed

Estimate of percent cleared: NA

Condition: Derived Native Grassland

Extent in the 2021 survey area: 0.58 ha

Plots completed in 2021 survey area: no vegetation integrity plots were required in addition to those completed for the BAR (Umwelt 2019).

Structure	Height range	Average cover (%)	Typical species
Trees	10	1	Largely absent, with scattered occurrences of forest red gum (*Eucalyptus tereticornis*) and narrow-leaved ironbark (*Eucalyptus crebra*).
Small trees	0.5–1.0	1	Largely absent, with some regenerating forest red gum (*Eucalyptus tereticornis*).
Ground covers	<0.2	70	Purple wiregrass (*Aristida ramosa*), common couch (*Cynodon dactylon*), red grass (*Bothriochloa decipiens var. decipiens*), rock fern (Chei*lanthes sieberi subsp. sieberi*) and variable glycine (*Glycine tabacina*). Introduced species generally occur at low abundance, including lambs tongue (*Plantago lanceolata*), scarlet pimpernel (*Lysimachia arvensis*) and *Richardia humistrata*.

Vegetation description:

This vegetation zone is consistent with the extent described previously in the BAR (Umwelt 2019). The small size of the total extent of this vegetation zone within the total revised project area did not trigger the need for any additional plots.

In the 2021 survey area this vegetation zone comprises native grassland derived from the moderate to good condition zone of PCT 1598 associated with a small patch of mature and young forest red gums in a paddock to the northeast of Maison Dieu Road. This zone has been heavily grazed however there is active regeneration of the canopy species.

This vegetation zone has been aligned with PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter given its position in the landscape and adjacent remnant vegetation.

Photo 3.2 PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – DNG (Umwelt 2019)

3.1.1.3 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Moderate to Good Condition

Vegetation Zone: 3

Vegetation formation: Grassy Woodland

Vegetation class: Coastal Valley Grassy Woodland

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC listed under the BC Act and the Central Hunter Valley Eucalypt Forest and Woodland CEEC listed under the EPBC Act.

Estimate of percent cleared: 71.00

Condition: Moderate to Good

Extent in the 2021 survey area: 5.35 ha

Plots completed in the 2021 survey area: 1 vegetation integrity plot 2021.

Structure	Height range	Average cover (%)	Typical species
Tree	10–20	35	The dominant canopy species recorded in the plot of the additional area was grey box (*Eucalyptus moluccana*) with scattered forest red gum (*Eucalyptus tereticornis*). Spotted gum (*Corymbia maculata*) and narrow-leaved ironbark (*Eucalyptus crebra*) were commonly observed throughout this vegetation zone. There are also occurrences of red ironbark (*Eucalyptus fibrosa*) along Rixs Creek Lane.
Small trees	1–8	-	Regeneration of canopy species is common
Shrubs	0.5	1	Largely absent, with scattered occurrences of native shrubs including small-leaf blue bush (*Maireana microphylla*) and ruby saltbush (*Enchylaena tomentosa*), as well as exotic African olive (*Olea europaea* subsp. *cuspidata*).
Ground covers	0–0.5	64	Common native species include threeawn speargrass (*Aristida vagans*), windmill grass (*Chloris truncata*), hairy panic (*Panicum effusum*), slender flat-sedge (*Cyperus gracilis*), *Juncus usitatus*, fuzzweed (*Vittadinia cuneata*), whiteroot (*Pratia purpurascens*), forest nightshade (*Solanum prinophyllum*), amulla (*Eremophila debilis*), and slender tick-trefoil (*Desmodium varians*). Introduced species generally occur at low abundance, including guinea grass (*Megathyrsus maximus*), African boxthorn (*Lycium ferocissimum*), galenia (*Galenia pubescens*) soursob (*Oxalis pes-caprae*), dill (*Anethum graveolens*), goosegrass (*Galium aparine*), and paddy's lucerne (*Sida rhombifolia*).

Vegetation description:

This vegetation zone is consistent with the extent described previously in the BAR (Umwelt 2019).

This vegetation zone in the 2021 survey area comprises a woodland to open forest structure with a history of grazing, because of this the understory is structurally simplified. It occurs across the mid to upper slopes within the northern extent of the remaining revised project area.

This zone is aligned with PCT 1604 as it supports a high proportion of characteristic species listed in the PCT description according to the VIS Classification Database (DPE 2022e). While five of the 14 flora species listed on the VIS Classification Database as characteristic for PCT 1604 were recorded in the vegetation integrity plot in 2021 survey area, this vegetation zone supports 13 of these species (93 %) across the total revised project area. While this vegetation zone also has similarity to several other closely related PCTs, it has the highest per cent floristic similarity to PCT 1604.

Photo 3.3 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Moderate to Good Condition

3.1.1.4 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Thinned Canopy

Vegetation Zone: 4

Vegetation formation: Grassy Woodland

Vegetation class: Coastal Valley Grassy Woodland

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Consistent with the Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC listed under the BC Act and the Central Hunter Valley Eucalypt Forest and Woodland CEEC listed under the EPBC Act.

Estimate of percent cleared: 71.00

Condition: Thinned Canopy

Extent in the 2021 survey area: 0.53 ha

Plots completed in 2021 survey area: four vegetation integrity plots were completed in 2019 (Umwelt 2019); no additional vegetation integrity plot were undertaken in the 2021 survey area due to the small extent of this vegetation zone.

Structure	Height range	Average cover (%)	Typical species
Trees	12–18	25	The dominant canopy species comprise spotted gum (*Corymbia maculata*), grey box (*Eucalyptus moluccana*) and narrow-leaved ironbark (*Eucalyptus crebra*). It is noted that some of the grey box (*Eucalyptus moluccana*) trees have influence from white box (*Eucalyptus albens*) at the southern end of the revised project area, as indicated by fruit size, foliage colour and rough bark extent. Bulloak (*Allocasuarina luehmannii*) is also present in low abundance.
Small trees	1–6	15	Generally sparse, with patches of dense eucalypt regeneration.
Shrubs	0.5–1	5	Common exotic shrubs include African boxthorn (*Lycium ferocissimum*) and African olive (*Olea europaea* subsp*. cuspidata*).
Ground covers	<0.5	60	Common species include purple wiregrass (*Aristida ramosa*), barbed wire grass (*Cymbopogon refractus*), slender bamboo grass (*Austrostipa verticillata*), red grass (*Bothriochloa decipiens var. decipiens*), tall chloris (*Chloris ventricosa*), speargrass (*Austrostipa scabra*), common couch (*Cynodon dactylon*), blue trumpet (*Brunoniella australis*), kidney weed (*Dichondra repens*), variable glycine (*Glycine tabacina*), wattle matrush (*Lomandra filiformis* subsp. *coriacea)*, many-flowered mat-rush (*Lomandra*

Structure	Height range	Average cover (%)	Typical species
			multiflora subsp. *multiflora*), *Lomandra filiformis* subsp. *filiformis*, *Arthropodium* sp., bristly cloak fern (*Cheilanthes distans*), rock fern (*Cheilanthes sieberi* subsp. *sieberi*), slender tick-trefoil (*Desmodium varians*), ruby saltbush (*Enchylaena tomentosa*), climbing saltbush (*Einadia nutans* subsp. *linifolia*), berry saltbush (*Einadia hastata*), amulla (*Eremophila debilis*), corrugated sida (*Sida corrugata*), spiked sida (*Sida hackettiana*), common everlasting (*Chrysocephalum apiculatum*), knob sedge (*Carex inversa*), slender flat-sedge (*Cyperus gracilis*), slender stackhousia (*Stackhousia viminea*) and small-leaf bluebush (*Maireana microphylla*). Common introduced species include galenia (*Galenia pubescens*), Paddys lucerne (*Sida rhombifolia*), tiger pear (*Opuntia aurantiaca*), creeping pear (*Opuntia humifusa*), fireweed (*Senecio madagascariensis*), common prickly pear (*Opuntia stricta*), African lovegrass (*Eragrostis curvula*) and lambs tongue (*Plantago lanceolata*).

Vegetation description:

This vegetation zone is consistent with the extent described previously in the BAR (Umwelt 2019).

This vegetation zone comprises an open woodland to woodland with a history of grazing and vegetation clearing. In the 2021 survey area this vegetation zone is reduced to small clusters of trees where the understory is structurally simplified and influenced by surrounding exotic grassland due to grazing practices and vegetation clearing. This vegetation zone occurs on the slopes in the central portion of the 2021 survey area, while a larger patch extends north through the previous 2019 survey area (Umwelt 2019).

This zone is aligned with PCT 1604 as it supports a reasonable proportion of characteristic species listed in the PCT description according to the VIS Classification Database (DPE 2022e). Of the 14 flora species listed on the VIS Classification Database as characteristic for PCT 1604, this vegetation zone supports 11 or 79%. While this vegetation zone also has similarity to several other closely related PCTs, it has the highest per cent floristic similarity to PCT 1604.

Photo 3.4 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Thinned Canopy (Umwelt 2019)

3.1.1.5 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Derived Native Grassland

Vegetation Zone: 5

Vegetation formation: Grassy Woodland

Vegetation class: Coastal Valley Grassy Woodland

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Portions are consistent with the *Central Hunter Valley Eucalypt Forest and Woodland* CEEC listed under the EPBC Act.

Estimate of percent cleared: 71.00

Condition: Derived Native Grassland

Extent in the 2021 survey area: 12.59 ha

Plots completed in the 2021 survey area: 2 vegetation integrity plots.

Structure	Height range	Average cover (%)	Typical species
Trees	12–25	<1	Scattered mature paddock trees comprising grey box (*Eucalyptus moluccana*) and narrow-leaved ironbark (*Eucalyptus crebra*) were recorded opportunistically throughout the vegetation zone.
Small trees	8	<1	Regenerating forest red gum (*Eucalyptus tereticornis*) and grey box (*Eucalyptus moluccana*) were recorded fringing established woodland stands.
Shrubs	0.5–1.5	5	Native species in the shrub layer were limited to western boobialla (*Myoporum montanum*). Common exotic shrubs include narrow-leaved cotton bush (*Gomphocarpus fruticosus*), black-berry nightshade (*Solanum nigrum*), and African boxthorn (*Lycium ferocissimum*).
Ground covers	<0.5	65	Native grass species dominated grassland habitats and comprised purple wiregrass (*Aristida ramosa*), windmill grass (*Chloris truncata*), tall chloris (*Chloris ventricosa*), brown's lovegrass (*Eragrostis brownii*), slender flat-sedge (Cyp*erus* gracilis), common couch (*Cynodon dactylon*), paddock lovegrass (*Eragrostis leptostachya*), hairy panic (*Panicum effusum*), slender rat's tail grass (*Sporobolus creber*). Native forbs often occurred in low abundance, include forest nightshade (*Solanum prinophyllum*), small-leaf bluebush (*Maireana microphylla*), variable glycine (*Glycine tabacina*), ruby saltbush (*Enchylaena tomentosa*), amulla (*Eremophila debilis*), yellow burr-daisy (*Calotis lappulacea*), common everlasting (*Chrysocephalum apiculatum*), star cudweed (*Euchiton sphaericus*), sprawling bluebell (*Wahlenbergia gracilis*), and purple burr-daisy (*Calotis cuneifolia*).

Structure	Height range	Average cover (%)	Typical species
			Introduced species include scarlet pimpernel (*Anagallis arvensis*), paddy's lucerne (*Sida rhombifolia*), lambs tongues (*Plantago lanceolata*), galenia (*Galenia pubescens*), tiger pear (*Opuntia aurantiaca*), prickly pear (*Opuntia stricta*), onion grass (*Romulea rosea*), onion weed (*Nothoscordum borbonicum*), african lovegrass (*Eragrostis curvula*), *Brassica* spp., and fireweed (*Senecio madagascariensis*).

Vegetation description:

This vegetation zone is consistent with the extent described previously in the BAR (Umwelt 2019).

This vegetation zone occurs across the slopes within the revised project area where the canopy has been removed and it surrounds the remnant patches of other condition zones. Scattered paddock trees occur sporadically.

Portions of this zone were identified by regional mapping as non-native vegetation; however, these portions have been aligned with PCT 1604 based on its position in the landscape, surrounding woodland and forest vegetation that aligns with PCT 1604 and presence of characteristic groundcover species (refer to **Figure 3.1.1** and **Figure 3.1.2**).

Photo 3.5 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Derived Native Grassland

3.1.1.6 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – African Olive Infestation

Vegetation Zone: 6

Vegetation formation: Grassy Woodland

Vegetation class: Coastal Valley Grassy Woodland

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: NA

Estimate of percent cleared: 71.00

Condition: African Olive infestation

Extent in the 2021 survey area: 2.80 ha

Plots completed in the 2021 survey area: 1 vegetation integrity plot.

Structure	Height range	Average cover (%)	Typical species
Tree	15–20	-	Small, scattered stands of trees comprising spotted gum (*Corymbia maculata*) and grey box (*Eucalyptus moluccana*).
Shrub	2–4	20	African olive (*Olea europaea* subsp. *cuspidata*) dominated the mid-story.
Ground cover	<0.5	40	Native grass species dominated ground layer and comprised slender bamboo grass (*Austrostipa verticillata*), red grass (*Bothriochloa macra*), tall chloris (*Chloris ventricosa*), common couch (*Cynodon dactylon*), hairy panic (*Panicum effusum*), and slender flat-sedge (*Cyperus gracilis*). Common native forbs and low shrub species included blue trumpet (*Brunoniella australis*), swamp dock (*Rumex brownii*), forest nightshade (*Solanum prinophyllum*), ruby saltbush (*Enchylaena tomentosa*), and winter apple (*Eremophila debilis*). Introduced species commonly observed included galenia (*Galenia pubescens*), spear thistle (*Cirsium vulgare*), purpletop (*Verbena bonariensis*), slender celery (*Cyclospermum leptophyllum*), flaxleaf fleabane (*Conyza bonariensis*), annual trampweed (*Facelis retusa*), brazilian whitlow (*Paronychia brasiliana*), burr medic (*Medicago polymorpha*), catsear (*Hypochaeris radicata*), paddy's lucerne (*Sida rhombifolia*), fireweed (*Senecio madagascariensis*), and pigeon grass (*Setaria parviflora*).

Vegetation description:

This vegetation zone is consistent with the extent described previously in the BAR (Umwelt 2019).

This vegetation zone comprises derived native grassland with an infestation of African olive (*Olea europaea* subsp. *cuspidata*). This vegetation zone occurs on the slopes within the rail corridor along the eastern boundary of the revised project area where scattered paddock trees occur sporadically. Small clusters of mature trees are confined to the edges of gullies where the midstory is dominated by thickets of African olive.

This vegetation zone demonstrates influences PCT 1598 that would have likely occurred downslope historically (pre-development) as indicated by the presence of scattered forest red gum (*Eucalyptus tereticornis*) downslope. However, this zone has been aligned with PCT 1604 based on its position in the landscape, surrounding woodland and forest vegetation that aligns with PCT 1604 and presence of some characteristic groundcover species.

Photo 3.6 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – African Olive Infestation

3.1.1.7 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Regeneration

Vegetation Zone: 7

Vegetation formation: Grassy Woodland

Vegetation class: Coastal Valley Grassy Woodland

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: NA

Estimate of percent cleared: 71.00

Condition: Regenerating vegetation

Extent in the 2021 survey area: 0.13 ha

Plots completed in the 2021 survey area: 1 rapid assessment point was undertaken where the single patch was too small (approximately 10 m x 70 m) to complete a floristic plot (20 m x 50 m or 100 m x 10 m). Height and average cover were not recorded during the rapid assessment.

Structure	Typical species
Tree	The canopy layer comprised a mix of narrow-leaved ironbark (*Eucalyptus crebra*), spotted gum (*Corymbia maculata*), and swamp oak (*Casuarina glauca*).
Small Tree	The mid-story was dominated by regenerating swamp oak (*Casuarina glauca*) as well as scattered narrow-leaved ironbark (*Eucalyptus crebra*) and spotted gum (*Corymbia maculata*).
Shrub	Scattered fan wattle (*Acacia amblygona*) was observed in fringing areas where swamp oak (*Casuarina glauca*) was less abundant.
Ground cover	Common native ground layer species included purple burr-daisy (*Calotis cuneifolia*), variable glycine (*Glycine tabacina*), winter apple (*Eremophila debilis*), hairy panic (*Panicum effusum*), and slender flat-sedge (*Cyperus gracilis*) and wattle mat-rush (*Lomandra filiformis*). Exotic species included Rhodes grass (*Chloris gayana*), galenia (*Galenia pubescens*), paddy's lucerne (*Sida rhombifolia*), fireweed (*Senecio madagascarensis*), and flax leaf fleabane (*Conyza bonariensis*).

Vegetation description:

This vegetation zone comprises dense shrubby woodland dominated by established and regenerating swamp oak (*Casuarina glauca*), with scattered ironbark (*Eucalyptus crebra*) and spotted gum (*Corymbia maculata*). This vegetation zone is confined to a small patch along the northern boundary at the entrance to the Rixs Creek Rest Area. The ground layer comprises native herbs and grasses in low abundance while the dense swamp oak regeneration provides a high level of litter cover and shading.

This zone has been aligned with PCT 1604 based on its position in the landscape, surrounding woodland and forest vegetation that aligns with PCT 1604 and presence of some characteristic canopy and groundcover species.

Photo 3.7 PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Regeneration

3.1.1.8 42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley – Low Condition

Vegetation Zone: 8

Vegetation formation: Forested Wetlands

Vegetation class: Eastern Riverine Forests

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Consistent with the Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act.

Estimate of percent cleared: 95.00

Condition: Low condition

Extent in the 2021 survey area: 3.99 ha

Plots completed in 2021 survey area: 2 vegetation integrity plots 2021.

Structure	Height range	Average cover (%)	Typical species
Tree	12–30	15	River red gum (*Eucalyptus camaldulensis*) and river oak (*Casuarina cunninghamiana*) dominate the southern lower bank of the Hunter River. The northern bank features only river oak in small clusters.
Shrubs and small Tree	0.5–4	15	Dominated by exotic species including willow (*Salix* spp.), castor oil (*Ricinus communis*), and balloon vine (*Cardiospermum grandiflorum*).
Ground Cover	< 0.5	75	Scattered native forbs and grass species include scented-top grass (*Capillipedium spicigerum*), corrugated sida (*Sida corrugata*), *Swainsona* spp., and native geranium (*Geranium solanderi*). Common exotic species dominating the understory include Rhodes grass (*Chloris gayana*), castor oil plant (*Ricinus communis*), fireweed (*Senecio madagascariensis*), galenia (*Galenia pubescens*), soursob (*Oxalis pes-caprae*), guinea grass (*Megathyrsus maximus*), red natal grass (*Melinis repens*), goosegrass (*Galium aparine*), *Richardia stellaris*, and scarlet pimpernel (*Anagallis arvensis*).

Vegetation description:

This vegetation zone comprises tall red gum woodland on the banks of the Hunter River with influences of historic clearing and weed invasion. Much of this vegetation zone occurs throughout the southern portion of the revised project area and was inaccessible due to the steep banks and dense exotic vegetation.

This vegetation zone comprises a native canopy dominated by river red gum (*Eucalyptus camaldulensis*), while the exotic dominated understory supports few native grasses and forbs in low abundance.

This zone is aligned with PCT 42 due to the presence of river red gum (*Eucalyptus camaldulensis*) along the eastern bank, while stands of river oak (*Casuarina cunninghamiana*) occur along the lower banks throughout the full extent of the zone.

Photo 3.8 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley – Low Condition

3.1.1.9 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – Low Condition

Vegetation Zone: 9

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Swamp Forests

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: NA

Estimate of percent cleared: 62.00

Condition: Low

Extent in the 2021 survey area: 0.42 ha

Plots completed in the 2021 survey area: 1 vegetation integrity plot 2021.

Structure	Height range	Average cover (%)	Typical species
Tree	4–10	10	Swamp oak (*Casuarina glauca*).
Shrubs	1–2	5	Scattered infestations of African boxthorn (*Lycium ferocissimum*) beyond plot location.
Ground cover	< 0.5	65	Exotic species dominating the ground layer include sharp rush (*Juncus acutus*), galenia (*Galenia pubescens*), panic veldtgrass (*Ehrharta erecta*), hedge mustard (*Sisymbrium officinale*), slender celery (*Cyclospermum leptophyllum*), celery buttercup (*Ranunculus sceleratus*), praire grass (*Bromus catharticus*), perennial ryegrass (*Lolium perenne*), *Carduus* spp., dandelion (*Taraxacum officinale*), fireweed (*Senecio madagascariensis*), *Brassica* spp., common peppercress (*Lepidium africanum*), burr medic (*Medicago polymorpha*), white clover (*Trifolium repens*), spear thistle (*Cirsium vulgare*). Scattered native grass species include common couch (*Cynodon dactylon*), slender bamboo grass (*Austrostipa verticillata*), and slender flat-sedge (*Cyperus gracilis*), common reed (*Phragmites australis*). Native forb species were uncommon throughout this vegetation zone, where they occurred, they include Cobbler's tack (*Glossocardia bidens*), corrugated sida (*Sida corrugata*), kidney weed (*Dichondra repens*), water pepper (*Persicaria hydropiper*), swamp dock (*Rumex brownii*), common woodruff (*Asperula conferta*), knotweed goosefoot (*Einadia polygonoides*), berry saltbush (*Einadia hastata*), and native wandering jew (*Commelina cyanea*).

Vegetation description:

This vegetation zone comprises a number of small patches of swamp oak (*Casuarina glauca*) occurring along riparian habitats of an unnamed ephemeral drainage line that flows into the Hunter River from the north. This zone has been historically thinned and disturbed by ongoing grazing, however there is active regeneration of the canopy species.

This zone has been aligned with PCT 1604 based on the dominance of swamp oak (*Casuarina cunninghamiana*), the presence of several characteristic understory species and its position in the landscape.

Photo 3.9 1731 Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley – Low to Moderate Condition

3.1.1.10 Exotic grassland

Vegetation formation: NA

Vegetation class: NA

Other mapping sources: The Vegetation of the Central Hunter Valley, NSW (Peake 2006)

Conservation status: Not listed

Estimate of percent cleared: NA

Condition: Exotic Grassland

Extent in the 2021 survey area: 128.85 ha

Plots completed in 2021 survey area: 1 vegetation integrity plot 2021.

Structure	Height range	Average cover (%)	Typical species
Trees	12–20	<1	Isolated paddock trees consisting of grey box (*Eucalyptus moluccana*), spotted gum (*Corymbia maculata*) and narrow-leaved ironbark (*Eucalyptus crebra*).
Small Trees	1–4	<1	cooba (*Acacia salicina*).
Shrubs	1–2	5	Exotic shrub species include African boxthorn (*Lycium ferocissimum*) and African olive (*Olea europaea* subsp. *cuspidata*).
Ground cover	<0.5	85	This vegetation zone is dominated by exotic species while natives were uncommonly observed they included barbed wire grass (*Cymbopogon refractus*), common couch (*Cynodon dactylon*), tall chloris (*Chloris ventricosa*), corrugated sida (*Sida corrugata*), native geranium (*Geranium solanderi*), common woodruff (*Asperula conferta*), purple wiregrass (*Aristida ramosa*), and *Convolvulus erubescens*. Exotic species dominating this vegetation zone include galenia (*Galenia pubescens*), paddy's lucerne (*Sida rhombifolia*), guinea grass (*Megathyrsus maximus*), prickly pear (*Opuntia stricta*), paspalum (*Paspalum dilatatum*), spear thistle (*Cirsium vulgare*), flaxleaf fleabane (*Conyza bonariensis*), annual trampweed (*Facelis retusa*), fireweed (*Senecio madagascariensis*), common sowthistle (*Sonchus oleraceus*), common peppercress (*Lepidium africanum*), brazilian whitlow (*Paronychia brasiliana*), and chickweed (*Stellaria media*).

Vegetation description:

Discrete patches of grassland dominated by exotic species occur in the rail corridor and surrounding agricultural land to the east and south from the 2019 survey area. This vegetation zone has been subject to historic land clearing and ongoing agricultural practices such that introduced species dominate the ground layer of this community. The area of this vegetation zone also includes cropped paddocks south and east of the Hunter River.

This zone is not attributable to any PCT based on the dominance of exotic species.

Photo 3.10 Exotic grassland

3.1.2 Regional Vegetation Mapping

Field surveys completed for this supplementary BAR did not include the MDHF. Regional vegetation mapping has been used to describe vegetation within this area. The predicted PCTs outlined in **Table 3.3** and shown in **Figure 3.1.1** to **Figure 3.1.3**, were previously described in Section 3.1.8 of the BAR (Umwelt 2019). Recent aerial photography shows that most of the ancillary compound to the west of McDougalls Hill has been cleared. The extent of the PCTs present in this area have been calculated based on this updated aerial photography. As survey has not been undertaken and condition cannot be assessed, areas that appear cleared have been assumed consistent with PCT 1600 in a derived native grassland form.

Table 3.3 Summary of Regional Vegetation Mapping – McDougalls Hill Ancillary Facility

PCT	Predicted conservation status	Area
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	**BC Act –** Central Hunter Ironbark – Spotted Gum –Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (only areas of woodland/forest; does not include DNG). **EPBC Act –** Central Hunter Valley Eucalypt Forest and Woodland CEEC.	0.06
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the Lower Hunter Derived Native Grassland (DNG).	No TECs listed under the BC Act or the EPBC Act.	2.44
1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	**BC Act –** Central Hunter Ironbark – Spotted Gum –Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (only areas of woodland/forest; does not include DNG). **EPBC Act –** Central Hunter Valley Eucalypt Forest and Woodland CEEC.	0.05
1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.	No TECs listed under the BC Act or the EPBC Act.	0.07
0 Non-native.	No TECs listed under the BC Act or the EPBC Act.	0.07
	Total area	**2.69**

3.1.3 Threatened Ecological Communities

A total of five TECs listed under the BC Act and three TECs listed under the EPBC Act were identified with the potential to occur in the 2021 survey area.

Five vegetation zones described above and mapped within the 2021 survey area conform to State or Commonwealth listed TECs. Analysis of consistency with the Final Determinations/Approved Conservation Advice for each TEC was carried out, with consideration of the advice provided by the NSW Threatened Species Scientific Committee and/or the Commonwealth Threatened Species Scientific Committee Guidelines for interpreting listings for species, populations and ecological communities and policy statement under the BC Act and EPBC Act respectively. In particular, comparisons of floristic structure and composition, geographical location, biophysical attributes (soil type, location in the landscape, etc.) and other specifically relevant attributes, such as key diagnostic features and condition thresholds (in the case of the EPBC Act CEEC) were made.

The TECs listed under the BC Act with the potential to occur within the project area include:

- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC.
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC.
- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC.

- Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC.
- River-flat Eucalypt Forest on Coastal Floodplain EEC.

The TECs listed under the EPBC Act with the potential to occur within the project area includes:

- Central Hunter Valley Eucalypt Forest and Woodland CEEC.
- Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland EEC.
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria CEEC.

The following sections summarise the findings of these comparisons/analyses.

3.1.3.1 Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC Listed under the BC Act

The extent of Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC Listed under the BC Act in the 2021 survey area is consistent with the extent mapped previously in the BAR (Umwelt 2019).

Zone 1 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good condition is consistent with the NSW Threatened Species Scientific Committee's Final Determination for the *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC (NSW Scientific Committee 2011). **Table 3.4** summarises the findings of this comparison.

Zone 2 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Derived Native Grassland is not consistent with *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC as the Final Determination does not include derived native grassland forms.

Table 3.4 Comparison of final determination for Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC Listed under the BC Act

Final Determination	Vegetation Zone 1 within the 2021 survey area
Location – in the NSW Sydney Basin and NSW North Coast Bioregion.	Yes – Occurs in Sydney Basin Bioregion.
Location – recorded in the LGAs Maitland, Cessnock, Port Stephens, Singleton and Muswellbrook.	Yes – Occurs in the Singleton LGA.
Found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor.	Yes – Occurs on Permian sediments on gentle slopes in association with the upper reaches of a drainage line.
Community structure is typically an open forest.	Yes – Occurs as an open forest.
Characteristic flora assemblage.	Yes – 25% of the species on the characteristic species list were recorded.

Final Determination	Vegetation Zone 1 within the 2021 survey area
Common canopy species comprise *Eucalyptus tereticornis* and *Eucalyptus punctata*, although other frequently occurring canopy species include *Angophora costata*, *Corymbia maculata*, *Eucalyptus crebra* and *Eucalyptus moluccana*	Yes – Canopy is dominated by *Eucalyptus tereticornis*, with occurrences of *Eucalyptus crebra*.
Mid stratum is characterised as open with sparse shrubs of *Breynia oblongifolia*, *Leucopogon juniperinus*, *Daviesia ulicifolia* and *Jacksonia scoparia*.	Not conclusive – Shrubs are absent given the history of grazing.
Ground layer of grasses and herbs, characterised by *Microlaena stipoides* var. *stipoides*, *Cymbopogon refractus*, *Echinopogon caespitosus* var. *caespitosus*, *Cheilanthes sieberi* subsp. *sieberi* and *Pratia purpurascens*.	Yes – Seven characteristic ground layer species recorded, including *Microlaena stipoides* var. *stipoides* and *Pratia purpurascens*.

3.1.3.2 Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act

The extent of *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* EEC Listed under the BC Act in the 2021 survey area is consistent with the predicted extent mapped previously in the BAR (Umwelt 2019).

Zone 8 – 42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley – Low Condition is consistent with the NSW Threatened Species Scientific Committee's Final Determination for the Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act (NSW Scientific Committee 2011). **Table 3.5** summarises the finding of this comparison.

Table 3.5 Comparison of final determination for Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act

Final Determination	Vegetation Zone 8 within the 2021 survey area
Location – in the NSW North Coast and Sydney Basin Bioregion.	Yes – Occurs in Sydney Basin Bioregion.
Location – recorded in the LGAs Maitland, Mid-Western, Muswellbrook, Singleton, and Upper Hunter.	Yes – Occurs in the Singleton LGA.
Community structure is typically a tall woodland	Yes – Occurs as a tall woodland.
Occurs on floodplains and associated floodplain rises along the Hunter River and tributaries	Yes – Occurs on a floodplain along the Hunter River.
Common canopy species comprise *Eucalyptus camaldulensis* in combinations with *Eucalyptus tereticornis, Eucalyptus melliodora* and *Angophora floribunda*.	Yes – Canopy contains *Eucalyptus camaldulensis*

3.1.3.3 Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act

The extent of Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act is consistent with the extent mapped previously in the BAR (Umwelt 2019).

Zone 3 – 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Moderate to Good Condition and Zone 4 – 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Thinned Canopy are consistent with the NSW Threatened Species Scientific Committee's Final Determination for the Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (NSW Scientific Committee 2010). **Table 3.6** summarises the findings of this comparison.

Zone 5 – 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Derived Native Grassland is not consistent with Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC as the final determination does not include derived native grassland forms.

Table 3.6 Comparison of final determination for Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC Listed under the BC Act

Final Determination	Vegetation Zone 3 and 4 within 2021 survey area
Location – on NSW North Coast and Sydney Basin Bioregion.	Yes – Occurs in Sydney Basin Bioregion.
Location – recorded in the LGAs of Cessnock, Singleton and Muswellbrook.	Yes – Occurs in the Singleton LGA.
Generally occurs on Permian sediments.	Yes – Occurs on soils characterised by Permian sediments.
Community structure is typically Open Forest to Woodland.	Yes – Occurs as an Open Forest, Woodland and Open Woodland, depending on land use and disturbance history.
Characteristic flora species assemblage.	Yes – 68% of species on characteristic species list were recorded in the 2021 survey area.
Canopy is dominated by *Eucalyptus crebra*, *Corymbia maculata* and *Eucalyptus moluccana*.	Yes – The canopy is dominated by *Eucalyptus crebra*, *Corymbia maculata* and *Eucalyptus moluccana*.
Other tree species may be present and occasionally dominate or co-dominate and include *Eucalyptus fibrosa* and *Eucalyptus tereticornis*.	Yes – There are also occurrences of *Eucalyptus fibrosa* and *Eucalyptus tereticornis*.
A sparse layer of small trees may be present in some areas, typically including *Allocasuarina luehmannii* or *Acacia parvipinnula*.	Yes – *Allocasuarina luehmannii* was recorded in low abundance across the revised project area.
The shrub layer is typically sparse or absent in some cases, through to moderately dense. Common shrub species include *Daviesia ulicifolia*, *Pultenaea spinosa*, *Breynia oblongifolia*, *Hakea sericea* and *Bursaria spinosa*.	Yes – The shrub layer is typically sparse or absent, with occurrences in some areas of *Daviesia ulicifolia*, *Breynia oblongifolia* and *Bursaria spinosa*.
Ground cover can be sparse to moderately dense, and consists of numerous forbs, a few grass species, and a limited number of ferns, sedges or other herbs.	Yes – The ground cover is typically moderately dense and contains many of the common species listed in the EEC final determination.

3.1.3.4 Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC listed under the BC Act

Zone 9 – 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – low condition is not consistent with the NSW Threatened Species Scientific Committee's Final Determination for the Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC (NSW Scientific Committee 2011). **Table 3.7** summarises the findings of this comparison.

Table 3.7 Comparison of final determination for Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC listed under the BC Act

Final Determination	Vegetation Zone 9 within the 2021 survey area
Location –coastal floodplain of the NSW. North Coast, Sydney Basin or South East Corner bioregion.	Yes – Occurs in Sydney Basin Bioregion, adjacent to the Hunter River in the Singleton LGA.
Typically occurs below 20 m (rarely above 10 m) ASL.	No – Extent of PCT 1731 occurs between approximately 40 m and 50 m within the remaining portion of the 2021 survey area.
Occurs in association with humic clay or sandy loams soils?	Yes – Occurs on sandy loam soils.
Subjected to waterlogging and/or below the highest flood level.	Yes – Occurs on floodplain in proximity to Hunter River.
Canopy dominated by Swamp Oak or Swamp Paperbark.	Yes – Patches are dominated by swamp oak (*Casuarina glauca*).
Presence of any characteristic shrub and/or ground layer species.	No – This vegetation zone supports a reasonably low portion of species that are listed as characteristic species for the EEC. Four (9%) characteristic species identified by the final determination were recorded in the vegetation integrity plot, being swamp oak (*Casuarina glauca*), common couch (*Cynodon dactylon*), common reed (*Phragmites australis*), and native wandering jew (*Commelina cyanea*).

3.1.3.5 River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Zone 1 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good Condition is not consistent with the NSW Threatened Species Scientific Committee's Final Determination for the *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* EEC (NSW Scientific Committee 2011). **Table 3.8** summarises the findings of this comparison.

Table 3.8 Comparison of final determination for River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC listed under the BC Act

Final Determination	Vegetation Zone 1 within the 2021 survey area
Location – south of Port Stephens in the NSW North Coast, Sydney Basin or South East Corner bioregions.	Yes – Occurs in Sydney Basin Bioregion, adjacent to the Hunter River in the Singleton LGA.
Occurs on the coastal floodplain.	No – Extent of Zone 1 occurs in proximity to drainage lines and gullies upslope of the floodplain.
Occurs on silty, clay or sandy loam soil with a lack of deep humic layers and has little or no saline (salt) influence.	No – Occurs on Permian sediments on gentle slopes in association with the upper reaches of a drainage line.
Occurs on a river flat or terrace in an upper part of the Coastal Floodplain.	No – Extent of Zone 1 occurs in proximity to ephemeral drainage lines and gullies in the Hunter River catchment.
Vegetation consists of an open forest or woodland with a mixture of Eucalypt or Angophora trees, particularly Forest Red Gum, Cabbage Gum or Broad-leaved Apple.	Yes – Canopy is dominated by forest red gum (*Eucalyptus tereticornis*) with total foliage cover of 10%.
Presence of any characteristic shrub and/or ground layer species present.	Not conclusive – This vegetation zone supports a reasonably low proportion of species that characteristic species in the list of characteristic species for the EEC. Three of the 69 (4%) native understory species recorded in this zone are characteristic species in the EEC listing. None of the native understory species recorded in this zone are key indicator species in the EEC listing.
Are there relatively low numbers of She-oaks, Paperbarks or Swamp Mahogany trees.	Yes – No she-oaks, paperbarks or swamp mahogany trees were recorded in Zone 1.

3.1.3.6 Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the EPBC Act

Central Hunter Valley Eucalypt Forest and Woodland CEEC occurs in the Hunter Valley region on soils derived from Permian sedimentary bedrock (TSSC 2015). Typically, it is characterised as a eucalypt woodland and open forest, with a shrub layer of variable density and/or a grassy ground layer. Across its range, one or more of a complex of four eucalypt tree species, namely spotted gum (*Corymbia maculata*), narrow-leaved ironbark (*Eucalyptus crebra*), slaty gum (*Eucalyptus dawsonii*) or grey box (*Eucalyptus moluccana*) dominate the canopy (TSSC 2015).

Targeted surveys to map *Central Hunter Valley Eucalypt Forest and Woodland* CEEC were carried out in the northern portion of the 2019 project area (Umwelt 2019) in accordance with the sampling protocols and with consideration of the key diagnostic characteristics and condition thresholds provided within the Approved Conservation Advice (TSSC 2015). These 'key diagnostic characteristics' and 'condition thresholds' provided by the Approved Conservation Advice (TSSC 2015) and Identification Guide (DoEE 2016) formed the basis for delineating and identifying patches of native vegetation as being the threatened ecological community and distinguishing between patches of different quality. Additionally, Umwelt have considered previous advice provided to Umwelt by the Commonwealth Ecological Communities Section of DoEE for the *Central Hunter Valley Eucalypt Forest and Woodland* CEEC.

The extent of *Central Hunter Valley Eucalypt Forest and Woodland* CEEC Listed under the EPBC Act is consistent with the extent mapped in the BAR. The following vegetation zones are considered, either entirely or in part, to conform to the Central Hunter Valley Eucalypt Forest and Woodland CEEC:

- Zone 3 – 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Moderate to Good Condition.
- Zone 4 – 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Thinned Canopy.
- Zone 5 – 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Derived Native Grassland.

The results of the assessment for these vegetation zones within the northern portion of the 2021 survey area against the key diagnostic characteristics according to the Approved Conservation Advice are detailed in **Table 3.9** (as detailed in Umwelt 2019).

Table 3.9 Assessment of vegetation patches within the remaining portion of the revised project area against the key diagnostic features according to the Approved Conservation Advice (TSSC 2015)

Key Approved Conservation Advice (TSSC 2015)	Vegetation within the 2021 survey area
Key Diagnostic Characteristics	
It occurs in the Hunter River catchment (typically called the Hunter Valley region).	Yes – the remaining portion of the 2021 survey area occurs within the Hunter River catchment.
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks.	Yes – the remaining portion of the 2021 survey area is underlain by Permian derived soils in undulating country on low hillslopes and ridges of the valley floor.
It does not occur on alluvial flats, river terraces, Aeolian sands, Triassic sediments or escarpments.	Yes – the remaining portion of the 2021 survey area does not occur on alluvial flats, river terraces, Aeolian sands, Triassic sediments, or escarpments.
It is woodland or forest, with a projected canopy cover of trees of 10 per cent 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 m in height.	Yes – patches associated with vegetation zones 3 and 4 within the 2021 survey area comprise a projected canopy of cover at least 10 per cent with a native tree density of at least 10 native tree stems per 0.5 ha that are at least one m in height.
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: narrow-leaved ironbark (*Eucalyptus crebra*), spotted gum (*Corymbia maculata*), slaty gum (*E. dawsonii*) and grey box (*E. moluccana*); OR a fifth species, bulloak / buloke (*Allocasuarina luehmannii*) 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.	Yes – The canopy is dominated by *Eucalyptus crebra*, *Corymbia maculata* and *E. moluccana*. *Allocasuarina luehmannii* only occurs in low abundance.

Key Approved Conservation Advice (TSSC 2015)	Vegetation within the 2021 survey area
Forest oak/ she-oak, rose she-oak/oak (*Allocasuarina torulosa*), white mahogany (*Eucalyptus acmenoides*) and red/broad-leaved ironbark (*Eucalyptus fibrosa*) are largely absent from the canopy of a patch. Largely absent meaning no more than two trees per ha on average across a patch.	Conforms to determination as while a contra-indicative species was recorded this species was *Eucalyptus fibrosa*, which dominated the road corridor along Rixs Creek Lane along the northern tip of the 2021 survey area. The regular distancing and formation of these trees within the road corridor indicates that these were likely planted and is not representative of the remaining patch extent (**Photo 3.11**).
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 – all vegetation patches within the northern portion of the 2021 survey area have a mid-dense to dense ground layer dominated by native grasses and other native herbs and/or native shrubs.
Derived native grassland and shrublands are not included in this nationally protected ecological community. The exceptions are where there is a gap, in or at the edge of a patch; or connecting two patches across a short distance (i.e., 30 m).	Portions of vegetation zone 5 (derived native grasslands) have been mapped within gaps or between patches of woodland and forest forms of the CEEC that are separated by less than 30 m from the outer edge of the canopy.

Photo 3.11 Planted row of broad-leaved ironbark (Eucalyptus fibrosa) along Rix Creek Lane

3.1.3.7 Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland EEC

Coastal *Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland* EEC occurs on grey-black clay-loam and/or sandy loam soils generally at elevations of less than 20 m ASL. However, elevation may extend up to 50 m ASL on floodplains of, or coastland flats associated with, former or current coastal river systems (DoEE 2018). It is typically found on coastal flats, floodplains, drainage lines, lake margins, wetlands, and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. The canopy is dominated by swamp oak (*Casuarina glauca*), however scattered trees including forest red gum (*Eucalyptus tereticornis*), bangalay (*E. botryoides*), flooded gum (*E. grandis*), woollybutt (*E. longifolia*), or swamp mahogany (*E. robusta*) may also occur. Freshwater patches may include a number of *Melaleuca* species as emergent or in the sub-canopy stratum.

The survey and assessment of the 2021 survey area considered the key diagnostic characteristics and condition thresholds provided within the Approved Conservation Advice (TSSC). The key diagnostic conditions form the basis for delineating and identifying patches of native vegetation as being the threatened ecological community and distinguishing between patches of different quality.

The results of the assessment for these vegetation zones within the 2021 survey area against the key diagnostic characteristics according to the Approved Conservation Advice are detailed in **Table 3.10**.

Table 3.10 Assessment of vegetation patches within the remaining portion of the revised project area against the key diagnostic features according to the Approved Conservation Advice (TSSC 2015)

Key Approved Conservation Advice (TSSC 2015)	Vegetation within the 2021 survey area
Key Diagnostic Characteristics	
Occurs from south-east Queensland to southern NSW within the South Eastern Queensland, NSW North Coast, Sydney Basin, or South East Corner bioregions.	Yes – Occurs in the Sydney Basin.
Occurs in coastal catchments at elevations up to 50 m ASL, typically less than 20 m ASL, on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. There are also minor occurrences on coastal dune swales or flats, particularly deflated dunes and dune soaks.	Occurs at approximately 40 m ASL on an ephemeral drainage line that flows to the Hunter River. Pooling water was observed during the survey.
Occurs on soils derived from unconsolidated sediments (including alluvium), typically hydrosols (grey-black clay-loam and/or sandy loam soils) and sometimes organosols (peaty soils). It may occur in transitional soils (or catenas) where shallow unconsolidated sediments border lithic substrates.	Occurs on sandy loam soils associated with the Sedgefield soil landscape where yellow solodic soils occur on lower slopes and in drainage lines. Salting may occur in some drainage lines.
Has an open woodland, woodland, forest, or closed forest structure, with a tree canopy that has a total crown cover of at least 10 per cent.	Yes - Forms small, discrete patches within remaining revised project area where tree canopy has total crown cover of approximately 15 per cent.
Has a canopy of trees dominated by Casuarina glauca (swamp-oak, swamp she-oak).	Yes - Canopy is dominated by swamp oak (*Casuarina glauca*).

Key Approved Conservation Advice (TSSC 2015)	Vegetation within the 2021 survey area
Other Relevant Diagnostic Considerations	
Typically occurs where groundwater is saline or brackish.	May have saline influence from land use.
Typically occurs within 30 km of the coast, but in some areas, such as along tidal river catchments, the ecological community can occur more than 100 km inland.	Occurs approximately 70 km inland along a coastal river upstream of tidal influences.
Does not occur on rocky headlands, sea cliffs or other consolidated sediments.	Yes – Does not occur on rocky headlands, sea cliffs or other consolidated sediments.
Consideration of condition thresholds	
Patch Size Classes: Large patch (>5 ha), medium patch (2–5 ha), small contiguous* patch (0.5–2 ha and is connected to a larger patch of vegetation >5 ha), or small patch (0.5–2 ha).	No – Patch size of Zone 9 ranges between 0.027–0.161 ha. Patches are not considered to be contiguous and are separated by more than 30 m.
Vegetation Quality: High quality (meets key diagnostics and is predominantly native understory): Category A (large patch), Category B (medium patch/small contiguous* patch) or Category C (small patch). Good quality (meets key diagnostics and is mostly native understory): Category B (large patch) or Category C (medium patch/small contiguous* patch). Moderate quality (meets key diagnostics and has some native understory): Category C (large patch).	Not applicable as Zone 9 does not meet threshold for patch size.

* Contiguous patch condition – where the patch is connected or in close proximity (within 30 m) to another area of native vegetation.

Based on the key diagnostic conditions, Vegetation Zone 9 - 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – low condition does not conform to the Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland EEC.

3.1.3.8 River-flat Eucalypt Forest on Coastal Floodplains of Southern New South Wales and Eastern Victoria CEEC

PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter is not consistent with the Conservation Advice for the *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* CEEC (DAWE 2020). **Table 3.11** summarises the findings of this comparison.

Table 3.11 Comparison of final determination for River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions CEEC listed under the EPBC Act

Final Determination	Vegetation Zone 1 within the revised project area
Key Diagnostic Characteristics	
Occurs in the South East Corner and Sydney Basin IBRA Bioregions, in eastern Victoria and south eastern New South Wales.	Yes – Occurs in Sydney Basin Bioregion, adjacent to the Hunter River in the Singleton LGA.
Occurs within catchments of the eastern and southern watershed of the Great Dividing Range.	Yes – Occurs in in proximity to upper drainage lines within the catchment of the Hunter River.
Occurs at elevations up to 250 m ASL, but most typically below 50 m ASL.	Extent of this PCT 1598 within the revised project area occurs between 50–100 m ASL.
Occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates, including floodplains, riverbanks, riparian zones, lake foreshores, creek lines (including the floors of tributary gullies), floodplain pockets, depressions, alluvial flats, fans, terraces, and localised colluvial fans.	Occurs on Permian sediments on gentle slopes in association with the upper reaches of a drainage line, not alluvial soils.
Occurs on alluvial soils of various textures including silts, clay loams, sandy loams, gravel and cobbles. Does not occur on soils that are primarily marine sands, or aeolian sands.	As above.
Occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland. The canopy has a crown cover of at least 20 percent.	Occurs as a tall woodland within the revised project area with a canopy cover of 10%.
Has a canopy dominated by one or a combination of the following species: *Angophora floribunda, A. subvelutina, Eucalyptus amplifolia, E. baueriana, E. benthamii, E. bosistoana, E. botryoides, E. botryoides x E. saligna, E. elata, E. grandis, E. longifolia, E. moluccana, E. ovata, E. saligna, E. tereticornis, E. viminalis.*	The canopy was dominated by forest red gum (*Eucalyptus tereticornis*).

Table 3.12 details the area of TECs listed under the BC Act within the 2021 survey area. **Table 3.4** details the area of TECs listed under the EPBC within the remaining portion of the 2021 survey area. TECs listed under the BC Act are shown on **Figure 3.2.1** to **Figure 3.2.3** and TECs listed under the EPBC Act are shown on **Figure 3.3 1** to **Figure 3.3.3**.

Table 3.12 Vegetation Zones conforming to TECs listed under the BC Act

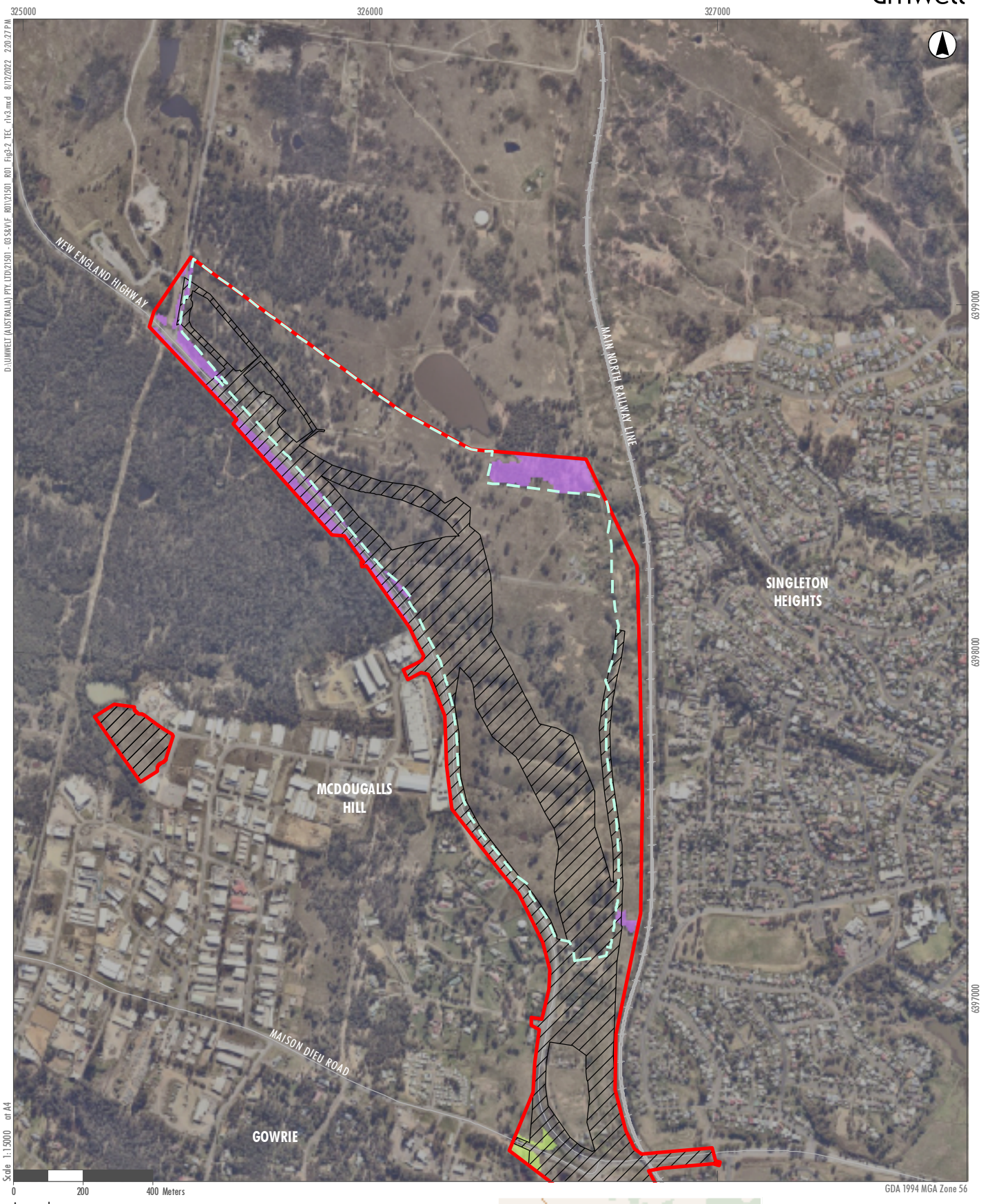
TEC listed under the BC Act	Conforming Vegetation Zones	Extent in the 2021 survey area
TECs identified in 2019		
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC.	VZ1 and VZ2	0.61
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC.	VZ8	3.99
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC.	VZ3 and VZ5	5.88
Additional TECs requiring consideration		
Swamp oak floodplain forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC.	Does not occur in survey area	-
River-flat Eucalypt Forest on Coastal Floodplain EEC.	Does not occur in survey area	-
Total		**10.48**

Previous interpretation of regional vegetation mapping identified the *Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions* EEC (BC Act) as potentially occurring within the 2021 survey area in association with PCT 1603 (Umwelt 2019). This PCT and associated TEC does not occur within the 2021 survey area based on the ground truthed vegetation mapping.

Table 3.13 Vegetation Zones conforming to TECs listed under the EPBC Act

TEC listed under the EPBC Act	Conforming Vegetation Zones	Extent in the 2021 survey area
TECs identified previously		
Central Hunter Valley Eucalypt Forest and Woodland CEEC.	VZ3, VZ4 and VZ5	6.23
Additional TECs requiring consideration		
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland EEC.	Does not occur in survey area	-
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria CEEC.	Does not occur in survey area	-
Total		**6.23**

The extent of Central Hunter Valley Eucalypt Forest and Woodland CEEC comprises 5.88 ha of forest/woodland habitat and 0.36 ha derived native grassland.



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Survey Area Boundary

Threatened Ecological Communities BC Act

- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC

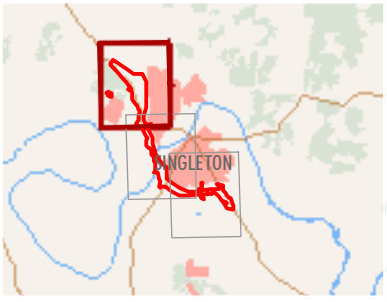
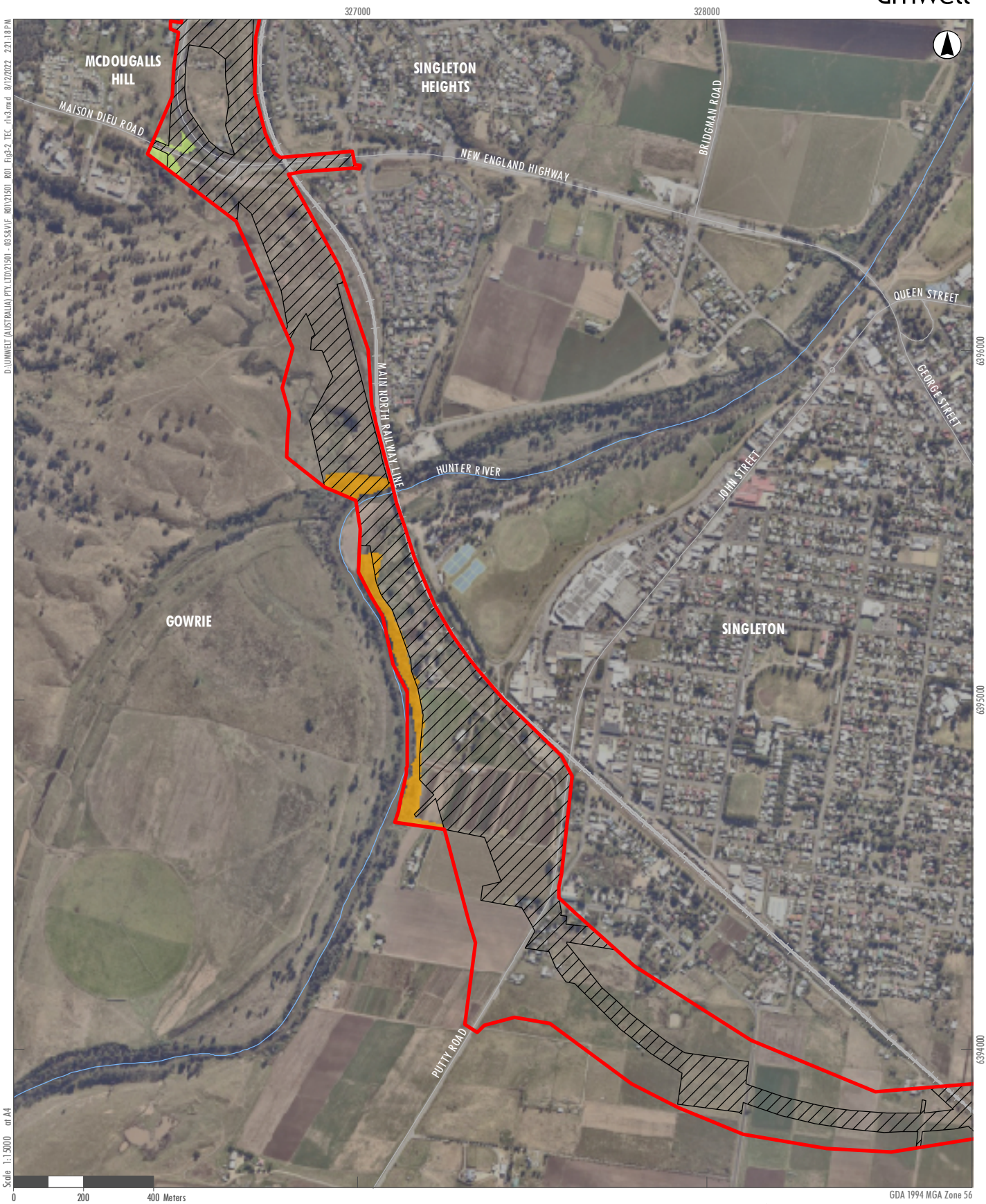


FIGURE 3.2.1

Threatened Ecological Communities Listed under the NSW BC Act - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)



Legend

- Revised Project Area
- Revised Impact Area

Threatened Ecological Communities BC Act

- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC

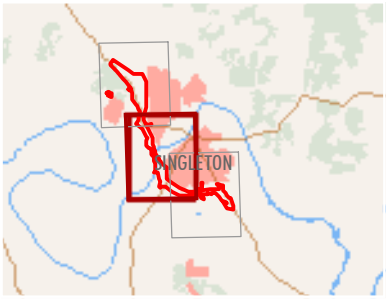


FIGURE 3.2.2

Threatened Ecological Communities Listed under the NSW BC Act - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

Legend

- Revised Project Area
- Revised Impact Area

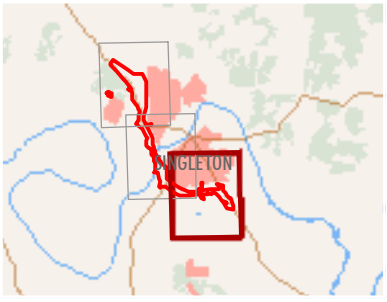
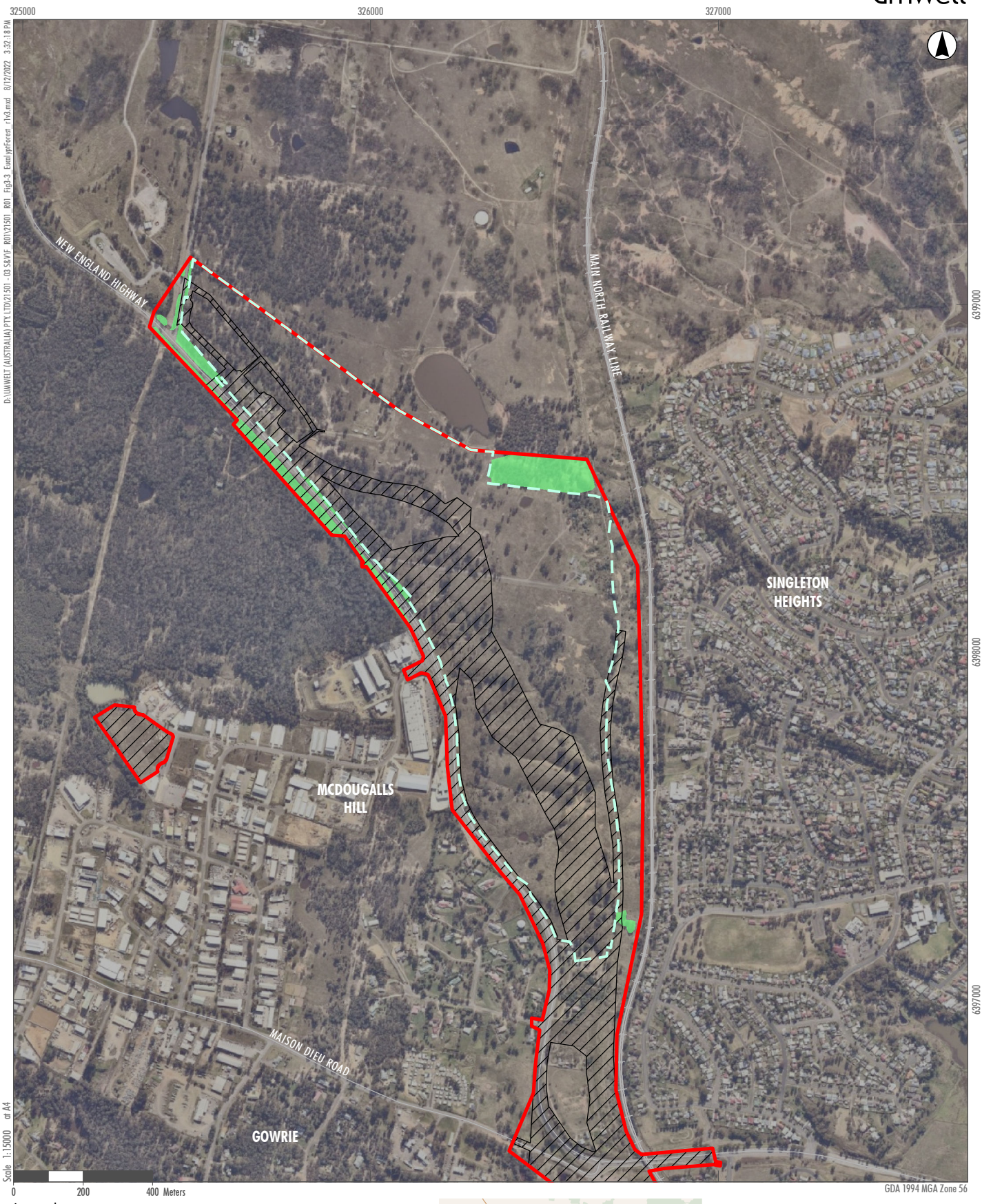


FIGURE 3.2.3

Threatened Ecological Communities Listed under the NSW BC Act - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Survey Area Boundary

Threatened Ecological Communities EPBC Act

- Central Hunter Valley Eucalypt Forest and Woodland CEEC

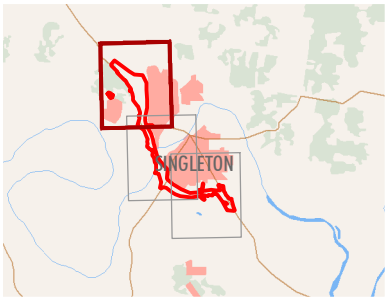


FIGURE 3.3.1

Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the Commonwealth EPBC Act - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

FIGURE 3.3.2

Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the Commonwealth EPBC Act - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

FIGURE 3.3.3

Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the Commonwealth EPBC Act - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

3.1.4 Groundwater Dependent Ecosystems

Outcomes of the groundwater dependent ecosystems (GDEs) desktop assessment outlined in the BAR is consistent with the surveys undertaken in 2021.

A review of the Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (BoM 2022) identified the Hunter River as a high potential aquatic Groundwater Dependent Ecosystem (GDE) with an inflow dependent ecosystems (IDE) likelihood score of 10, that is the ecosystem is reliant on groundwater in addition to rainfall in the Hunter River channel (BOM 2021).

Terrestrial GDEs mapped within the 2021 survey area are situated along the southern bank of Hunter River and in the northern portion of the revised project area (east of the rail corridor). The GDEs Atlas (BOM 2022) indicated that Terrestrial GDEs are associated with the following PCTs:

- 42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley – high potential GDE; IDE score 9
- PCT 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – high potential GDE; IDE score 9
- PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – low potential GDE; IDE Score 8.

It is recognised that these PCT 42, PCT 1731 and the river red gums located on the southern bank of the Hunter River have some dependency on groundwater and are terrestrial GDEs.

3.1.5 Threatened Species and Populations

One threatened flora species was recorded in the 2021 survey area, being river red gum (*Eucalyptus camaldulensis*) listed as threatened population under the BC Act. A total of 39 individuals were recorded along the lower bank of the Hunter River (refer to **Photo 3.12**).

Photo 3.12 River red gum (Eucalyptus camaldulensis) adjacent to the revised impact area

Three threatened fauna species were recorded in the 2021 survey area including:

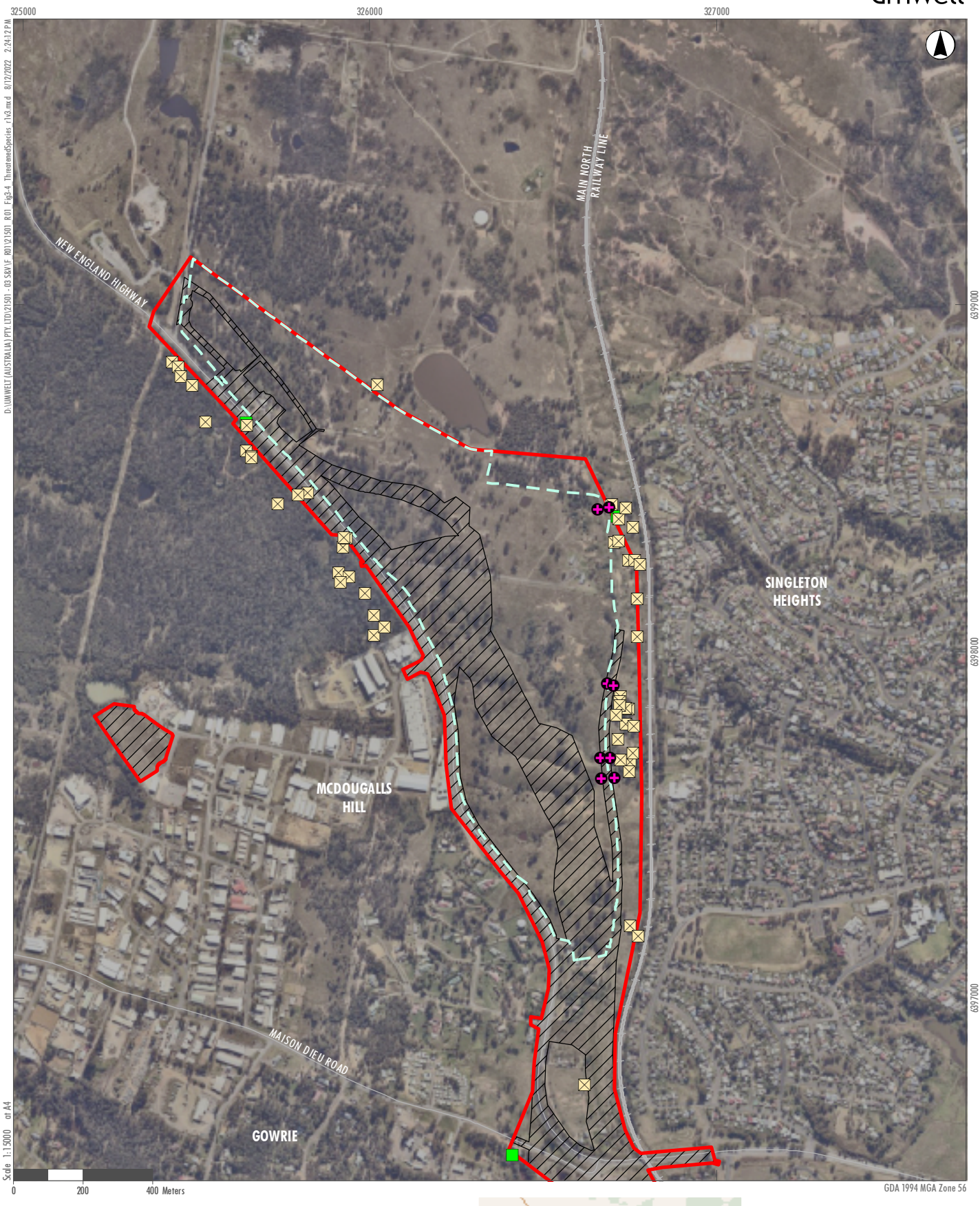
- Grey-crowned babblers (eastern subspecies) (*Pomatostomus temporalis temporalis*), listed a vulnerable under the BC Act, two individuals were recorded calling from woodland to the northeast of Hunter River.
- Grey-headed flying-fox (*Pteropus poliocephalus*), listed as vulnerable under the BC Act and EPBC Act, individuals were observed flying overhead during nocturnal surveys.
- Southern myotis (*Myotis macropus*), listed as vulnerable under the BC Act, a total of 17 were recorded in a harp trap set at one of the four culverts west of the Main North rail line. The presence of pregnant females as well as one female carrying a young pup confirms that the culverts support a maternal roost for this species (refer to **Photo 3.13**). The breeding status of individuals captured during the survey is summarised in **Table 3.13**.

The locations of the four threatened species observed during the 2021 survey are provided in **Figure 3.4.1** to **Figure 3.4.3**.

Table 3.14 Breeding status of southern myotis (Myotis macropus) recorded at Culvert 2

Sex	Signs of breeding	No. Individuals recorded
Female	No obvious abdomen bulge (not likely pregnant)	4
	Obvious abdomen bulge (likely pregnant)	10
	Carrying young pup	1
Male	Testes not swollen	1
	Swollen testes	1
Total		**17**

Photo 3.13 Female southern myotis carrying young detected in harp trap



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Survey Area Boundary
- Culvert Entrance Locations
- Hollow-bearing Tree Locations (ELA 2019)
- Hollow-bearing Tree Locations

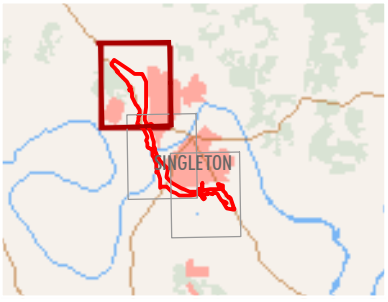


FIGURE 3.4.1

Location of Threatened Species and Key Habitat Features - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021); ELA (2019)

Legend

- Revised Project Area
- Revised Impact Area
- Hollow-bearing Tree Locations (ELA 2019)
- Hollow-bearing Tree Locations

Threatened Species under BC Act

- Grey-crowned Babbler (BC Act - Vulnerable)
- *Eucalyptus camaldulensis* population in the Hunter catchment (BC Act Endangered Population)

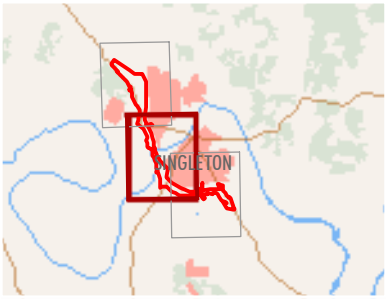


FIGURE 3.4.2

Location of Threatened Species and Key Habitat Features - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021); ELA (2019)

Legend

- Revised Project Area
- Revised Impact Area

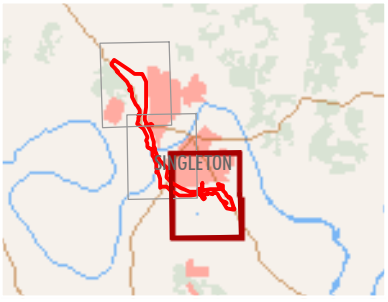


FIGURE 3.4.3

Location of Threatened Species and Key Habitat Features - 2021 Survey Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021); ELA (2019)

3.1.6 Fauna Habitat

The 2021 survey area comprises habitats suitable for supporting a range of fauna groups including amphibians, small fish, reptiles, woodland birds, small terrestrial mammals, and arboreal mammals.

Areas of woodland and forest vegetation, located on fringes of larger patches and corridors to the northwest, were considered to provide a stable range of habitat features. Scattered wood debris, sheeting bark, fallen timber, hollow bearing trees, and winter flowering eucalypts were recorded in the 2021 survey area. Vegetated gullies were generally lined by small boulders and included four culvert structures under the historic rail line in the northern portion of the 2021 survey area. The diversity of habitat features, while sparse, provides foraging and nesting habitat for amphibians, reptiles, woodland birds, small terrestrial mammals, and arboreal mammals. No large stick nests associated characteristic of large raptors were recorded during the survey.

The relationship between native and exotic grassland species is known to fluctuate seasonally and are influenced by historical agricultural practices, specifically the presence of annual grass species. Habitat features of grasslands included a number of permanent waterbodies, scattered trees (providing hollows and nectar), and a diversity grass tussock (basking sites for reptiles).

Dams and stagnate pools along ephemeral drainage lines were found to provide habitat for a number of frog species and small fish, while providing water resources for many other fauna groups. Fringing vegetation (in varying densities) was observed across a number of ephemeral waterbodies throughout the 2021 survey area. Fringing vegetation provides foraging habitat and breeding habitat for many amphibian and fish species while improving water quality and retention. The revised project area traverses the Hunter River, that provides aquatic and riparian habitat for many fish and bird species in the locality.

3.1.7 Koala Habitat

The BAR (Umwelt 2019) considered State Environmental Planning Policy 44 – Koala Habitat Protection (SEPP 44) for assessment of koala habitat in the revised project area. Since that time SEPP 44 has been replaced by State Environmental Planning Policy (Biodiversity and Conservation) 2021 which includes two chapters providing for assessment, conservation and management of koala habitat in NSW). Chapter 3 Koala Habitat Protection 2020 applies to rural zoned land in non-metropolitan local government areas while Chapter 4 Koala Habitat Protection 2021 applies to metropolitan local government areas and non-rural zoned land in non-metropolitan land.

Like SEPP 44, SEPP (Biodiversity and Conservation) 2021, koala habitat protection chapters apply to development applications in the Singleton local government area. While a development application is not being lodged for the land in the revised project area, the habitat definitions have been used to define koala habitat in the 2021 survey area.

The land between the north bank of the Hunter River and the New England Highway in the 2021 survey area is zoned RE2 Private Recreation, R1 General Residential and SP2 Infrastructure. For this section of the project, Chapter 4 Koala Habitat Protection 2021 would apply (refer to **Section 3.1.7.1**).

The majority of the 2021 survey area is zoned RU1 Primary Production under the Singleton Local Environmental Plan 2013 (LEP). This includes all land north of the New England Highway and Maison Dieu Road, and all land south of the Hunter River north bank, excluding the rail corridor which is zoned SP2 Infrastructure. On these lands Chapter 3 Koala Habitat Protection 2020 applies (refer to **Section 3.1.7.2**).

3.1.7.1 Non-Rural Lands – Chapter 4 Koala Habitat Protection 2021

Koala habitat in non-rural lands is assessed under SEPP (Biodiversity and Conservation) 2021, Chapter 4 Koala Habitat Protection 2021. This chapter provides for identification of highly suitable koala habitat. This is not defined in the SEPP however Koala Habitat Protection Guideline for implementing SEPP (Koala Habitat Protection) 2019 (DPIE 2020) provides guidance that highly suitable koala habitat is native vegetation where 15 percent or greater of the total number of trees are regionally relevant koala feed tree species. Regionally relevant koala feed tree species for Singleton are those listed in the Central Coast Koala Management Area in Schedule 3 of SEPP (Biodiversity and Conservation) 2021.

There are five vegetation zones across three PCTs in the 2021 survey area. **Table 3.15** identifies the five vegetation zones, whether koala feed trees are present and whether the vegetation zones provide highly suitable koala habitat as defined by Chapter 4 Koala Habitat Protection 2021 (**Figure 3.5**). The assessment of highly suitable koala habitat has also considered ranking of koala feed tree use in the Central Coast Koala Management Area as provided in Appendix A of the Koala Habitat Information Base Technical Guide (DPIE 2019).

Table 3.15 Highly Suitable Koala Habitat Non-Rural Lands

VZ	PCT	Regionally Relevant Koala Feed Trees	Highly Suitable Koala Habitat
4	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – Thinned Canopy.	Spotted gum (irregular or low use) Grey box (high preferred use) Narrow-leaved ironbark (significant use) White box (high preferred use).	Yes, supports four regionally relevant species including two high preferred use species.
5	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Derived Native Grassland.	Grey box (high preferred use) Narrow-leaved ironbark (significant use) Forest red gum (high preferred use).	Yes, scattered canopy and small trees dominated by three regionally relevant species including two high preferred use species.
6	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – African olive infestation.	Spotted gum (irregular or low use) Grey box (high preferred use).	Yes, canopy and small trees dominated by two regionally relevant species including one high preferred use species.
8	42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley – Low Condition.	River red gum (high use).	Yes, dominant tree species.
9	1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – Low Condition.	Swamp oak (irregular or low use).	No, while swamp oak is identified as regionally relevant it is only used irregularly.

PCT 1604 and PCT 42 both are considered highly suitable koala habitat. Highly suitable koala habitat is core koala habitat where koalas are recorded as being present or where koalas have been recorded as being present in the previous 18 years. A review of BioNet koala records for the last 18 years within 2.5 km of the revised project area identified there are no koala (*Phascolarctos cinereus*) records in the revised project area and only two koala records within 2.5 km of the revised project area. The closest is about 1.45 km to the south of the revised project area near Putty Road and is dated 1980. The other record is from 2014 and is to the northeast of the northern end of the revised project area in the Wattle Ponds locality.

The one record in the last 18 years that may indicate generational persistence of the koala, is separated from the revised project area by residential area and the Main North railway line. It is anticipated that these land uses would represent a barrier to dispersal of the koala. There are more records of koalas further to the north-east of this record. Given the uniformity of rural landscape between these records it is likely that the resident population is to the northeast of Wattle Ponds and Singleton.

No evidence of the koala has been recorded in the 2019 project area (Umwelt 2019). There is a low likelihood that a resident population of the koala occurs in the revised project area.

3.1.7.2 Rural Lands – Chapter 3 Koala Habitat Protection 2020

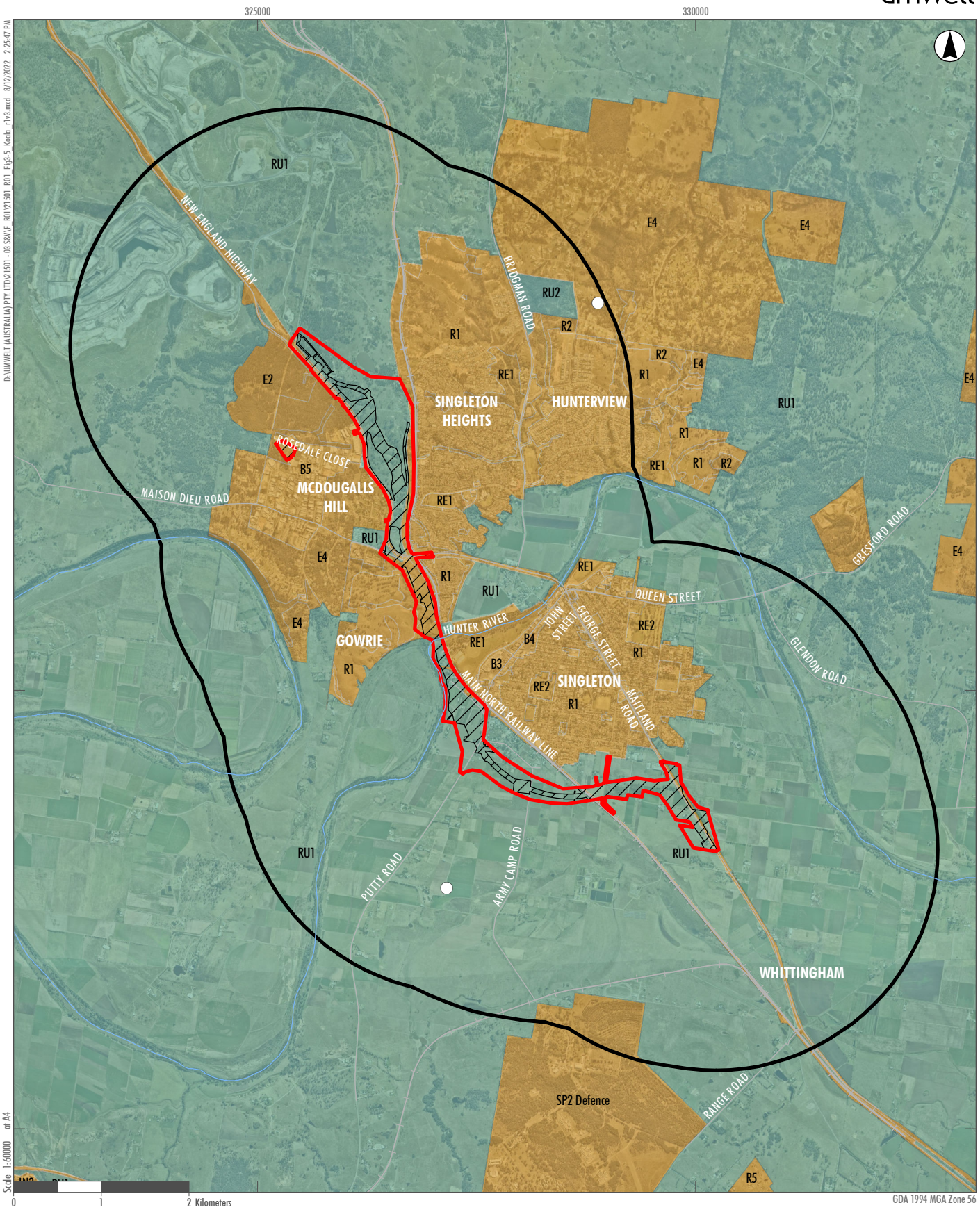
To all intents and purposes SEPP (Biodiversity and Conservation) 2021, Chapter 3 Koala Habitat Protection 2020, defines koala habitat as SEPP 44 did and as was presented in the BAR (Umwelt 2019). That is, potential koala habitat is defined as areas of native vegetation where koala feed trees listed in Schedule 1 of SEPP (Biodiversity and Conservation) 2021, constitute at least 15 per cent of the total number of trees in the upper or lower strata of the tree component.

In the 2021 survey area there are four vegetation zones and three PCTs in the rural zoned land. **Table 3.16** identifies the four vegetation zones, whether koala feed trees are present and whether the vegetation zones provide potential koala habitat as defined by Chapter 3 Koala Habitat Protection 2020.

Table 3.16 Potential Koala Habitat Rural Lands

VZ	PCT	Schedule 1 Koala Feed Trees	Potential Koala Habitat
2	PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Derived Native Grassland.	Forest red gum scattered	No, trees largely absent from grassland.
3	1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Moderate to Good Condition.	Forest red gum scattered	No, not one of the dominant tree species, representing less than 15% coverage.
5	1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Derived Native Grassland.	Regenerating forest red gum present at fringes	No, not one of the dominant tree species, representing less than 15% coverage.
8	42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley – Low Condition.	River red gum	Yes, dominant tree species.

Core koala habitat means an area of land that supports a resident population of koalas (breeding females with young, and recent sightings of and historical records of a population). While potential koala habitat may occur around the revised project area, as noted in **Section 3.1.6**, there are no koala records in the revised project area and only two records of the koala within 2.5 km of the revised project area. Given the absence of historical and recent records in the revised project area and connected vegetation, there is a low likelihood that the revised project area supports a resident population of koalas and core koala habitat.



Legend

- Revised Project Area
- Revised Impact Area
- 2.5 km Buffer
- Bionet Koala Records
- Rural - Chapter 3 - Koala Habitat Protection 2020 Applies
- Non-rural - Chapter 4 - Koala Habitat Protection 2021 Applies

FIGURE 3.5

Koala Records and SEPP (Biodiversity and Conservation) 2021 Koala Habitat Protection

Image Source: Nearmap (Jan 2021) Data source: NSW DSFI (2021) AECOM (2019); DPIE (2021)

3.1.8 Summary of Matters of National Environmental Significance Present

A total of seven Matters of National Environmental Significance (MNES) were predicted to occur in the EPBC Act Protected Matters Report (DAWE 2022) in addition to those outlined by the BAR (Umwelt 2019) including:

- *River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria* endangered ecological community (EEC) under BC Act and critically endangered ecological community (CEEC) under the EPBC Act.
- White Box-Yellow Box-Blakely's Red Gu Grassy Woodland and Derived Native Grassland EEC under BC Act and CEEC under the EPBC Act.
- Austral toadflax (*Thesium australe*) listed a vulnerable under the BC Act and EPBC Act.
- Grey falcon (*Falco hypoleucos*) listed as endangered under the BC Act and vulnerable under the EPBC Act.
- Large-eared pied bat (*Chalinolobus dwyeri*) listed a vulnerable under the BC Act and EPBC Act.
- Pink-tailed legless lizard (*Aprasia parapulchella*) listed a vulnerable under the BC Act and EPBC Act.
- Striped legless lizard (*Delma impar*) listed a vulnerable under the BC Act and EPBC Act.

None of these additional MNES were considered likely to occur or were identified during the survey of the 2021 survey area.

The full EPBC Act Protected Matters Report is provided in **Appendix A**. TECs listed under the EPBC Act have been assessed against the approved conservation measures (see **Section 3.1.2**). Threatened species, populations, communities listed and migratory species under the EPBC Act that have the potential to occur within the revised project area have been identified in the Habitat Assessment in **Appendix C**.

3.2 Comparison of 2019 Project Area and the Revised Project Area

The Project Area has been revised since the BAR (Umwelt 2019) increasing the total area from 257.73 ha in 2019 to 268.56 ha in 2021.

The following sections provide a summary of the existing environment for the 2019 and the revised project areas, while the amendments to the revised impact area are discussed in the Impact Assessment (outlined in **Section 4.0**).

3.2.1 Plant Community Types

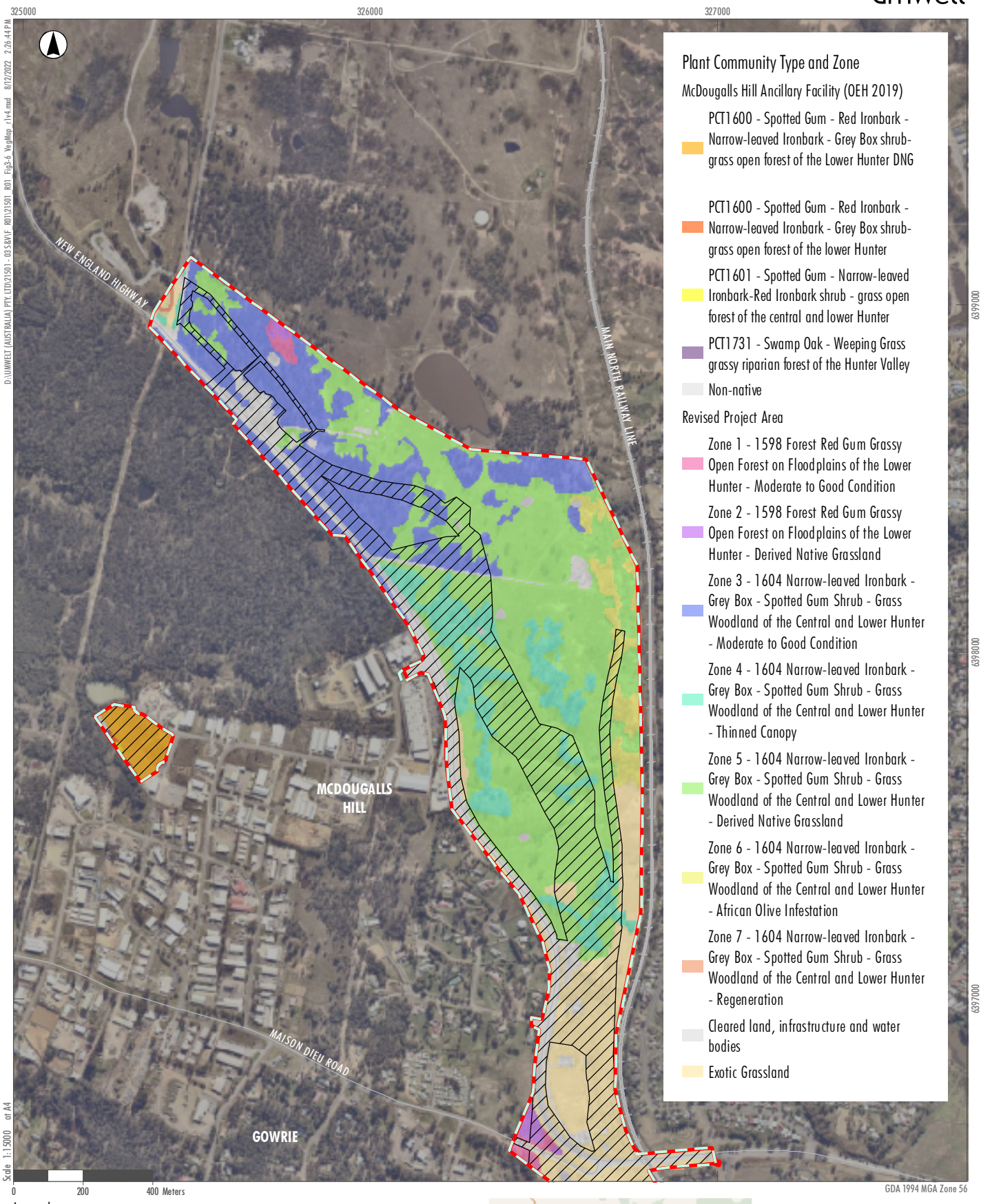
Table 3.17 compares the extent of PCTs as identified in Umwelt (2019) and as assessed in the revised project area.

The extent of PCTs across the revised project area and the revised impact area is detailed in **Figure 3.6.1.1** to **Figure 3.6.3**.

Table 3.17 Review of PCTs within the revised project area

Veg Zone	Plant Community Type (PCT)	Condition	Area in 2019 project area	Area in revised project area
Verified vegetation mapping				
1	1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter	Moderate - Good	0.47	1.08
2	1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter	DNG	0.22	0.8
3	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Moderate - Good	19.45	24.81
4	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Thinned canopy	11.46	11.8
5	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	DNG	50.16	62.65
6	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	African olive	1.14	4.28
7	1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	Regenerating	-	0.13
8	42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley	Low condition	-	4
9	1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	Low Condition	-	0.42
-	Exotic grassland	-	0.84	129.68
-	Cleared Land, infrastructure, water bodies	-	2.84	26.22
		Total extent verified	**86.57**	**265.87**
Regional vegetation mapping*				
42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley		-	3.83	-
1600 Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub-grass open forest of the lower Hunter		-	4.36	0.06
1600 Spotted Gum – Red Ironbark – Narrow-leaved Ironbark – Grey Box shrub-grass open forest of the lower Hunter		DNG	2.44	2.44
1601 Spotted Gum – Narrow-leaved Ironbark-Red Ironbark shrub – grass open forest of the central and lower Hunter		-	4.15	0.05
1603 Narrow-leaved Ironbark – Bull Oak – Grey Box shrub – grass open forest of the central and lower Hunter		-	0.15	-
1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum shrub – grass woodland of the central and lower Hunter		-	0.02	-
1731 Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley		-	-	0.07
Non-native Vegetation		-	156.11	0.07
		Total extent of regional vegetation mapping	**171.06**	**2.69**
		Total for project area	**257.73**	**268.56**

* The portion of the study area informed by regional vegetation mapping in the BAR (Umwelt 2019) and for MDHF in this supplementary BAR.



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

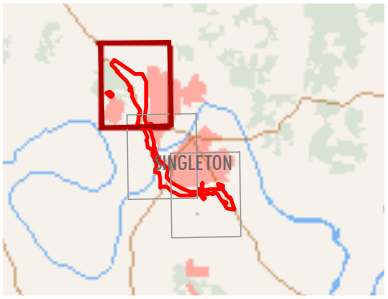


FIGURE 3.6.1

Vegetation Mapping - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

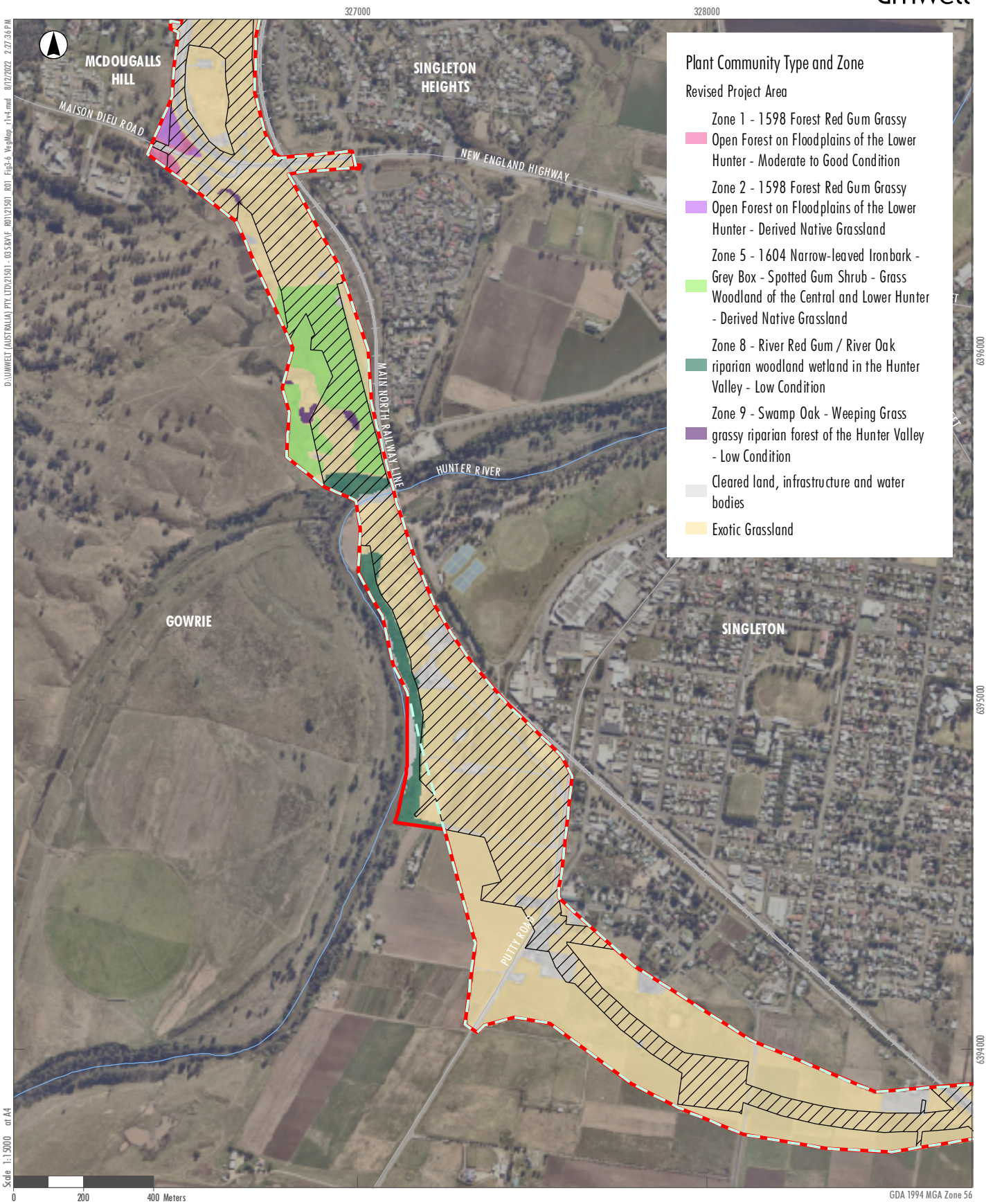
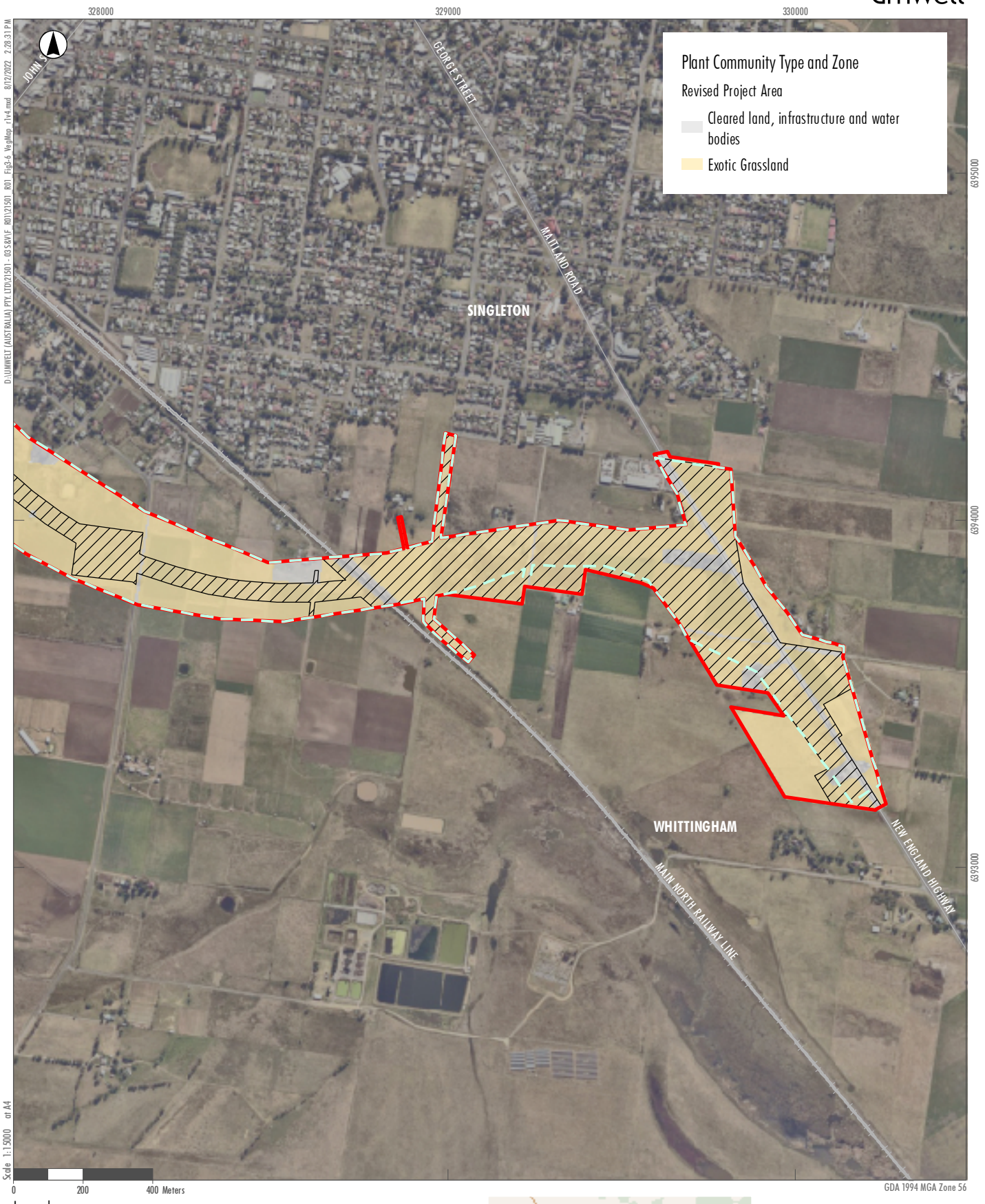


FIGURE 3.6.2

Vegetation Mapping - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

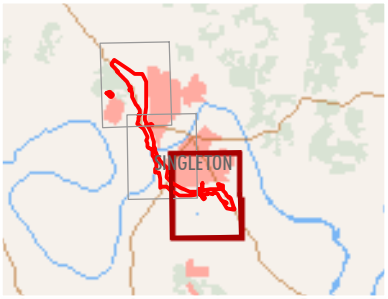


FIGURE 3.6.3

Vegetation Mapping - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

3.2.2 Threatened Ecological Communities

The area of TECs listed under the BC Act within the 2019 project area and in the revised project area (including the MDHF) are provided in **Table 3.18** and shown in **Figure 3.7.1** to **Figure 3.7.3.** Assessments of TEC against BC Act scientific determinations and EPBC Act conservation advice are provided in **Section 3.1.2**.

Table 3.18 Review of TECs listed under the BC Act within the 2019 project area and revised project area

TEC	Area in 2019 project area	Area in revised project area
TECs identified previously		
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC.	0.47	**1.08**
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC.	3.83	**4.00**
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC.	39.44	**36.72**
Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC.*	0.15	-
Total	**43.88**	**41.80**

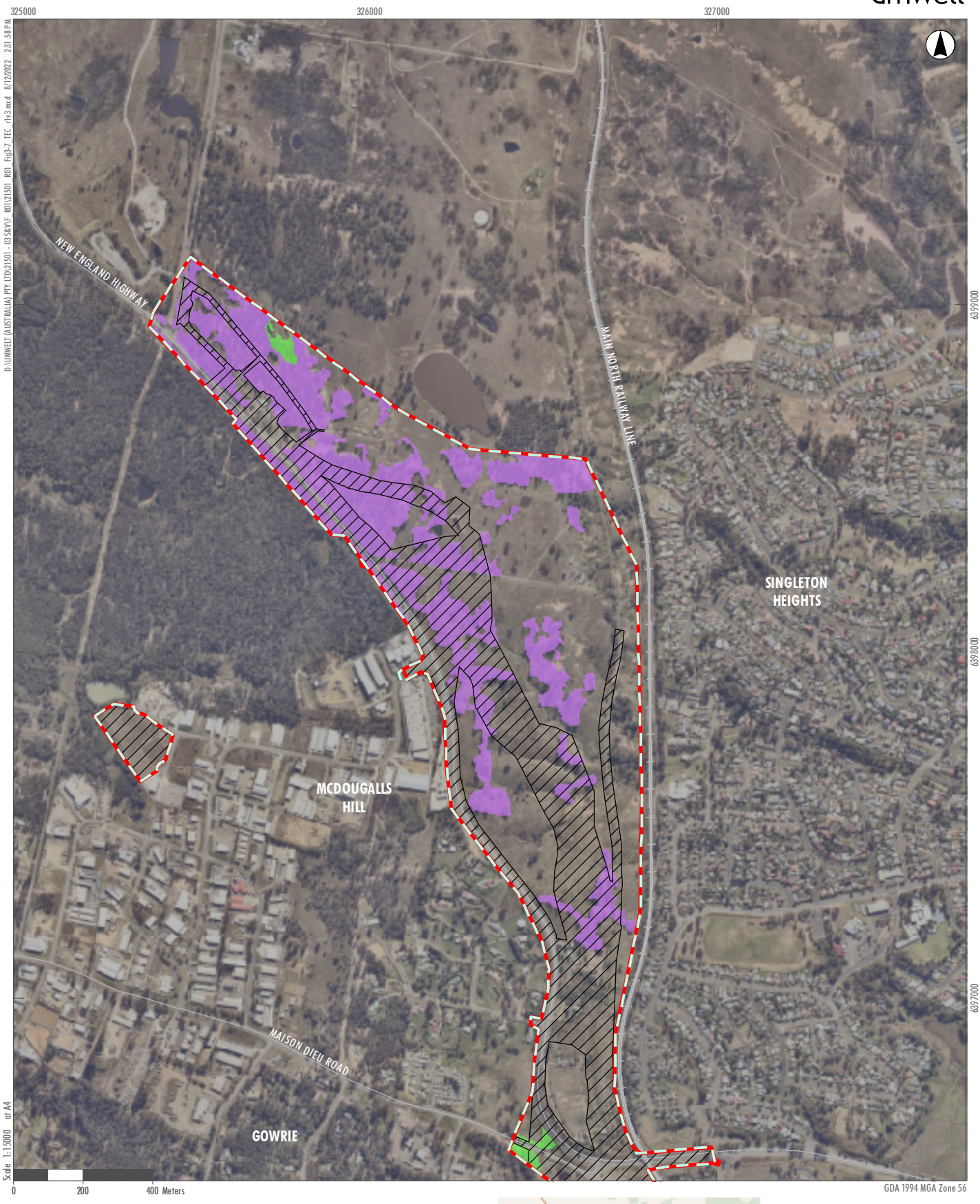
** TEC predicted to occur based on regional vegetation mapping (Umwelt 2019). Field surveys have not identified this EEC the revised project area.*

The area of TECs listed under the EPBC within the revised project area are shown in **Table 3.19** and **Figure 3.8.1** to **Figure 3.8.3**.

Table 3.19 Review of the TECs listed under the EPBC Act within the 2019 project area and revised project area

TEC	Area in 2019 project area	Area in Revised project area
Central Hunter Valley Eucalypt Forest and Woodland CEEC	47.77	47.16

The extent of *Central Hunter Valley Eucalypt Forest and Woodland* CEEC within the revised project area (including the MDHF) comprises 36.72 ha of forest/woodland habitat and 10.44 ha derived native grassland.



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

Threatened Ecological Communities BC Act

- Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC

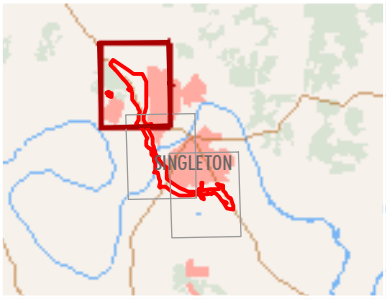


FIGURE 3.7.1

Threatened Ecological Communities Listed under the NSW BC Act - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

Threatened Ecological Communities BC Act

- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC

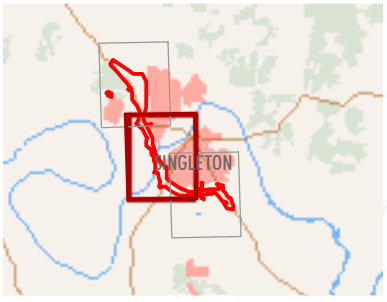


FIGURE 3.7.2

Threatened Ecological Communities Listed under the NSW BC Act - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

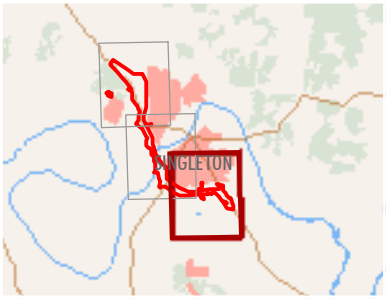
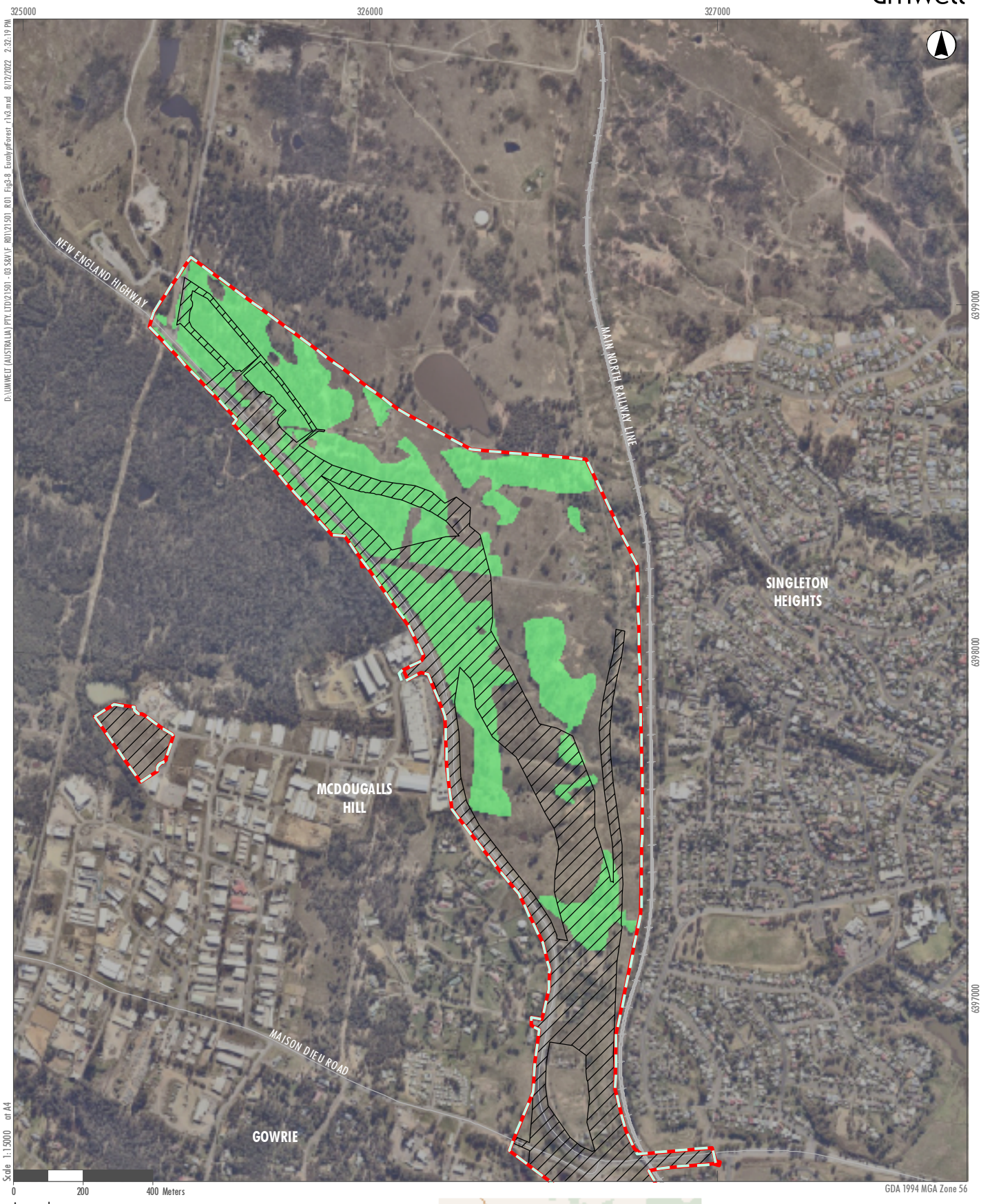


FIGURE 3.7.3

Threatened Ecological Communities Listed under the NSW BC Act - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

Threatened Ecological Communities EPBC Act

- Central Hunter Valley Eucalypt Forest and Woodland CEEC

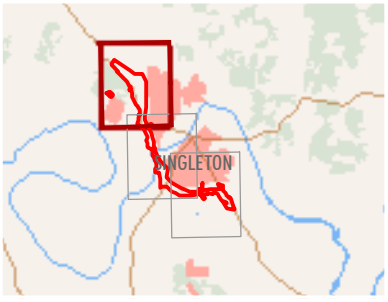


FIGURE 3.8.1

Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the Commonwealth EPBC Act - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

FIGURE 3.8.2

Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the Commonwealth EPBC Act - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area

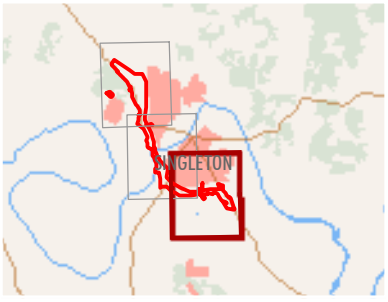


FIGURE 3.8.3

Central Hunter Valley Eucalypt Forest and Woodland CEEC Listed under the Commonwealth EPBC Act - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021)

3.2.3 Threatened Species and Populations

A total of nine threatened fauna species and one endangered population have been recorded as present, and four threatened fauna species as potentially present, within the revised project area (refer to **Table 3.20**). No additional threatened species were recorded during the 2021 biodiversity surveys.

Table 3.20 Threatened Flora and Fauna Species Recorded within the Revised Project Area

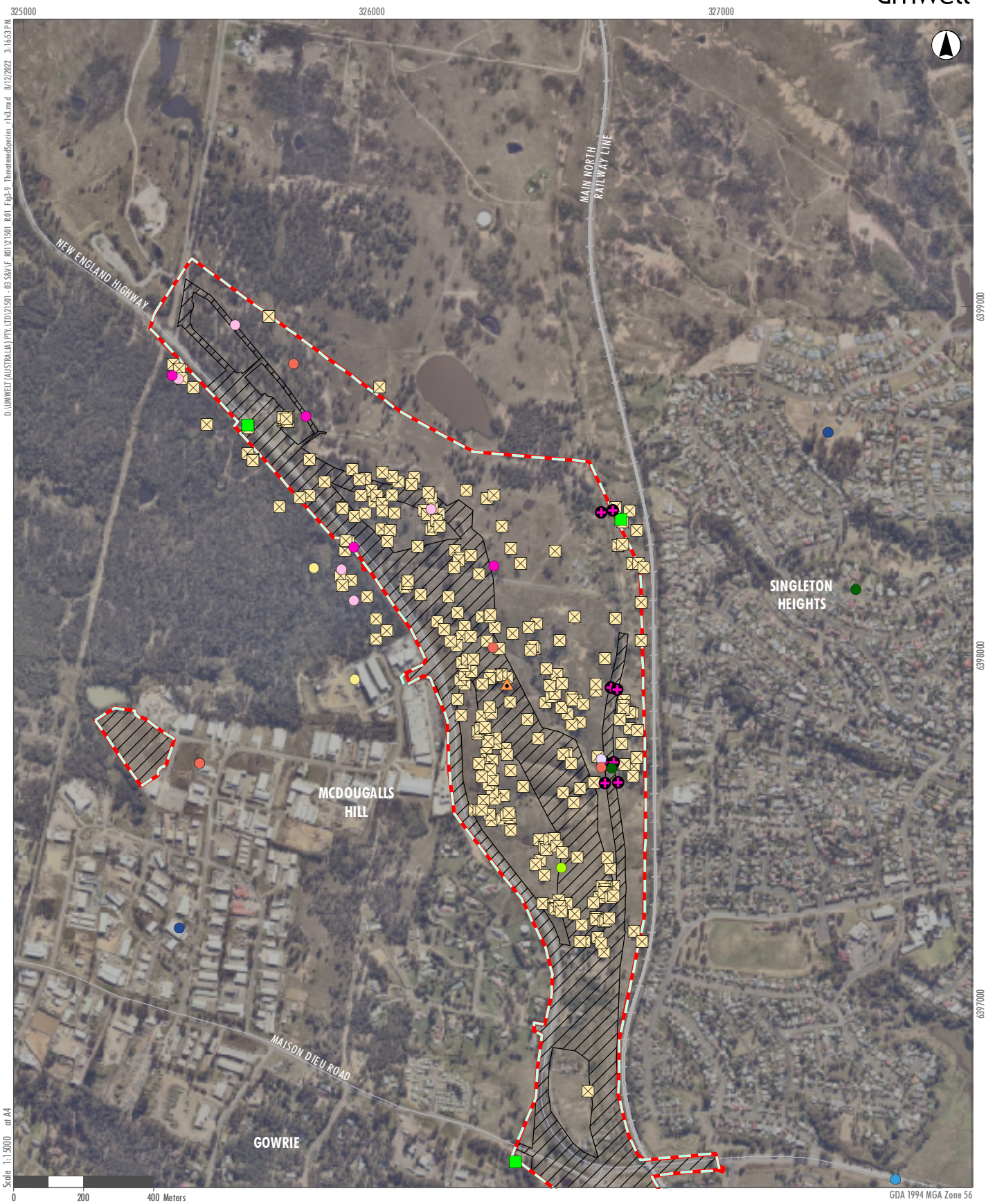
Scientific Name	Common Name	BC Act	EPBC Act	2019	2021	Comments
Threatened flora species						
Eucalyptus camaldulensis	river red gum	End pop	-	✓	✓	Population occurring along southern bank of the Hunter River
Threatened fauna species						
Hieraaetus morphnoides	little eagle	V	-	✓		
Pomatostomus temporalis	grey-crowned babbler	V	-	✓	✓	
Tyto novaehollandiae	masked owl	V	-	✓		Potential sighting (ELA record)
Falsistrellus tasmaniensis	eastern false pipistrelle	V	-	✓		Potential recording (ELA record)
Micronomus norfolkensis	eastern coastal free-tailed bat	V	-	✓		
Miniopterus australis	little bent-winged bat	V	-	✓		
Miniopterus orianae oceanensis	large bent-winged bat	V	-	✓	✓	Recorded during targeted survey August 2022
Myotis macropus	southern myotis	V	-	✓	✓	Recorded in harp trap (Umwelt 2021)
Petaurus norfolcensis	squirrel glider	V	-	✓		
Phascogale tapoatafa	brush-tailed phascogale	V	-	✓		
Pteropus poliocephalus	grey-headed flying-fox	V	V	✓	✓	Flying over revised project area
Scoteanax rueppellii	greater broad-nosed bat	V	-	✓		Potential recording (ELA record)
Vespadelus troughtoni	eastern cave bat	V	-	✓		Potential recording (ELA record)

Habitat for threatened species which occur in the revised project area (refer to **Figure 3.9.1** to **Figure 3.9.3**) include:

- Approximately 112.59 ha of native vegetation, comprised of 65.89 ha of grassland habitat and 46.70 ha of woodland and forest vegetation that contains 242 hollow-bearing trees.
- Microbat roost sites were recorded in the existing large sandstone arch culverts located in the revised project area. A maternity roost was confirmed in the southern most culvert while signs of use were identified in the other two culverts arch culverts.
- Key fish habitat in the Hunter River.
- A total of 39 river red gums (*Eucalyptus camaldulensis*) forming part of the endangered population in the Hunter catchment were recorded in the revised project area.
- Threatened species, populations, communities listed and migratory species under the BC Act and EPBC Act that have the potential to occur within the revised project area have been identified in the Habitat Assessment in **Appendix C**.

3.2.4 Matters of National Environmental Significance

Threatened species, populations, communities listed and migratory species under the EPBC Act that have the potential to occur within the revised project area have been identified in the likelihood of occurrence table in **Appendix C.**



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area
- Hollow-bearing Tree Locations
- Hollow-bearing Tree Locations (ELA 2019)
- Culvert Entrance Locations
- *Tyto* sp. (ELA 2019)

Threatened Species under BC Act

- Southern Myotis (Vulnerable)

Threatened Fauna Records

- Brush-tailed Phascogale
- Eastern Coastal Free-tailed Bat
- Grey-crowned Babbler (eastern subspecies)
- Grey-headed Flying-fox
- Large Bent-winged Bat
- Little Bent-winged Bat
- Little Eagle
- Southern Myotis
- Squirrel Glider
- White-bellied Sea-Eagle

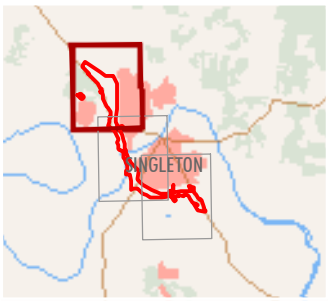
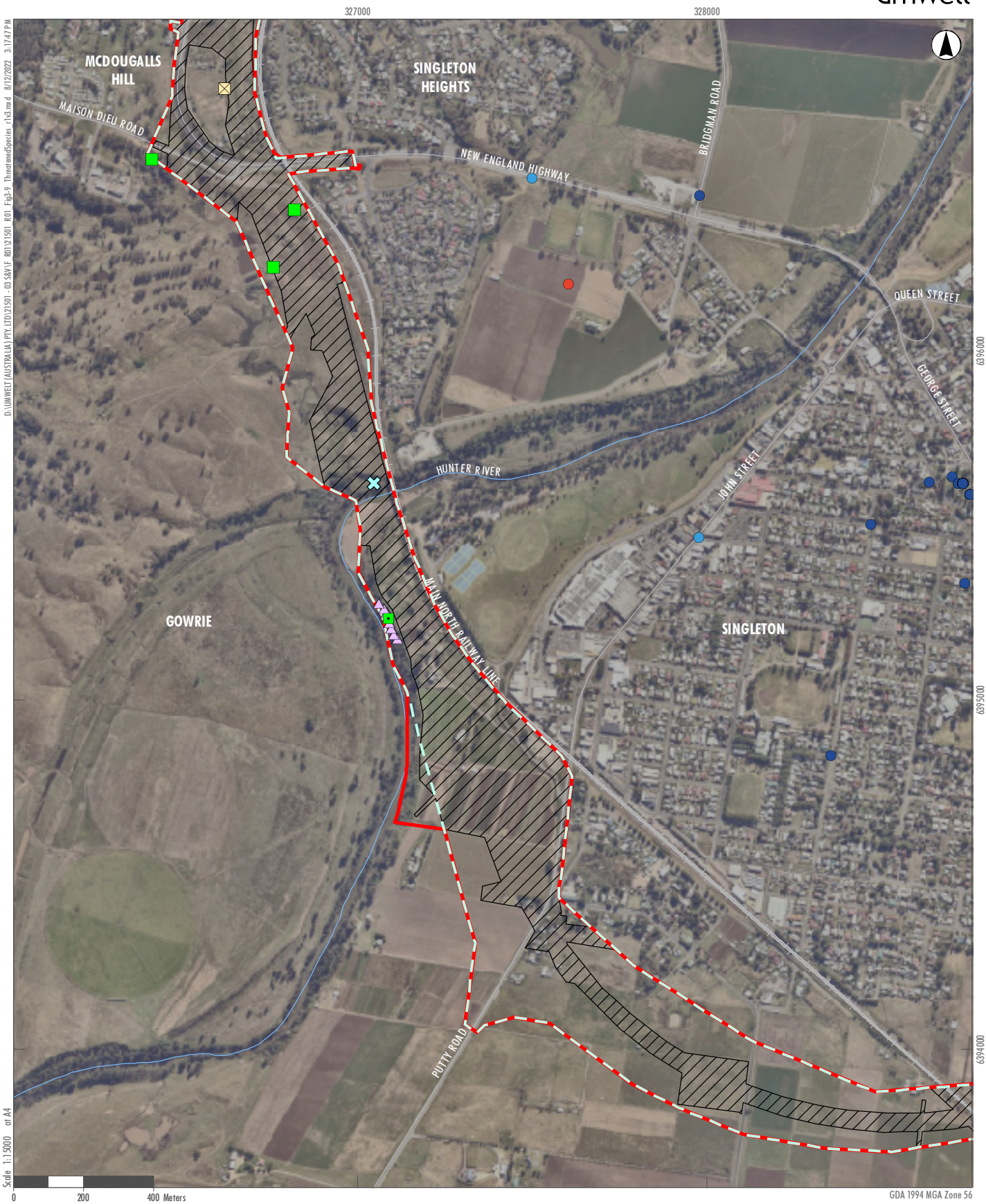


FIGURE 3.9.1

Location of Threatened Species and Key Habitat Features - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021), ELA (2019), NSW DPIE (2021)



Legend

- Revised Project Area
- Revised Impact Area
- 2019 Project Area
- Hollow-bearing Tree Locations
- Hollow-bearing Tree Locations (ELA 2019)

Threatened Species under BC Act

- Grey-crowned Babbler (Vulnerable)
- *Eucalyptus camaldulensis* (Endangered Population)

Threatened Flora Records

- *Eucalyptus camaldulensis*

Threatened Fauna Records

- Grey-headed Flying-fox
- Spotted-tailed Quoll
- White-bellied Sea-Eagle

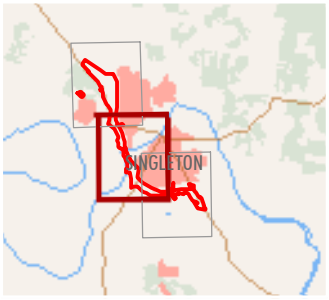


FIGURE 3.9.2

Location of Threatened Species and Key Habitat Features - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021), ELA (2019), NSW DPIE (2021)

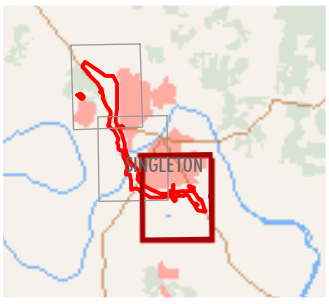


FIGURE 3.9.3

Location of Threatened Species and Key Habitat Features - Revised Project Area

Image Source: Nearmap (Dec 2021) Data source: AECOM (2019), Umwelt (2021), ELA (2019), NSW DPIE (2021)

4.0 Impact Assessment

4.1 Construction Impacts

The modifications to the project since the BAR (Umwelt 2019) primarily occur in the area south of the Hunter River to the Putty Road connection. The revised impact area includes a number of additional areas occurring to the north of the Hunter River to facilitate the relocation of ancillary facilities, utilities, access and other minor modifications. Restrictions would be placed on the extent of clearing for ancillary facilities and enabling work to reduce the area of impact. A review of clearing as a consequence of the detailed design of the project would occur to confirm clearing limits and ensure reductions are achieved.

4.1.1 Removal of Native Vegetation

The revised impact area covers about 147.49 ha which includes a total of 42.89 ha of native vegetation. Of the 42.89 ha of native vegetation being removed, 40.27 ha occurs within the main construction area of the new road alignment and 2.62 ha occurs in the MDHF (as predicted by regional vegetation mapping).

The area of described PCTs which would be cleared as a result of the project are provided in **Table 4.1.** One of the nine vegetation zones do not occur within the revised impact area, being VZ7 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – Regenerating. **Table 4.1** also identifies whether there has been a change in the impact areas (red – increase >10 ha; orange – increase <10 ha; green – decrease) for each PCT and whether this is consistent with the approved project.

No new key threatening processes (KTPs) under the BC Act relevant to the removal of native vegetation have been identified in addition to those outlined in the BAR (Umwelt 2019). No significant changes in the operation of these KTPs are expected because of the revised impact area. Changes to KTPs as a result of the project are summarised in **Section 4.4**.

Table 4.1 Potential Impacts on Native Vegetation

PCT	Estimate of % cleared	Area		Change in impact
		2019	Revised	
Verified vegetation mapping				
VZ1 - 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good.	-	-	0.37	Present in impact area, small area to be impacted.
VZ2 - 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – DNG.	-	-	0.30	Present in impact area, small area to be impacted.
VZ3 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Moderate to Good.	71.00	5.34	8.61	Present in impact area, increase of 3.27 ha (61%) in impact area.
VZ4 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – Thinned Canopy.	71.00	6.35	6.69	Present in impact area, decrease of 0.34 ha (5%) in impact area.
VZ5 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – DNG.	71.00	14.21	22.39	Present in impact area, increase of 8.18 ha (57%) in impact area.
VZ6 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – African Olive Infestation.	71.00	-	0.46	Present in impact area, small area to be impacted.
VZ8 - 42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley – Low condition.	95.00	-	1.21	Present in impact area, small area to be impacted.
VZ9 - 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – low condition.	62.00	-	0.24	Present in impact area, small area to be impacted.
Native vegetation predicted by regional vegetation mapping*				
42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley.	95.00	1.22	-	Revised impact area predicted by regional vegetation mapping is attributed only to the MDHF.
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	71.00	2.21	0.06	
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the Lower Hunter DNG.	71.00	2.44	2.44	
1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	71.00	0.08	0.05	
1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley.	62.00	0.08	0.07	
Total area of native vegetation removed		**31.93**	**42.89**	

** Total area in the 2019 impact area predicted for PCT 42, PCT 1600, PCT 1600 DNG, PCT 1601, and PCT 1731 (Umwelt 2019); Total area of predicted native vegetation attributed to only the MDHF.*

***Note:** the regional vegetation mapping for the revised impact area includes areas of native vegetation that were not able to be verified during the 2021 field survey, being a small area adjacent to the Singleton Council water pump station. **Table 3.1** identifies the PCTs that were verified within the 2021 survey area. All native vegetation has been verified within the revised impact area for these calculations.*

4.1.1.1 Threatened Ecological Communities

Of the 42.89 ha of native vegetation with potential to be impacted, 21.13 ha conforms to a TEC including 16.99 ha that conforms to TEC's listed under the BC Act and 19.55 ha the conforms to a TEC listed under the EPBC Act.

The area of each TEC identified in the revised impact area is provided in **Table 4.2** and **Table 4.3**.

Table 4.2 compares the area of TECs listed under the BC Act between the 2019 impact area and revised impact area (including the MDHF)**.**

Table 4.2 TECs listed under the BC Act in revised impact area

TEC	Area in 2019 impact area	Area in revised impact area	Change in potential impact
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC.	-	0.37	New impact
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC.	1.22	1.21	Minimised impact
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC.	13.97	15.41	Increased impact
Total	**15.19**	**16.99**	

A total of 0.37 ha Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC (BC Act), 1.21 ha of Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act), and 15.41 ha of Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act) is located in the revised impact area.

Previously *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC was not identified within the Impact Area. An assessment of significance was undertaken for this TEC and the outcomes are provided in **Section 4.4** and **Appendix D**).

Table 4.3 compares the area of TECs listed under the EPBC Act between the 2019 impact area and revised impact area (including the MDHF).

Table 4.3 TECs listed under the EPBC Act in revised impact area

TEC	Area in 2019 impact area	Area in revised impact area	Change in potential impact
Central Hunter Valley Eucalypt Forest and Woodland CEEC.	16.89	19.55	Increased impact

The revisions to the impact area have increased the potential clearing of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* (EPBC Act) by 2.66 ha. A total of 19.55 ha of the CEEC (comprises 15.41 ha of forest/woodland habitat and 4.14 ha derived native grassland) is located in the revised impact area. Given the minor increase in the clearance of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* (EPBC Act) the previous assessment of significance is consistent with the outcomes of this report. The BAR identified that clearing 16.89 ha of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* (EPBC Act) for the project will constitute a significant impact.

4.1.2 Removal of Threatened Fauna Habitats

The 42.89 ha of native vegetation which occurs in the revised impact area and ancillary compounds provides potential foraging and/or breeding habitat for numerous threatened fauna species (**Appendix C**). **Table 4.4** lists the threatened fauna species recorded in the revised impact area.

Table 4.4 Threatened species and their habitat recorded in the revised impact area

Threatened Fauna Species	BC Act	EPBC Act	Species or ecosystem credit species	Likelihood of occurrence (moderate, high, or recorded)	Associated PCT and Vegetation Zone	Direct impact area
grey-crowned babbler (eastern sub-species) (*Pomatostomus temporalis temporalis*)	V	-	Ecosystem-credit species	Recorded	1604 (VZ3, VZ4, VZ5) RVM* (1600,1600 DNG,1601)	40.24 ha foraging habitat
grey-headed flying-fox (*Pteropus poliocephalus*)	V	V	Dual credit – ecosystem-credit species for this assessment (no breeding habitat impacted)	Recorded	1604 – VZ3, VZ4, VZ5 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat
southern myotis (*Myotis macropus)*	V	-	Species-credit species	Recorded maternal roost	1598 – VZ1, 1604 – VZ3, VZ4, 42 – VZ8, 1731 – VZ9, RVM* (1600,1601, 1731)	12.34 ha habitat (within 200m of waterbodies)
squirrel glider (*Petaurus norfolcensis*)	V	-	Species-credit species	Recorded	1598 – VZ1, 1604 – VZ3,VZ4,VZ6, 1731 – VZ9, RVM* (1600,1601,1731)	16.55 ha habitat
brush-tailed phascogale (*Phascogale tapoatafa*)	V	-	Species-credit species	Recorded	1598 – VZ1, 1604 – VZ3,VZ4,VZ6, 1731 – VZ9, RVM* (1600,1601,1731)	16.55 ha habitat
masked owl (*Tyto novaehollandiae*)	V	-	Dual credit – ecosystem-credit species for this assessment (foraging habitat only)	Potentially recorded	1604 – VZ3, VZ4, VZ5, RVM* (1600, 1600 DNG, 1601)	33.66 ha foraging habitat
eastern false pipistrelle (*Falsistrellus tasmaniensis*)	V	-	Ecosystem-credit species	Recorded (potential)	1604 – VZ3, VZ4, VZ5, 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat
eastern coastal free-tailed bat (*Micronomus norfolkensis*)	V	-	Ecosystem-credit species	Recorded	1604 – VZ3, VZ4, VZ5, 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat
little bent-winged bat (*Miniopterus australis*)	V	-	Dual credit – ecosystem-credit species for this assessment (foraging habitat only)	Recorded	1604 – VZ3, VZ4, VZ5, 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat

Threatened Fauna Species	BC Act	EPBC Act	Species or ecosystem credit species	Likelihood of occurrence (moderate, high, or recorded)	Associated PCT and Vegetation Zone	Direct impact area
large bent-winged bat (*Miniopterus orianae oceanensis*)	V	-	Dual credit – ecosystem-credit species for this assessment (foraging habitat only)	Recorded (confirmed by call analysis)	1604 – VZ3, VZ4, VZ5, 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat
greater broad-nosed bat (*Scoteanax rueppellii*)	V	-	Ecosystem- credit species	Likely	1604 – VZ3, VZ4, VZ5, 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat
eastern cave bat (*Vespadelus troughtoni*)	V	-	Species-credit species (foraging habitat only)	Recorded (identified as potential presence by call analysis)	1604 – VZ3, VZ4, VZ5, 42 – VZ8, RVM* (1600, 1600 DNG, 1601)	41.45 ha foraging habitat

* RVM – PCT predicted by Regional Vegetation Mapping for MDHF.

The project would result in the potential removal of 101 hollow-bearing trees, many of which contain multiple hollows and seven of which are stags. A total of three additional hollow bearing trees were recorded in the revised impact area during the 2021 survey. A summary of the hollow bearing trees recorded within the 2019 impact area and the revised impact area are provided in **Table 4.5**.

Table 4.5 Hollows and habitat trees proposed for removal

Hollow size class	Impact area (2019)		Revised impact area		Change since 2019	Habitat for recorded threatened species in Table 4.4
	Hollows	HBTs*	Hollows	HBTs*		
Tiny (< 5 cm)	192	84	200	87	Slight increase in number of HBTs with tiny hollows.	Microbats**.
Small (5–10 cm)	150	70	153	72	Slight increase in number of HBTs with small hollows.	Squirrel glider, Brush-tailed Phascogale.
Medium (10–20 cm)	60	45	62	47	Slight increase in number of HBTs with medium hollows.	Squirrel glider.
Large (20–30 cm)	13	12	15	14	Slight increase in number of HBTs with large hollows.	-
Extra-large (>30 cm)	3	3	4	4	Slight increase in number of HBTs with extra-large hollows.	Potential for Masked Owl.
Total No. Hollows	**418**	-	**434**	-	**Slight increase in the total number of hollows proposed for removal.**	

** Number of trees containing each hollow class.*
*** Cave dwelling threatened microbat species (such as those recorded) likely to use small hollows only for over-night roost.*

Three of the four culvert structures located within the revised project area were found to provide suitable roost and breeding habitat for microbats. Impacts in proximity to these culverts include the installation of services via trenching. These actions are not considered to directly impact the culverts. Breeding habitat was confirmed in the southernmost culvert by the presence of pregnant southern myotis (*Myotis macropus*). The two southern culverts occur within a section of the impact area designated for the installation of services (via trenching or boring) as well as being located between 30 to 50 m of the construction limits of the revised impact area. Given their location within the receiving environment, the two southern culverts may be indirectly impacted by the installation of services and construction activities through increased noise, light, and vibration impacts. The northern most culvert with suitable microbat habitat is located more than 300 m to the east of the revised impact area, in a different catchment. It is not expected that this culvert structure will be disturbed by drainage or sedimentation impacts of the project, however this culvert is considered to be the next closest refuge location for microbats utilising culvert structures. Assessments of Significance (**Appendix D**) determined that no threatened microbat species were likely to be significantly impacted by the project considering a range of mitigation measures recommended in **Section 5.0**.

No new key threatening processes (KTPs) under the BC Act relevant to the removal of threatened fauna habitat have been identified in addition to those outlined in the BAR (Umwelt 2019). No significant changes in the operation of these KTPs are expected following the revised impact area. Changes to KTPs as a result of the project are summarised in **Section 4.4**.

4.1.3 Removal of Threatened Flora

Based on the 2021 survey a total of 39 river red gums (*Eucalyptus camaldulensis*) forming part of the endangered population in the Hunter catchment (BC Act) were recorded within the revised project area. The population was recorded in the revised project area, adjacent to the revised impact area (5 to 10 m). It occurs along the Hunter River in association with PCT 42. Approximately 1.21 ha of this PCT will be cleared as a result of the project; it is not expected that any river red gums will be removed. However, given the steep slope and short distance separating the threatened population to the revised impact area, works may exacerbate natural erosion process and result in the damage or loss to individuals.

Revised assessments of Significance (see **Section 4.3** for a summary and **Appendix D** for full assessments) determined that no endangered flora populations, including river red gum (*Eucalyptus camaldulensis*) listed as threatened population under the BC Act, are likely to be significantly impacted by the project considering a range of mitigation measures recommended in **Section 5.0**.

4.2 Indirect/Operational Impacts

The revised impact area considered by this consistency review follows a similar alignment to the impact area identified in the BAR (Umwelt 2019). A number of small patches of native vegetation occurring in the northern portion as well as a number of larger patches of non-native agricultural land to the southwest of the Hunter River have been included in the revised impact area.

4.2.1 Indirect Impacts to Microbat Roosting Habitat

Indirect impacts on threatened micro-bats utilising the sandstone arch culverts in proximity to the project include construction noise and vibration generated through the use of plant and mobile equipment. This would include impacts as a result of relocation of telecommunication services (including contamination test pits and installation by trenching) along the old rail alignment extending about 1.3 km north from the Gowrie Gates. Trench dimensions are expected to be no more than 0.5 m wide and 1 to 2 m deep.

Increased noise and vibration during construction may impact on micro-bats utilising the sandstone culverts. Impacts are most likely to result from sudden loud noise and vibration that the micro-bats are not habituated to, particularly if this occurs during the breeding season or when micro-bats are torpid over winter. Construction noise can potentially affect micro-bats in the following ways:

- Sudden, loud noises can potentially disturb micro-bats and cause abandonment of roosts and young.
- Sudden, loud noises can potentially cause temporary or permanent hearing loss in micro-bats, affecting echolocation and passive listening.
- Chronic disturbance may also alter important colony activity patterns, particularly during the breeding season, and could also disrupt critical torpor cycles of micro-bats during winter, forcing them to expend critical energy resources.

- Young at maternity colonies are particularly susceptible to noise induced hearing loss during sensitive development periods.
- Noisy environments can disturb colonies when roosting as well as substantially reduce foraging efficiency.
- Abandonment of roosts during daylight hours increases the risk of predation (particularly by birds during clearance activities). Microbats then seeking refuge in other culverts nearby may result in overcrowding, well as disruption and trigger impacts to other roosts throughout the area.

Earthworks in the upper catchment may increase the spread of weeds and increased encroachment of weeds such that they block the culvert entrances limiting flight pathways for micro-bats. Changes to flow regime through the culverts may increase runoff which could obstruct access/egress, while increased sedimentation within the sandstone block culverts may result in roosting habitat becoming less favourable. Conversely a decrease in flow may increase terrestrial fauna movements through the culverts, including predators. Predators such as foxes, while may not be able to reach the microbats in the roost structures, the increased presence of a threat will likely disrupt the microbat roost and cause abandonment.

4.3 Assessments of Significance

Assessments of significance have been conducted for those threatened species, populations and ecological communities known or with potential to occur within the revised impact area. Threatened ecological communities and species with the potential to be impacted by the project have been reviewed as a part of this consistency review.

Previous assessments of significance have been revised for:

- *Eucalyptus camaldulensis* endangered population in the Hunter Catchment under the BC Act.
- southern myotis (*Myotis macropus*) listed as vulnerable under the BC Act.
- Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act.

All other assessments of significance undertaken for the preparation of the BAR (Umwelt 2019) are considered to be consistent with the results of field surveys.

An additional assessment of significance was conducted for *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC* listed under the BC Act.

The full assessments of significance are provided in **Appendix D**, a summary of the outcomes of the assessments are provided in **Table 4.6**.

Table 4.6 Summary and Outcomes of Assessments of Significance under the BC Act and EPBC Act

Common Name	Scientific Name	Status	Likely significantly impacted	Change in impact
Entities assessed under the BC Act				
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions.		EEC	No	New assessment
Eucalyptus camaldulensis endangered population in the Hunter Catchment.		EP	No	No
Southern myotis	*Myotis macropus*	V	No	No
Entities assessed under the EPBC Act				
Central Hunter Valley Eucalypt Forest and Woodland.		CEEC	Yes	No

The Assessments of Significance under the BC Act and EPBC Act found the project is likely to result in a significant impact to the *Central Hunter Valley Eucalypt Forest and Woodland CEEC*.

No other significant impacts are likely for the other abovementioned threatened species, endangered population or TECs.

4.4 Summary of Impacts

Table 4.7 provides details of the potential impacts to biodiversity values that have been considered in this supplementary BAR. The potential impacts have been assessed prior to the implementation of mitigation measures including restrictions on clearing for certain activities and design solutions to reduce the clearing footprint. Actual clearing impacts would be reduced during development of the design. Impact areas would be recalculated prior to the commencement of construction.

Table 4.7 Summary of impacts and changes in impacts

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the project constitute or exacerbate a key threatening process?	Confidence in assessment	Change in assessment from 2019
Removal of native vegetation	Native vegetation.	Direct	Site based	Long term	Clearing of native vegetation (42.89 ha) would be exacerbated by the project.	Known	Increase in the clearing of native vegetation (previously 31.93 ha).
	Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC (BC Act).	Direct	Site Based	Long Term	Clearing of this community (0.37 ha) would be exacerbated by the project.	Known	New minor impact.
	Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act).	Direct	Site based	Long term	Clearing of this community (1.21 ha) would be exacerbated by the project.	Known	Small decrease (previously 1.22 ha) in the removal of this TEC.
	Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act).	Direct	Site based	Long term	Clearing of this community (15.41 ha) would be exacerbated by the project.	Known	Moderate increase (previously 13.98 ha) in the removal of this TEC.
	Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act).	Direct	Site based	Long term	Clearing of this community (19.55 ha) would be exacerbated by the project.	Known	Moderate increase in the removal of this TEC (previously 16.89 ha).
Removal of threatened fauna habitat	Species as assessed in Appendices D and E.	Direct	Site based	Long term	Clearing of native vegetation (42.89 ha) Loss of hollow-bearing trees (101) Removal of dead wood and dead trees. These KTPs would be exacerbated by the project.	Known	Small increase in the removal of native vegetation and their habitats.
Removal of threatened flora	N/A	N/A	N/A	N/A	No threatened flora identified within the revised impact area or ancillary facilities.	N/A	No change in impacts.

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the project constitute or exacerbate a key threatening process?	Confidence in assessment	Change in assessment from 2019
Aquatic impacts	Threatened aquatic fauna.	Direct	Site based	Short term	Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and stream would occur during construction associated with temporary instream rock platforms and access ramps.	Known	No change in impacts.
Aquatic impacts	Threatened aquatic fauna.	Direct	Site based	Long term	Removal of large woody debris.	Unknown	No change in impacts.
Aquatic impacts	Threatened aquatic fauna.	Direct	Site based	Long term	NA – Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and stream is not applicable in the long term as bridges have minimal impact on flow and are excluded.	N/A	No change in impacts.
Injury and mortality of fauna	Threatened fauna.	Direct	Site based	Short term Long term	The following KTPs would be exacerbated by the project: • Clearing of native vegetation • Loss of hollow-bearing trees.	Unknown	No change in impacts.
Fragmentation of identified biodiversity links and habitat corridors	Threatened fauna.	Direct/ indirect	Site-based	Short term Long Term	The following KTPs would be exacerbated by the project: • Clearing of native vegetation (42.89 ha) • Loss of hollow-bearing trees (101) • Removal of dead wood and dead trees.	Known	Small increase in the clearing of native vegetation.
Edge effects on adjacent native vegetation and habitat	Threatened flora. Threatened fauna.	Indirect	Site-based	Long term	N/A – edge effects are not expected to exacerbate KTPs.	Known	No change in impacts.

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the project constitute or exacerbate a key threatening process?	Confidence in assessment	Change in assessment from 2019
Invasion and spread of weeds	TECs	Indirect	Site based	Long term	The following KTPs have low potential to be exacerbated by the project: • Invasion of native plant communities by African Olive (*Olea europaea* subsp. *Cuspidata*) • Invasion of native plant communities by exotic perennial grasses.	Known	No change in impacts.
Invasion and spread of pests	Threatened fauna	Indirect	Site based	Long term	The following KTPs have low potential to be exacerbated by the project: • Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) • Predation and hybridisation of feral dogs (*Canis lupus familiaris*) • Predation by the European red fox (*Vulpes vulpes*) • Predation by the feral cat (*Felis catus*).	Unknown	No change in impacts.
Invasion and spread of pathogens and disease	Threatened fauna and TECs	Indirect	Site based	Long term	N/A – the project is not expected to lead to the invasion and spread of pathogens and disease exacerbate KTPs.	N/A	No change in impacts.
Groundwater dependent ecosystems	Groundwater dependent ecosystems	Direct	Site based	Long term	NA	Known	No change in impacts.
Changes to hydrology	Threatened aquatic fauna	Direct	Site based	Short term	Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers.	Known	No change in impacts.
Noise, light, and vibration	Threatened fauna	Direct/ indirect	Local	Short term Long term	N/A – noise, light and vibration are not expected to exacerbate KTPs.	NA	No change in impacts.

5.0 Avoid, Minimise and Mitigate Impacts

5.1 Avoidance and Minimisation

Transport and the successful design and construct contractor will reduce the impact footprint through the final road design. Upon completion of the final road design the smaller impact footprint will be assessed to refine the offset liability.

Restrictions on clearing for certain activities will be enforced to reduce the assessed impact on TEC's and sensitive threatened species. No additional avoidance and minimisation measures have been identified further to those included in the BAR (Umwelt 2019).

5.2 Mitigation Measures

Table 5.1 of the BAR (Umwelt 2019) identified a range of environmental outcomes and management measures that would be required to avoid or reduce environmental impacts. These included a number of environmental management measures outlined in Table 5-1 of the New England Highway Bypass of Singleton Submissions Report (AECOM 2020). The revisions to the environmental safeguards and management measures based on the outcomes of this supplementary BAR have been summarised in **Table 5.1.**

Mitigation measures in addition to those included in the BAR (Umwelt 2019) are detailed in **Table 5.2**.

All other mitigation measures detailed in the BAR (Umwelt 2019) and Submissions Report (AECOM 2020) should be implemented for the project.

Table 5.1 Review of 2019 Mitigation Measures

Impact	Mitigation Measures	Timing and Duration	Likely Efficacy of Mitigation	Residual impacts Anticipated	Outcomes from 2021
Removal of native vegetation **Removal of threatened species habitat and habitat features** **Aquatic impacts**	Prior to the commencement of construction, carry out: a) Targeted surveys to confirm the presence of the following along the Hunter River and unnamed tributary to the north of the Hunter River within the area to be impacted by the project ○ River red gum (*Eucalyptus camaldulensis*) (endangered population - BC Act) ○ Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions (EEC – BC Act). b) Threatened flora survey, fauna habitat assessments and ground-truthing of vegetation mapping, between the Hunter River and the southern extent of the area surveyed by Umwelt (2019), north of the New England Highway near Gowrie Gates, within the area to be impacted by the project c) Ground truthing surveys of the regional vegetation mapping within the McDougalls Hill ancillary facility to confirm presence of: ○ Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC (BC Act) ○ Central Hunter Valley Eucalypt Forest and Woodland CEEC (EPBC Act) ○ No clearing of threatened native vegetation is to be carried out within the McDougalls Hill ancillary facility. Subject to the outcomes of the above, a consistency review or environmental assessment may be required.	Prior to construction	Effective	Residual impacts to threatened ecological communities would be offset in accordance with the offset strategy detailed in **Section 6.0**.	Mitigation measure completed for a) and b). Surveys completed for a) and b), outcomes provided in this supplementary BAR. McDougalls Hill ancillary facility was not surveyed for the inclusion in this supplementary BAR and further assessment will be required when works are confirmed.
	Prior to the commencement of construction, carry out monitoring to determine the presence of threatened microbats in the culverts that are part of the former Great Northern Railway. If threatened microbats are identified, collect the following information: a) Species present. b) Total number of individuals and groups per occupied roost site. c) Description of occupied roost sites. d) Breeding status of colony, including approximate adult to juvenile ratios.	Prior to construction	Effective	Residual impacts to threatened species would be offset in accordance with the offset strategy detailed in **Section 6.0**.	Mitigation measure completed. Surveys completed and outcomes provided in this consistency review.

Impact	Mitigation Measures	Timing and Duration	Likely Efficacy of Mitigation	Residual impacts Anticipated	Outcomes from 2021
	A Bat Management Plan is to be developed and implemented. The Bat Management Plan is to be prepared by a microbat specialist and include the following: a) A monitoring program for both during and outside of breeding periods. b) Details of construction activities to be monitored that may affect microbat habitat, particularly light, noise, vibration, alteration of drainage into culverts. c) Mitigation measures to be implemented during construction, including regular inspections of impacts from sedimentation and weed encroachment to culvert entrances, consider timing and nature of immediately adjacent works in relation to known breeding period of relevant threatened microbats. d) Adaptive management measures to be implemented if monitoring indicates a decline in bat numbers or if bats are observed leaving the roost during construction activities. e) A process for evaluating the effectiveness of management measures.	Prior, during and post construction	Effective	Residual impacts to threatened species would be offset in accordance with the offset strategy detailed in **Section 6.0**.	Maternal roost of threatened microbats found during pre-construction surveys. The Bat Management Plan is to be prepared by a microbat specialist prior to construction.

Table 5.2 Additional recommended mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated	Outcomes from 2021
Removal of native vegetation **Removal of threatened species habitat and habitat features**	Notwithstanding the revised impact area, clearing of trees* in areas mapped as a Threatened Ecological Community (TEC) or habitat features would be avoided for the following activities unless within the design footprint of the bypass: • Geotechnical investigations • Construction compound sites including stockpiling and material laydown areas • Temporary infrastructure including security and exclusion fencing, erosion and sediment controls • Utility relocations. If the removal of trees for the above activities cannot be avoided, a Tree Removal Application would be prepared for approval. The application would include a review of options considered, justification for why removal is required, and total areas of TEC and habitat features to be removed. TfNSW approval of the application would be required prior to commencing the activity. * tree as defined Tree Hollow Replacement Guidelines (TfNSW 2022a): long lived woody perennial plant greater (or usually greater than) 3m in height with one or relatively few main sems or trunks (or as defined by the determining authority).	Prior and during construction	Effective	Residual impacts to threatened species would be offset in accordance with the offset strategy detailed in **Section 6.0**.	New mitigation measure
Removal of native vegetation **Removal of threatened species habitat and habitat features**	A Tree and Hollow Replacement Plan will be prepared in accordance with the TfNSW Tree and Hollow Replacement Guidelines (2022) for tree removal not subject to the Biodiversity Offset Strategy. The plan will exclude hollow replacement otherwise addressed by the Habitat Replacement Strategy.	Prior, during and post construction	Effective	Residual impacts to threatened species would be offset in accordance with the offset strategy detailed in **Section 6.0**.	New mitigation measure

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated	Outcomes from 2021
Injury to fauna during installation of services by trenching	A Flora and Fauna Management Plan prepared and implemented as part of the CEMP will include the following measures to reduce potential for fauna entrapment within the pipeline trenches: • Minimizing to the period of time the trench is open. • Provide opportunities for fauna to exit the trench such as trench plugs or other appropriate measures, at a minimum of every 500 m. • Installation of fauna shelter devices, such as sawdust filled bags, at 250 m intervals along the trench. • Daily pre-start inspections of the open trench, and removal of trapped fauna by suitably qualified personnel as required. • Welded pipe strings will be end capped to prevent fauna entry.	Construction	Effective	Residual impacts to threatened species would be offset in accordance with the offset strategy detailed in **Section 6.0**.	New mitigation measure

6.0 Offset Strategy

6.1 Quantification of Residual Impacts

6.1.1 Offsetting Threshold

The Guideline for Biodiversity Offsets (Roads and Maritime 2016) requires consideration of biodiversity offsets when threatened ecological communities or threatened species habitat is impacted above specified thresholds, as detailed in **Table 6.1**. Residual impacts to biodiversity will be compensated for in accordance with the TfNSW Biodiversity Policy (effective 1 August 2022) and the Tree and Hollow Replacement Guidelines (TfNSW 2022a).

Table 6.1 Offsetting Thresholds for REFs (Roads and Maritime 2016)

Description of activity or impact	Consider offsets or supplementary measures
Works involving clearing of national, or NSW listed critically endangered ecological communities (CEECs).	Where there is any clearing of an CEEC in moderate to good condition.
Works involving clearing of nationally listed TEC or nationally listed threatened species habitat.	Where clearing >1 ha of a TEC or habitat in moderate to good condition.
Works involving clearing of NSW endangered or vulnerable ecological community.	Where clearing > 5 ha or where the ecological community is subject to an SIS.
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the DPE Threatened Species Profile Database (TSPD).	Where clearing > 1 ha or where the species is the subject of an SIS.
Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in DPE's Threatened Species Profile Database (TSPD).	Where clearing > 5 ha or where the species is the subject of an SIS.
Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries).	Where there is any net loss of habitat.

Offsetting thresholds were assessed for four TECs (from five vegetation zones) and species-credit species being impacted by the proposed modification (refer to **Table 6.2** and **Table 6.3** respectively). The offsetting thresholds were triggered for two TECs and three species-credit species by the proposed modification, which is consistent with outcomes of the BAR (Umwelt 2019). Two of the four TEC trigger offset requirements, being *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC under the BC Act and *Central Hunter Valley Eucalypt Forest and Woodland* CEEC under the EPBC Act. Clearing impacts to the *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions* EEC and *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC both listed under the BC Act were below the 5-ha threshold for NSW listed EEC. The impacts to the remaining vegetation zones do not require offsets in accordance with The Guideline for Biodiversity Offsets (Roads and Maritime 2016) where VZ2 and VZ9 do not conform to any TEC listed under the BC act or EPBC Act.

Species-credit species triggering offset include southern myotis (*Myotis macropus*), squirrel glider (*Petaurus norfolcensis*) and brush-tailed phascogale (*Phascogale tapoatafa*) all listed as vulnerable under the BC Act. All other threatened species recorded are classified as ecosystem-credit species under the NSW Bionet Threatened Species Profile Database (TSPD) (DPE 2022). The majority of habitat removal for ecosystem-credit species would be covered by the offsets for the TECs, impacts to VZ1, VZ2, VZ6, VZ8 and VZ9 (total area of 2.58 ha) do not meet the offset requirements.

Table 6.2 Assessment of impacts to native vegetation against offset thresholds

Vegetation Zones conforming to TEC listed under the BC Act or EPBC Act	Impact area	Threshold for offset triggered?	Offset required?
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions **EEC listed under the BC Act**			
VZ1 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good.	0.37	Threshold not triggered.	No offset TEC impacts are < 5 ha
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions **EEC under the BC Act**			
VZ3 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Moderate to Good.	8.61	Clearing >1 ha of a TEC or habitat in moderate to good condition.	Yes
VZ4 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Thinned Canopy.	6.69		
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	0.06		
MDHF – 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	0.05		
Total area impacted	**15.41**		
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions **EEC listed under BC Act**			
VZ8 - 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley – Low condition.	1.21	Threshold not triggered.	No offset TEC impacts are < 5 ha
Central Hunter Valley Eucalypt Forest and Woodland **CEEC under the EPBC Act**			
VZ3 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Moderate to Good.	8.61	any clearing of an EPBC Act CEEC in moderate to good condition.	Yes
VZ4 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Thinned Canopy.	6.69		
VZ5 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – DNG.	4.14		

Vegetation Zones conforming to TEC listed under the BC Act or EPBC Act	Impact area	Threshold for offset triggered?	Offset required?
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	0.06		
MDHF – 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	0.05		
Total area impacted	**19.55**		

Table 6.3 Assessment of impacts to species – credit species against offset thresholds

Corresponding vegetation zone for species-credit species	Impact area	Threshold for offset triggered?	Offset required?
southern myotis (*Myotis macropus*) listed as vulnerable under the BC Act			
VZ1 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good.	0.37	Clearing > 1 ha of species-credit species habitat (Includes all woodland and forest habitat within 200 m of dams, sandstone culverts and Hunter River).	Yes
VZ3 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Moderate to Good.	6.55		
VZ4 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Thinned Canopy.	3.94		
VZ8 - 42 River Red Gum/River Oak riparian woodland wetland in the Hunter Valley – Low condition.	1.21		
VZ9 – 1731 Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley.	0.12		
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	0.06		
MDHF – 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	0.05		
MDHF – 1731 Swamp Oak -– Weeping Grass grassy riparian forest of the Hunter Valley.	0.04		
Total area impacted	**12.34**		
squirrel glider (*Petaurus norfolcensis*) listed as vulnerable under the BC Act			
VZ1 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good.	0.37	Clearing > 1 ha of species-credit species habitat (Bionet TSPD considers all corresponding woodland and forest habitats).	Yes
VZ3 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Moderate to Good.	8.61		
VZ4 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Thinned Canopy.	6.69		
VZ6 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – African Olive Infestation.	0.46		

Corresponding vegetation zone for species-credit species	Impact area	Threshold for offset triggered?	Offset required?
VZ9 – 1731 Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley.	0.24		
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	0.06		
MDHF – 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	0.05		
MDHF – 1731 Swamp Oak -– Weeping Grass grassy riparian forest of the Hunter Valley.	0.07		
Total area impacted	**16.55**		
brush-tailed phascogale (*Phascogale tapoatafa*) listed as vulnerable under the BC Act			
VZ1 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good.	0.37	Clearing > 1 ha of species-credit species habitat (Bionet TSPD considers all corresponding woodland and forest habitats).	Yes
VZ3 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Moderate to Good.	8.61		
VZ4 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – Thinned Canopy.	6.69		
VZ6 – 1604 Narrow-leaved Ironbark – Grey Box – Spotted Gum Shrub – Grass Woodland of the Central and Lower Hunter – African Olive Infestation.	0.46		
VZ9 – 1731 Swamp Oak – Weeping Grass grassy riparian forest of the Hunter Valley.	0.24		
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter.	0.06		
MDHF – 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter.	0.05		
MDHF – 1731 Swamp Oak -– Weeping Grass grassy riparian forest of the Hunter Valley.	0.07		
Total area impacted	**16.55**		

6.1.2 Preliminary Credit Requirement

A preliminary BAM credit calculator assessment was run to evaluate preliminary credit requirements for TECs and species-credit species where impacts from the project trigger offsets (refer to **Table 6.2** and **Table 6.3**)

The BAM calculator generates ecosystem credits for all PCTs, however in accordance with the offsetting thresholds for REFs (Roads and Maritime 2016) (**Table 6.1**) only the credits for PCTs associated with TECs listed under the BC Act and EPBC Act are applicable (**Table 6.2**). Species credits for the southern myotis, squirrel glider and brush-tailed phascogale have also been calculated against the applicable PCT impacts (**Table 6.3**).

The preliminary ecosystem and species credit calculations which meet the offset thresholds for REFs have been summarised in **Table 6.4**. (Roads and Maritime 2016). Retiring credits for *Central Hunter Valley Eucalypt Forest and Woodland* CEEC under the EPBC Act may include the credits generated for *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC under the BC Act where there is equivalence between the state and federal listings. Assuming that the entirety of the project impact area including all ancillary facilities are cleared, a total of 550 credits will be generated for TECs impacted by the project requiring offset.

These preliminary calculations are subject to further refinement as final project impacts are likely to be reduced during construction.

Table 6.4 Summary of Ecosystem-Credits Generated from Impacts Triggering Offset

Impacted Ecological Community Corresponding TEC	Impact Area	Biodiversity Credits (2021)
1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter*		
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC under the BC Act.	0.06	3
Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act.	-	-
Non-TEC component.	0	-
1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter*		
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC under the BC Act.	0.05	3
Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act.	-	-
Non-TEC component.	0	-
1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter		
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC under the BC Act.	15.3	483
Central Hunter Valley Eucalypt Forest and Woodland CEEC under the EPBC Act.	19.44	544
Non-TEC component.	18.71	-
Summary of Ecosystem Credits Requiring Offset		
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC under the BC Act / *Central Hunter Valley Eucalypt Forest and Woodland CEEC* under the EPBC Act**.	19.55	550

* PCTs associated only with MDHF.

** TEC with equivalent listing under BC Act and EPBC Act. There is overlap between the credit requirements for the TEC listed under the BC Act and the TEC listed under the EPBC Act.

Table 6.5 Summary of Species-Credits Generated from Impacts Triggering Offset

Species-credit species requiring offset	Impact area	Biodiversity credits (2021)
southern myotis (*Myotis macropus*) listed as vulnerable under the BC Act.	12.34	364
squirrel glider (*Petaurus norfolcensis*) listed as vulnerable under the BC Act.	16.55	517
brush-tailed phascogale (*Phascogale tapoatafa*) listed as vulnerable under the BC Act.	16.55	517

Transport for NSW (formerly Roads and Maritime) holds an agreement under Part 10 of the EPBC Act with the Australian Government Department of Agriculture, Water and the Environment (formerly the Department of the Environment and Energy at the time of the agreement) which provides for the undertaking of a Strategic Assessment of the impacts on 'Specified Protected Matters'. Appendix F of the Strategic Assessment – under Part 10, Environment Protection and Biodiversity Conservation Act 1999 – Supplementary Report (Roads and Maritime 2015b) lists the Cen*tral Hunter Valley Eucalypt Forest and Woodland* CEEC as a 'Specified Protected Matter'.

The project is likely to have a significant impact on the *Central Hunter Valley Eucalypt Forest and Woodland* CEEC. In keeping with the strategic assessment agreement, Transport for NSW would, as part of detailed design, reduce impacts where possible to this Specified Protected Matter and consult with DCCEEW regarding the activity.

Residual impacts to the CEEC would be offset through the retirement of biodiversity credits. Although The Guideline for Biodiversity Offsets (Roads and Maritime 2016) only requires offsets for impacts to vegetation in moderate to good condition, the EPBC Act strategic assessment approval requires significant impacts to MNES to be offset. Therefore, all native vegetation assigned to the Cen*tral Hunter Valley Eucalypt Forest and Woodland* CEEC (woodland and derived native grassland components) will be offset.

Fulfilling offset requirements under the BC Act 2016 would be achieved by Transport using one or a combination of the following offset strategies:

- In-perpetuity conservation through the establishment of a Stewardship site and the retirement of credits.
- Securing required credits through the open credit market and/or.
- Payments to the Biodiversity Conservation Fund administered by the Biodiversity Conservation Trust who are then obligated to conserve biodiversity equivalent to the offset requirements that have been relinquished by the proponent through that payment.

7.0 Conclusion

The current assessment has ground-truthed regional mapping that was relied upon for the assessment in the BAR (Umwelt 2019) and includes targeted surveys for threatened species and ecological communities to provide a better understanding of habitat values in the revised project area. These surveys and assessment satisfy the summary of environmental safeguards and management measures outlined in Number B4 of the Submission Report (AECOM 2020).

The revised project area contains three threatened ecological communities listed under the BC Act comprising the Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC, Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions EEC and Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregion EEC. Survey outcomes of ground-truthing regional vegetation mapping excluded the presence of Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC, previously predicted to occur within the project area. The vegetation and habitats of some of the revised project area also conforms with the EPBC Act listed Central Hunter Valley Eucalypt Forest and Woodland CEEC.

No threatened flora and fauna species or populations were recorded in addition to those identified in the BAR (Umwelt 2019). Surveys confirmed a total of 39 river red gum (*Eucalyptus camaldulensis*) that form part of the Hunter Catchment endangered population (BC Act), none of which are located within the revised impact area. A maternity roost for southern myotis (*Myotis macropus*) listed as vulnerable under the BC Act was recorded in the southernmost sandstone culvert while evidence of utilization was recorded in the remaining two large sandstone culverts. Two threatened fauna species were recorded opportunistically flying through the revised project area being grey-crowned babblers (eastern subspecies) (*Pomatostomus temporalis temporalis*) listed as vulnerable under the BC Act and grey-headed flying-fox (*Pteropus poliocephalus*) listed as vulnerable under the BC Act and EPBC Act.

The proposed modification of the project since the BAR (Umwelt 2019) primarily occurs south of the Hunter River and include the redesign of the Putty Road connection and the relocation of ancillary facilities which occur primarily on agricultural land. The revised impact area includes a number of additional areas occurring in the north of the Hunter River. The revised impact area covers about 147.49 ha, which contains about 42.89 ha of native vegetation and up to 101 hollow bearing trees, however the actual extent of works within this area is expected to be less. This includes approximately 0.37 ha of *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC (BC Act), 1.21 ha of *Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregion* EEC (BC Act), 15.41 ha of *Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions* EEC (BC Act) and 19.55 ha of *Central Hunter Valley Eucalypt Forest and Woodland CEEC* (EPBC Act).

The potential impacts have been assessed prior to the implementation of mitigation measures including restrictions on clearing for certain activities and design solutions to reduce the clearing footprint. Actual clearing impacts would be reduced during development of the design. Impact areas would be recalculated prior to the commencement of construction to verify the reduction.

Of the 19 Tests of Significance under the BC Act and Assessments of Significance under the EPBC Act undertaken for the BAR (Umwelt 2019), a total of three were revised based on outcomes of this consistency review, including one threatened fauna species, one endangered flora population, and one TEC listed under the BC Act. One additional assessment of significance was undertaken for *Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions* EEC listed under the BC Act, identified within the revised impact area.

Outcomes of these revised assessments were consistent to that of the BAR (Umwelt 2019), where the project would likely significantly impact the *Central Hunter Valley Eucalypt Forest and Woodland* CEEC (EPBC Act). No other threatened species, populations or ecological communities known or predicted to occur are likely to be significantly impacted by the project.

This supplementary BAR details additional and updated mitigation measures in Table 5.2. Key mitigation measures relevant to the outcomes of this consistency review include:

- Preparation of a Microbat Management Plan.
- Preparation of a Tree and Hollow Replacement Plan.
- Flora and Fauna Management Plan to consider additional measures for potential fauna entrapment within the pipeline trenches.
- Minimisation of vegetation removal through further detailed design including restrictions on activities requiring tree removal.
- Further assessment of McDougalls Hill ancillary facility if use of this site is necessary.

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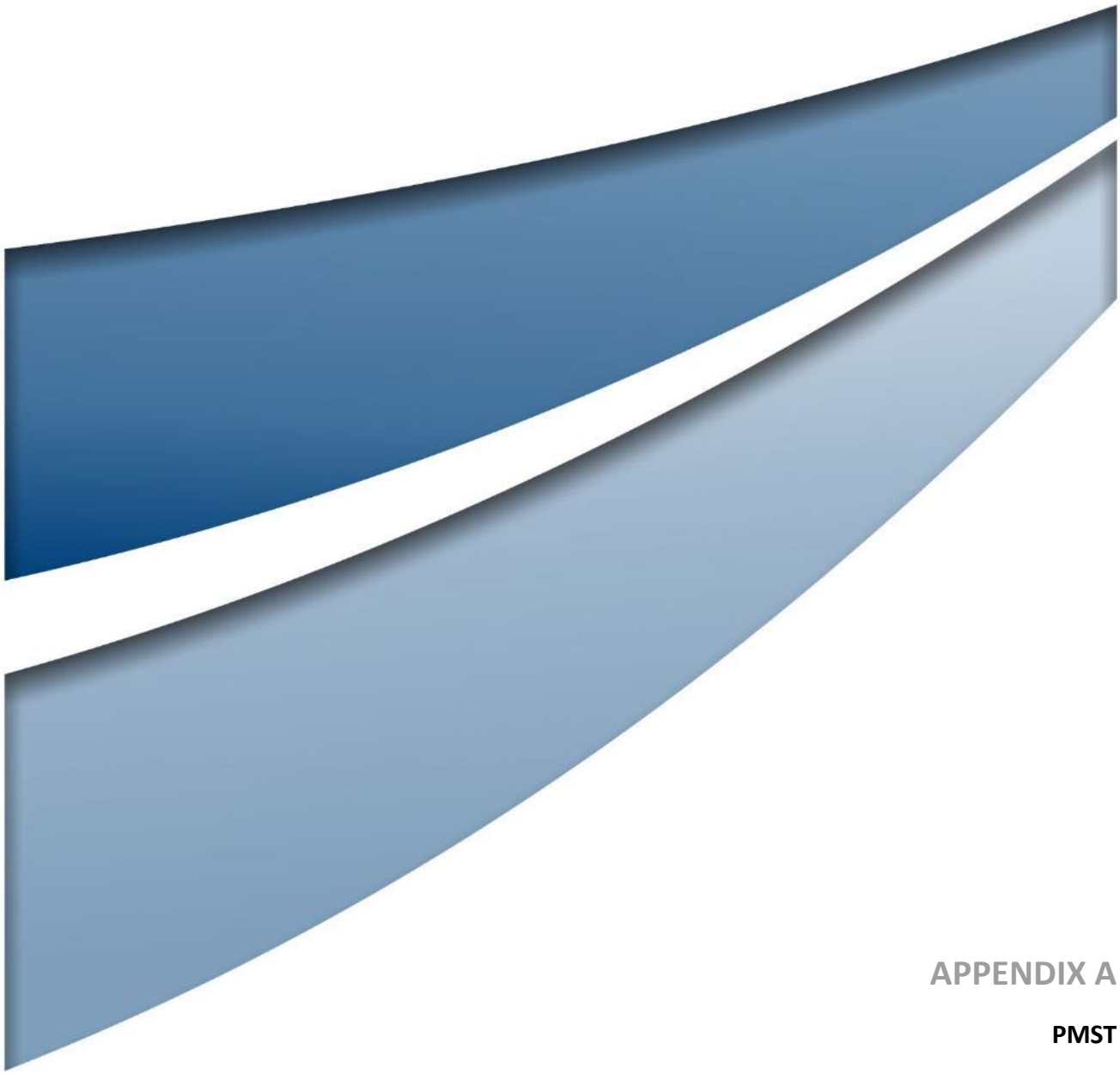

APPENDIX A

PMST

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 17-Nov-2022

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	9
Listed Threatened Species:	40
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

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

Commonwealth Lands:	49
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	24
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Hunter estuary wetlands	50 - 100km upstream from Ramsar site	In feature area

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community likely to occur within area	In feature area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area	In feature area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community may occur within area	In feature area
Hunter Valley Weeping Myall (Acacia pendula) Woodland	Critically Endangered	Community may occur within area	In feature area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area	In buffer area only
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community may occur within area	In feature area
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered	Community may occur within area	In buffer area only
Warkworth Sands Woodland of the Hunter Valley	Critically Endangered	Community may occur within area	In buffer area only
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
FROG			
[Litoria aurea](#) Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Litoria booroolongensis](#) Booroolong Frog [1844]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Dasyurus maculatus maculatus (SE mainland population)](#) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In feature area
[Notamacropus parma](#) Parma Wallaby [89289]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Nyctophilus corbeni](#) Corben's Long-eared Bat, South-eastern Long-eared Bat [83395]	Vulnerable	Species or species habitat may occur within area	In feature area
[Petauroides volans](#) Greater Glider (southern and central) [254]	Endangered	Species or species habitat may occur within area	In buffer area only
[Petaurus australis australis](#) Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Petrogale penicillata](#) Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Pseudomys novaehollandiae			
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In feature area
PLANT			
Asperula asthenes			
Trailing Woodruff [14004]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Cynanchum elegans			
White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Dichanthium setosum			
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Eucalyptus glaucina			
Slaty Red Gum [5670]	Vulnerable	Species or species habitat known to occur within area	In feature area
Euphrasia arguta			
[4325]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pomaderris brunnea			
Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Prasophyllum sp. Wybong (C.Phelps ORG 5269)			
a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area	In feature area
Prostanthera cineolifera			
[11233]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area	In feature area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In buffer area only
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area	In feature area
Delma impar Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus			
Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Communications, Information Technology and the Arts - Telstra Corporation Limited		
Commonwealth Land - Australian Telecommunications Commission [12587]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12586]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12585]	NSW	In buffer area only
Defence - Defence Housing Authority		
Commonwealth Land - Defence Housing Authority [12589]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12588]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15438]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15439]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12592]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12610]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12584]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12612]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12596]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12611]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12597]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15408]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Defence Housing Authority [12600]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12601]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12606]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12595]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12603]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12602]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12594]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12609]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12608]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12590]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12591]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16534]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12593]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16533]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16532]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16531]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [16530]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12605]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12604]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12607]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15714]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15715]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12598]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [15716]	NSW	In buffer area only
Commonwealth Land - Defence Housing Authority [12599]	NSW	In buffer area only
Unknown		
Commonwealth Land - [15542]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - [12581]	NSW	In buffer area only
Commonwealth Land - [12583]	NSW	In buffer area only
Commonwealth Land - [12582]	NSW	In buffer area only
Commonwealth Land - [15544]	NSW	In buffer area only
Commonwealth Land - [15543]	NSW	In buffer area only
Commonwealth Land - [15545]	NSW	In buffer area only
Commonwealth Land - [15547]	NSW	In buffer area only
Commonwealth Land - [15546]	NSW	In buffer area only

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area	In buffer area only

Extra Information

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State	Buffer Status
North East NSW RFA	New South Wales	In feature area

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Hunter Valley Operations (HVO) North Open Cut Coal Continuation Project	2022/09207		Referral Decision	In buffer area only
Hunter Valley Operations (HVO) South Open Cut Coal Continuation Project	2022/09206		Referral Decision	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Action clearly unacceptable				
Cull Grey Headed Flying Fox at Burdekin Park	2007/3916	Action Clearly Unacceptable	Completed	In buffer area only
Controlled action				
Bulga Coal Optimisation Project Modification, near Singleton, NSW	2018/8300	Controlled Action	Post-Approval	In buffer area only
Extending Existing operations at Warkworth Coal Mine	2002/629	Controlled Action	Post-Approval	In buffer area only
Extension of existing open cut coal mine at the Bulga Coal Complex	2012/6637	Controlled Action	Post-Approval	In buffer area only
Gas Transmission Pipeline	2011/5917	Controlled Action	Completed	In buffer area only
Hunter Valley Coal Mining Operations North - State approved mining, NSW	2016/7640	Controlled Action	Post-Approval	In buffer area only
Mt Owen continued coal mining operation	2013/6978	Controlled Action	Post-Approval	In buffer area only
Queensland Hunter Gas Pipeline, approximately 825 km in length	2008/4483	Controlled Action	Completed	In buffer area only
Relocation of Flying Foxes From Burdekin Park	2008/4323	Controlled Action	Completed	In buffer area only
Not controlled action				
Ashton Coal Project	2001/524	Not Controlled Action	Completed	In buffer area only
Ashton Coal South East Open Cut Project	2010/5315	Not Controlled Action	Completed	In buffer area only
Clearance of 35 ha in Ravensworth State Forest for extension of Mt Owen coal mining operations	2004/1369	Not Controlled Action	Completed	In buffer area only
Hunter Valley Coal Mining Operations South - Modification 5	2016/7641	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Queensland Hunter Gas Pipeline, approximately 833 km in length	2008/4620	Not Controlled Action	Completed	In buffer area only
Relocation of flying foxes	2007/3435	Not Controlled Action	Completed	In buffer area only
Rix's Creek Continuation of coal Mining Project, northwest of Singleton, NSW	2014/7348	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
Aerial baiting for wild dog control	2006/2717	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Aerial baiting for wild dog control	2006/2713	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Aerial baiting for wild dog control at Singleton Military Area and Bulga Coal Mine	2005/2078	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Redbank 2 Power Station & Infrastructure	2003/1088	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Tree Maintenance Works in Burdekin Park	2010/5489	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Bioregional Assessments			
SubRegion	BioRegion	Website	Buffer Status
Hunter	Northern Sydney Basin	BA website	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

Please feel free to provide feedback via the Contact us page.

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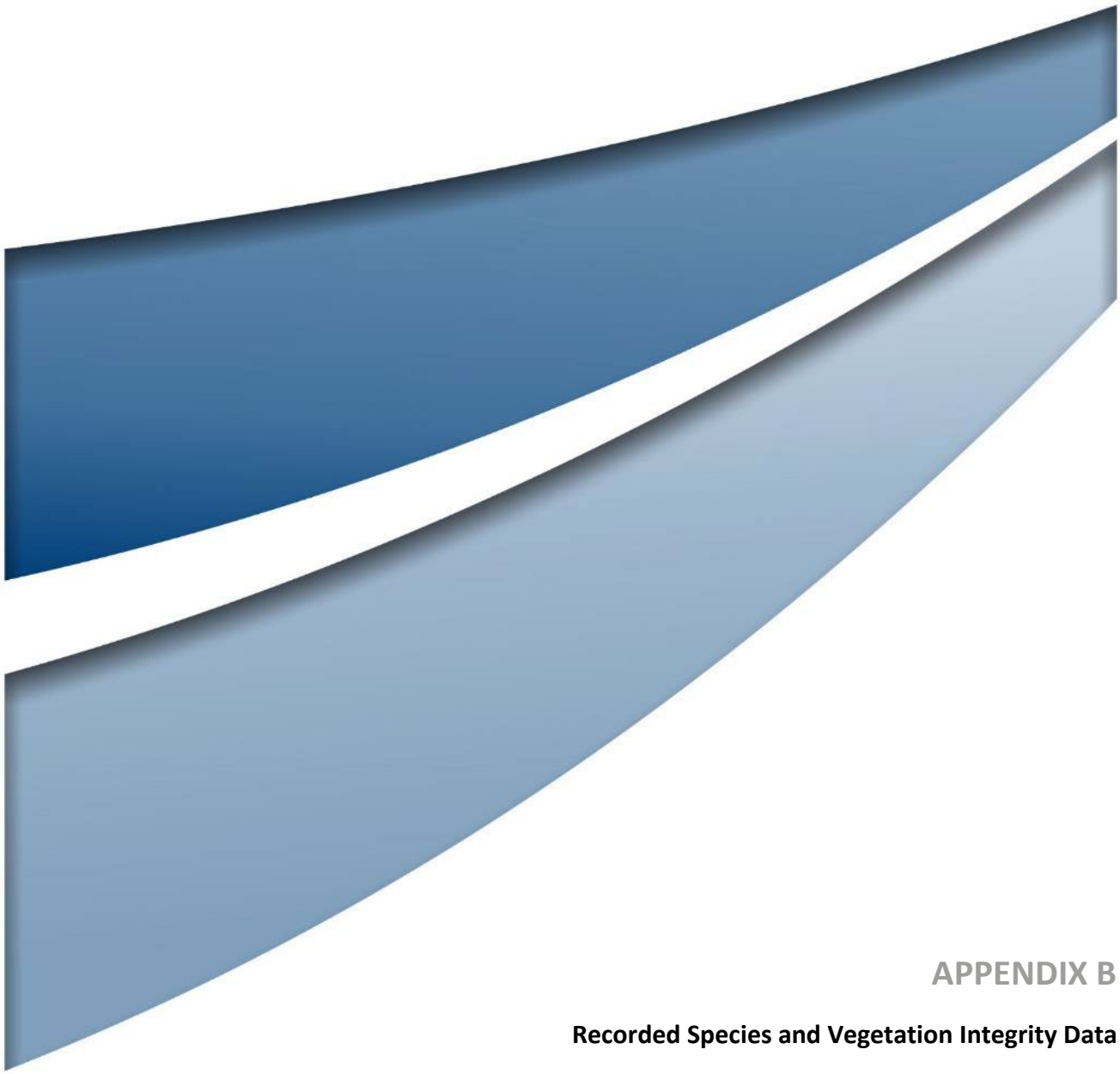


APPENDIX B

Recorded Species and Vegetation Integrity Data

1.1Umwelt Flora Species List

Table B1 provides the results of the vegetation integrity plots surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

AA	abundance estimate in accordance with BAM (DPIE 2020a)
PC	per cent cover in accordance with BAM (DPIE 2020a)
asterisk (*)	denotes non-native species
double asterisk (**)	denotes non-native species listed as High Threat Weeds under the BAM (DPIE 2020)
subsp.	subspecies
var.	variety
x	denotes species recorded outside, but in proximity to, sampling location and within the same vegetation zone

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2019), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Table B1 Flora Species List – Vegetation Zones Recorded within the 2021 Survey Area

Family	Scientific Name	Common Name	VZ1		VZ3		VZ5				VZ6		VZ8				VZ9		Exot	
			Q07		Q01		Q02		Q06		Q05		Q03		Q08		Q09		Q04	
			PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA
Filicopsida																				
Marsileaceae	*Marsilea drummondii*	Common Nardoo			0.1	25														
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	0.1	35	0.1	10	0.1	50												
Magnoliopsida – Liliidae (Monocots)																				
Alliaceae	**Nothoscordum borbonicum*	Onion weed					0.1	50	0.1	1					0.1	1	0.1	50		
Cyperaceae	*Carex appressa*	Tall Sedge					0.1	25												
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge									0.1	25								
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	0.1	70	5	500	0.1	25									1	250		
Juncaceae	***Juncus acutus*	Sharp Rush															7	100		
Juncaceae	*Juncus spp.*												0.2	3						
Juncaceae	*Juncus usitatus*				7	50														
Poaceae	***Chloris gayana*	Rhodes Grass	5	250									5	250						
Poaceae	***Eragrostis curvula*	African Lovegrass	25	1000			0.3	10	0.5	50										
Poaceae	***Paspalum dilatatum*	Paspalum															0.3	50	0.1	5
Poaceae	**Bromus catharticus*	Praire Grass													0.1	5	10	1000		
Poaceae	**Digitaria spp.*																0.1	10	0.1	5
Poaceae	**Ehrharta erecta*	Panic Veldtgrass															3	1000		
Poaceae	**Eragrostis spp.*																		1	500
Poaceae	**Lolium perenne*	Perennial Ryegrass									0.1	1					15	1000		
Poaceae	**Megathyrsus maximus*	Guinea Grass			2	250									35	1000			10	1000
Poaceae	**Melinis repens*	Red Natal Grass											0.2	25						
Poaceae	**Polypogon monspeliensis*	Annual Beardgrass															0.2	100		
Poaceae	**Setaria parviflora*	Pigeon Grass									0.5	100								
Poaceae	**Vulpia bromoides*	Squirrel Tail Fesque															0.1	10		
Poaceae	*Aristida ramosa*	Purple Wiregrass							1	500									5	500
Poaceae	*Aristida spp.*						25	1000												
Poaceae	*Aristida vagans*	Threeawn Speargrass			15	1000														
Poaceae	*Austrostipa scabra*	Speargrass	2	150																
Poaceae	*Austrostipa verticillata*	Slender Bamboo Grass									1	250					1	250		
Poaceae	*Bothriochloa macra*	Red grass									1	250								
Poaceae	*Capillipedium spicigerum*	Scented-top Grass	10	300									70	1000						
Poaceae	*Chloris truncata*	Windmill grass			5	500	5	1000												
Poaceae	*Chloris ventricosa*	Tall Chloris			0.5	100	1	150			5	500							5	500

Family	Scientific Name	Common Name	VZ1		VZ3		VZ5				VZ6		VZ8				VZ9		Exot	
			Q07		Q01		Q02		Q06		Q05		Q03		Q08		Q09		Q04	
			PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	1	250															10	1000
Poaceae	*Cynodon dactylon*	Common Couch	3	500			5	500	20	1000	15	1000					10	1000	35	1000
Poaceae	*Dichanthium sericeum*	Queensland Bluegrass	1	250																
Poaceae	*Eragrostis brownii*	Brown's Lovegrass			0.2	25	10	1000												
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	0.2	10			1	250												
Poaceae	*Panicum effusum*	Hairy Panic	0.5	30	5	1000	5	500			0.5	25								
Poaceae	*Phragmites australis*	Common Reed															1	100		
Poaceae	*Rytidosperma spp.*				0.1	25														
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	1	250	0.1	10	10	1000	25	1000										
Magnoliopsida – Magnoliidae (dicots)																				
Acanthaceae	*Brunoniella australis*	Blue Trumpet	0.3	100	0.1	25	0.1	15			0.1	1								
Aizoaceae	***Galenia pubescens*	Galenia	1	100	2	25	0.2	5	0.3	50	25	1000	0.2	10			2	250	15	1000
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed			0.1	25														
Apiaceae	**Anethum graveolens*	Dill			0.5	3														
Apiaceae	**Cyclospermum leptophyllum*	Slender Celery	0.2	250							0.1	100					0.2	500		
Apiaceae	**Daucus spp.*								0.1	5										
Apocynaceae	**Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	0.1	1	0.1	5	0.1	1									0.2	5		
Asteraceae	***Bidens pilosa*	Cobblers Pegs	0.1	1	0.1	1	0.1	5			0.2	25	0.1	1						
Asteraceae	***Carthamus lanatus*	Saffron Thistle									0.1	1								
Asteraceae	**Carduus spp.*																5	250		
Asteraceae	**Cirsium vulgare*	Spear Thistle			0.1	5			0.1	10	0.5	100					1	25	0.1	1
Asteraceae	**Conyza bonariensis*	Flaxleaf Fleabane	0.2	30			0.1	5	0.1	25	1	500	0.1	10	0.1	1	0.1	25	0.1	5
Asteraceae	**Facelis retusa*	Annual trampweed	0.2	100							0.1	100	0.1	5					0.1	10
Asteraceae	**Gamochaeta americana*	Cudweed	0.1	20							0.1	1								
Asteraceae	**Hypochaeris radicata*	Catsear	0.1	15					0.1	1	2	250	0.1	30						
Asteraceae	**Lactuca serriola*	Prickly Lettuce															0.2	10		
Asteraceae	**Senecio madagascariensis*	Fireweed	1	250	0.1	25	0.1	15	0.1	1	5	250	0.2	50			0.2	25	0.5	100
Asteraceae	**Silybum marianum*	Variegated Thistle															2	35		
Asteraceae	**Sonchus oleraceus*	Common Sowthistle			0.1	10	0.1	20	0.2	35	1	250	0.1	10	0.1	2	0.2	100	0.1	20
Asteraceae	**Taraxacum officinale*	Dandelion															0.3	200		
Asteraceae	*Brachyscome multifida*	Cut-leaved Daisy	0.3	40																
Asteraceae	*Calotis cuneifolia*	Purple Burr-Daisy	0.2	25			0.5	100												
Asteraceae	*Calotis lappulacea*	Yellow burr-daisy					0.5	50												
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting					1	150												

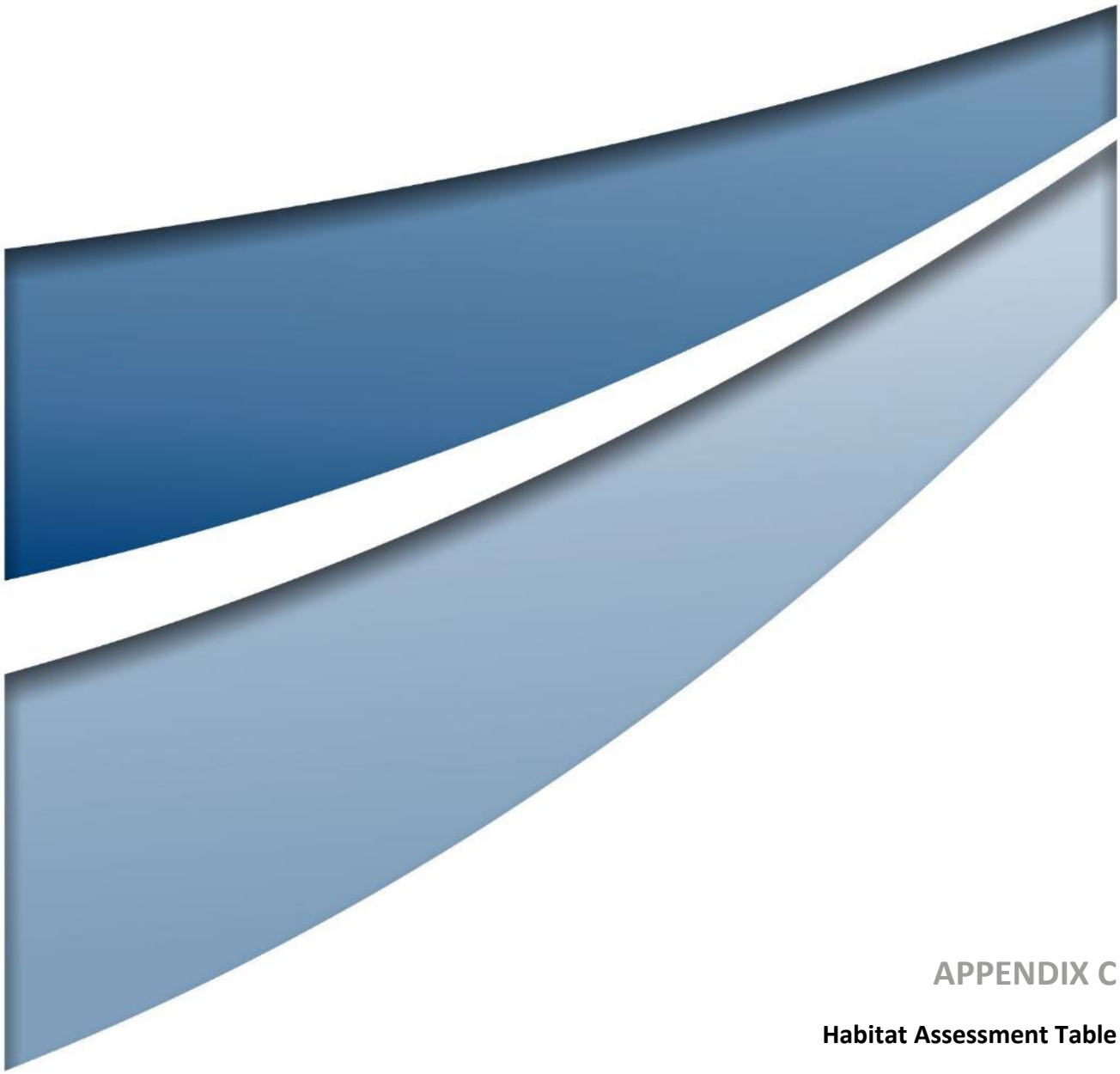
Family	Scientific Name	Common Name	VZ1		VZ3		VZ5				VZ6		VZ8				VZ9		Exot	
			Q07		Q01		Q02		Q06		Q05		Q03		Q08		Q09		Q04	
			PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA
Asteraceae	*Euchiton sphaericus*	Star cudweed							0.1	1										
Asteraceae	*Euchiton spp.*		0.1	1																
Asteraceae	*Glossocardia bidens*	Cobbler's Tack	0.1	5													0.1	10		
Asteraceae	*Vittadinia cuneata*	Fuzzweed			0.3	35														
Brassicaceae	**brassica spp.*								0.3	5							0.5	25		
Brassicaceae	**Lepidium africanum*	Common Peppercress									0.1	30					0.3	100	0.1	1
Brassicaceae	**Sisymbrium officinale*	Hedge Mustard															5	500		
Cactaceae	***Opuntia aurantiaca*	Tiger Pear	0.1	1	0.1	5	0.1	5			0.2	10								
Cactaceae	***Opuntia stricta*	Prickly pear	0.3	15			0.1	2	0.2	10	0.1	1			0.1	1			0.3	10
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell					0.1	5												
Campanulaceae	*Wahlenbergia spp.*		0.1	100																
Caryophyllaceae	**Cerastium glomeratum*	Mouse-ear Chickweed									0.1	25								
Caryophyllaceae	**Paronychia brasiliana*	Chilean Whitlow Wort, Brazilian Whitlow									1	500							0.1	50
Caryophyllaceae	**Petrorhagia nanteuilii*	Proliferous Pink															0.1	1		
Caryophyllaceae	**Stellaria media*	Chickweed																	0.1	5
Casuarinaceae	*Allocasuarina luehmannii*	Bulloak	0.5	2																
Casuarinaceae	*Casuarina cunninghamiana*	River Oak											10	2						
Casuarinaceae	*Casuarina glauca*	Swamp Oak															15	5		
Chenopodiaceae	*Einadia hastata*	Berry Saltbush															0.1	25		
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	0.2	50			2	250												
Chenopodiaceae	*Einadia polygonoides*	Knotweed Goosefoot															0.5	50		
Chenopodiaceae	*Enchylaena tomentosa*	Ruby Saltbush	0.2	35	10	1000	1	100			0.3	30								
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush			1	5	0.3	5												
Commelinaceae	*Commelina cyanea*	Native Wandering Jew															0.1	25		
Convolvulaceae	*Convolvulus Erubescens*		0.1	1															0.1	25
Convolvulaceae	*Dichondra repens*	Kidney Weed					0.5	100									0.1	50		
Euphorbiaceae	**Ricinus communis*	Castor oil plant													25	1000				
Euphorbiaceae	*Euphorbia drummondii*	Caustic Weed	0.3	100																
Fabaceae (Faboideae)	**Medicago polymorpha*	Burr Medic					0.5	50	0.1	100	5	1000					0.3	200		
Fabaceae (Faboideae)	**Melilotus indicus*	Hexham scent									0.1	1								
Fabaceae (Faboideae)	**Trifolium campestre*	Hop Clover															0.2	100		
Fabaceae (Faboideae)	**Trifolium repens*	White Clover									0.2	100					0.3	100		
Fabaceae (Faboideae)	*Desmodium brachypodum*	Large Tick-trefoil	0.2	50																

Family	Scientific Name	Common Name	VZ1		VZ3		VZ5				VZ6		VZ8				VZ9		Exot	
			Q07		Q01		Q02		Q06		Q05		Q03		Q08		Q09		Q04	
			PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA
Fabaceae (Faboideae)	*Desmodium gunnii*	Slender Tick-trefoil					0.1	25												
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil			1	250														
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine	0.3	250			0.2	50												
Fabaceae (Faboideae)	*Swainsona spp.*												0.5	75						
Fabaceae (Mimosoideae)	*Acacia falcata*	Hickory wattle	0.3	5																
Fabaceae (Mimosoideae)	*Acacia salicina*	Cooba	2	10															0.1	1
Geraniaceae	*Geranium solanderi*	Native Geranium											0.3	50					0.5	20
Goodeniaceae	*Goodenia pinnatifida*	Scrambles Eggs	0.2	35																
Goodeniaceae	*Goodenia spp.*						0.5	100												
Iridaceae	***Romulea rosea*	Onion Grass	0.1	1			0.2	50					0.1	1						
Iridaceae	**Crocosmia crocosmiiflora*	Montbretia			0.1	2														
Lamiaceae	**Salvia spp.*										0.5	500								
Lamiaceae	**Stachys arvensis*	Stagger Weed					0.5	100	5	500	0.1	10								
Linaceae	**Linum spp.*		0.1	50																
Lobeliaceae	*Pratia purpurascens*	Whiteroot			0.2	100														
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	0.2	20																
Malvaceae	**Malvastrum americanum*	Spiked Malvastrum					2	100	3	250										
Malvaceae	**Modiola caroliniana*	Red-flowered Mallow					0.1	10									0.1	25		
Malvaceae	**Sida rhombifolia*	Paddy's Lucerne			0.2	35	10	1000	0.2	100	0.3	50					2	200	10	1000
Malvaceae	*Sida corrugata*	Corrugated Sida	0.2	75									1	250			0.5	50	0.2	25
Myoporaceae	*Eremophila debilis*	Amulla	0.2	15	3	50	0.5	25			0.3	10								
Myoporaceae	*Myoporum montanum*	Western Boobialla					0.2	1												
Myrsinaceae	**Anagallis arvensis*	Scarlet pimpernel	0.7	250			0.5	25	5	1000	0.1	50	0.1	25			0.1	50		
Myrtaceae	*Corymbia maculata*	Spotted Gum									5	1								
Myrtaceae	*Eucalyptus camaldulensis*	River Red Gum													10	1				
Myrtaceae	*Eucalyptus moluccana*	Grey box			25	35					5	1								
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	7	10	10	5	5	35												
Oleaceae	**Olea europaea*	Olive			0.5	2														
Oleaceae	**Olea europaea subsp. cuspidata*	African olive							35	75										
Oxalidaceae	**Oxalis pes-caprae*	Soursob			0.5	100	0.2	100							0.5	50				
Oxalidaceae	*Oxalis perennans*						0.1	35	0.2	100										
Oxalidaceae	*Oxalis spp.*				0.1	10					0.2	100					0.1	50		
Plantaginaceae	**Plantago lanceolata*	Lambs tongues	0.2	100	0.2	50	2	250	1	100	0.5	250					0.1	25	0.1	30
Polygonaceae	**Rumex spp.*	A Dock																	0.1	1

Family	Scientific Name	Common Name	VZ1		VZ3		VZ5				VZ6		VZ8				VZ9		Exot	
			Q07		Q01		Q02		Q06		Q05		Q03		Q08		Q09		Q04	
			PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA
Polygonaceae	*Persicaria hydropiper*	Water Pepper			0.1	20											0.1	10		
Polygonaceae	*Rumex brownii*	Swamp Dock									0.1	1					0.5	50		
Ranunculaceae	**Ranunculus sceleratus*	Celery Buttercup															0.5	10		
Rubiaceae	**Galium aparine*	Goosegrass			0.3	35									3	100				
Rubiaceae	**Richardia stellaris*												0.2	50						
Rubiaceae	*Asperula conferta*	Common Woodruff			0.2	75											0.1	50	0.4	350
Salicaceae	***Salix spp.*	Willow											0.3	0						
Sapindaceae	***Cardiospermum grandiflorum*	Balloon Vine											0.1	1	10	100				
Scrophulariaceae	**Misopates orontium*	Weasel's snout							0.5	30										
Solanaceae	**Lycium ferocissimum*	African Boxthorn			3	2			5	10									0.1	1
Solanaceae	**Solanum nigrum*	Black-berry Nightshade	0.1	1					0.2	10									0.1	1
Solanaceae	*Solanum prinophyllum*	Forest Nightshade			1	30	0.2	3			0.1	1								
Verbenaceae	**Verbena bonariensis*	Purpletop	0.1	1	0.1	10	0.1	25	0.2	25	0.5	250					0.3	50		
Urticaceae	**Urtica urens*	Small Nettle															0.1	1		

Table B2 Vegetation Integrity Data – 2021 Survey Area

Plot	Composition						Structure						Function										
	Tr	Sh	Gr	Fb	Fn	Ot	Tr	Sh	Gr	Fb	Fn	Ot	Regen	Stem Classes (cm)					No. Large Trees	No. Hollow Trees	Litter (%)	Fallen Logs	High Threat Weeds
													> 5cm	5–10	10–20	20–30	30–50	50–80					
VZ1	**PCT 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good Condition**																						
Q07	3	3	10	11	1	2	9.5	0.7	19	2.2	0.1	0.4	0	1	1	1	1	0	0	0	41	1	31.6
VZ3	**1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – Moderate to Good Condition**																						
Q01	2	3	9	8	2	1	35	14	37.9	2.1	0.2	1	1	1	1	1	1	1	0	2	56	9	2.2
VZ5	**1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – Derived Native Grassland**																						
Q02	1	4	10	11	1	1	5	2	62.2	5.6	0.1	0.2	0	0	0	0	1	0	0	0	16	0	1
Q06	0	0	3	2	0	0	0	0	46	0.3	0	0	0	0	0	0	0	0	0	0	2	0	1
VZ6	**1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter – African Olive Infestation**																						
Q05	2	2	6	4	0	0	10	0.6	22.6	0.5	0	0	1	1	1	0	1	1	2	9	22	5	25.6
VZ8	**42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley – Low Condition**																						
Q03	1	0	2	3	0	0	10	0	70.2	1.8	0	0	0	0	1	0	1	0	0	1	66	0	5.8
Q08	1	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	1	0	0	1	9	20	10.1
VZ9	**1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley – Low Condition**																						
Q09	1	0	3	10	0	0	15	0	3	2.2	0	0	1	1	1	1	1	0	0	1	1	1	12.3
EXOT																							
Q04	1	0	4	3	0	1	0.1	0	55	1.1	0	0.1	0	0	0	0	0	0	0	0	6.2	0	15.4



APPENDIX C

Habitat Assessment Table

Table C1 was developed by Niche, with additions made by Umwelt based on updated database searches.

Table C1 Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the revised project area during the current survey.
High	It is highly likely that a species inhabits the revised project area and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10 km) and is known or likely to maintain resident populations in the project area. Also includes species known or likely to visit the revised project area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the project area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the revised project area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the project area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the revised project area and has not been recorded recently in the locality (10 km). It may be an occasional visitor, but habitat similar to the revised project area is widely distributed in the local area, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the revised project area, or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the project area.

Abbreviations used within the table include:

BC Act	*Biodiversity Conservation Act 2016*
EPBC	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
V	Vulnerable
E	Endangered
EEC	Endangered Ecological Community
EP	Endangered Population
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
M	Migratory
E-C	Ecosystem-credit species
S-C	Species-credit species
F	Foraging Habitat
B	Breeding Habitat

Table C2 Likelihood of Occurrence Assessment

Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Threatened Ecological Communities							
Central Hunter Valley Eucalypt Forest and Woodland.		-	CEEC	N/A	-	Recorded	
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions.		EEC	-	N/A	-	Recorded	
Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the NSW North Coast and Sydney Basin Bioregions.		EEC	-	N/A	-	Recorded	
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland.		EEC	EEC	N/A	-	None	Recorded (BC Act only)
Hunter Valley Weeping Myall (*Acacia pendula*) Woodland.		CEEC	CEEC	N/A	-	None	
Lowland Rainforest of Subtropical Australia.		EEC	CEEC	N/A	-	None	
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.		EEC	CEEC	N/A	-	None	
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.		EEC	CEEC	N/A	-	None	
Flora							
Austral toadflax (*Thesium australe*)	Occurs in small populations scattered along the east coast of NSW, from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast.	V	V	S-C	0	Low	New entry
A spear-grass (*Austrostipa wakoolica*)	Confined to the floodplains of the Murray River tributaries of central-western and south-western NSW. Floodplains of the Murray River tributaries, in open woodland on grey, silty clay or sandy loam soils.	E	E	S-C	0	None	
A Leek-orchid (*Prasophyllum* sp. Wybong	Known from near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell, Tenterfield, Currabubula and the Pilliga area. Occurs in open eucalypt woodland and grassland.	-	CE	S-C	0	Low	
Acacia pendula population in the Hunter catchment	This population is known to occur as far east as Warkworth and extends northwest to Muswellbrook and to the west of Muswellbrook at Wybong. Heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations.	EP	-	S-C	2	Moderate	
Brown Pomaderris (*Pomaderris brunnea*)	In NSW this species is known from 33 subpopulations. The majority of subpopulations are in south-west Sydney (Wollondilly and Camden local government areas), although others occur around Paddys River, Mittagong, Lake Burragorang, in the Hawkesbury – Wollemi region north of Sydney, the Glen Alice – Kandos region, and in Tuggolo State Forest south of Walcha in the northern tablelands. In NSW, it occurs on ridgetops and plateaux in relatively dry habitats, and also in moist woodland or forest on clay and alluvial soils of flood plains and creek lines in relatively damp habitats.	E	V	S-C	0	None	New entry
Bluegrass (*Dichanthium setosum*)	In NSW, found on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes. Cleared woodland, grassy roadside remnants and highly disturbed pasture, on heavy basaltic black soils and red-brown loams with clay subsoil.	V	V	S-C	0	Low	
Cymbidium canaliculatum population in the Hunter Catchment	The Hunter population occurs as far south as Weston and Pokolbin in the Lower Hunter, but is centred in the Upper Hunter, predominantly north of Singleton. Isolated occurrences are also known from the Merriwa plateau, Bylong valley and the Gungal area near Goulburn River. Grows on trees in sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. Within the Hunter Catchment, most commonly found in Eucalyptus albens (White Box) dominated woodlands.	EP	-	S-C	2	Moderate	
Eastern Underground Orchid (*Rhizanthella slateri*)	In NSW, occurs from the mid-north coast to the south coast. This species is known to occur in association with sclerophyll forest usually with a deep layer of organic material.	V	E	S-C	0	None	New entry
Eucalyptus camaldulensis population in the Hunter catchment	Disjunct population occurring from Bylong, south of Merriwa, to the east at Hinton, on the bank of the Hunter River. Riparian and floodplain woodland, often with Eucalyptus tereticornis, E. melliodora, Casuarina cunninghamiana subsp. cunninghamiana and Angophora floribunda.	EP	-	S-C	85	Recorded	
Euphrasia arguta	In NSW, recently recorded only from Nundle area of the north western slopes and tablelands, from near the Hastings River and from the Barrington Tops. Eucalypt forest with a mixed grass and shrub understorey, disturbed areas, along roadsides.	E	CE	S-C	0	None	
Heath Wrinklewort (*Rutidosis heterogama*)	Between Cessnock and Kurri Kurri, in Howes Valley, and north from Wyong to Newcastle on the Central Coast. Also on the north coast and on the New England Tablelands Heath on sandy soils, moist areas in open forest, and along disturbed roadsides.	V	V	S-C	0	None	

Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Illawarra Greenhood (*Pterostylis gibbosa*)	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). Open forest or woodland, on flat or gently sloping land with poor drainage.	E	E	S-C	0	None	
Magenta Lilly Pilly (*Syzygium paniculatum*)	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the central coast occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	E	V	S-C	0	None	
Scrub Turpentine (*Rhodamnia rubescens*)	In NSW, this species I known to occur in coastal areas north from Batemans Bay. This species is associated with warmer rainforest and occurs commonly on rainforest margins.	CE	CE	S-C	0	None	New entry
Singleton Mint Bush (*Prostanthera cineolifera*)	Grows in open woodlands on exposed sandstone ridges, usually found in association with shallow or skeletal sands.	V	V	S-C	0	Low	
Slaty Red Gum (*Eucalyptus glaucina*)	Only on the north coast of NSW. Found near Casino and farther south, from Taree to Broke, west of Maitland. Grassy woodland on dry eucalypt forest on deep, moderately fertile and well-watered soils.	V	V	S-C	115	Moderate	
Spreading Guinea Flower (*Hibbertia procumbens*)	Within NSW, known from several locations only on the Central Coast in the Gosford and Wyong local government areas. Banksia ericifolia–Angophora hispida–Allocasuarina distyla scrub/heath on skeletal sandy soils, or 'hanging swamp' vegetation on sandy deposits.	E	-	S-C	0	None	
Tarengo Leek Orchid (*Prasophyllum petilum*) Incl. Prasophyllum sp. Wybong	Four sites in NSW: at Boorowa, Captains Flat, Ilford and Delegate. Natural Temperate Grassland, grassy woodland, and Box-Gum woodland.	E	E	S-C	0	Low	
Trailing Woodruff (*Asperula asthenes*)	Only in NSW, in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area Damp sites, often along river banks.	V	V	S-C	1	Low	
White-flowered Wax Plant (*Cynanchum elegans*)	Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley. Dry rainforest; littoral rainforest; Leptospermum laevigatum-Banksia integrifolia subsp. integrifolia (Coastal Tea-tree– Coastal Banksia) coastal scrub; Eucalyptus tereticornis (Forest Red Gum) or Corymbia maculata (Spotted Gum) open forest and woodland; and Melaleuca armillaris (Bracelet Honeymyrtle) scrub.	E	E	S-C	0	Low	
Birds							
Australasian Bittern (*Botaurus poiciloptilus*)	Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly Typha sp. (bullrushes) and Eleocharis sp. (spikerushes).	E	E	S-C	0	Low	
Australian Painted Snipe (*Rostratula australis*)	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Swamps, dams and nearby marshy areas.	E	E	S-C	0	Moderate	
Black-breasted Buzzard (*Hamirostra melanosternon*)	Areas receiving less than 500 mm rainfall from north-western NSW and north-eastern SA to the east coast at about Rockhampton, then across northern Australia south almost to Perth. Inland habitats, including timbered watercourses, grasslands and sparsely timbered woodlands.	V	-	S-C	0	Low	
Black-necked Stork (*Ephippiorhynchus asiaticus*)	Coastal and subcoastal northern and eastern Australia, south to central-eastern NSW and with vagrants recorded further south and inland. In NSW, floodplain wetlands of the major coastal rivers are key habitat. Also, minor floodplains, coastal sandplain wetlands and estuaries.	E	-	S-C	9	None	
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	From eastern through central NSW, west to Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell. Eucalypt woodlands and dry open forest.	V	-	E-C	4	Moderate	
Curlew Sandpiper (*Calidris ferruginea*)	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin. Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	E	CE, M	S-C	0	None	
Diamond Firetail (*Stagonopleura guttata*)	Widely distributed in NSW, mainly recorded in the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina, and less commonly found in coastal areas and further inland. Grassy eucalypt woodlands, open forest, mallee, Natural Temperate Grassland, secondary derived grassland, riparian areas and lightly wooded farmland.	V	-	E-C	1	Moderate	

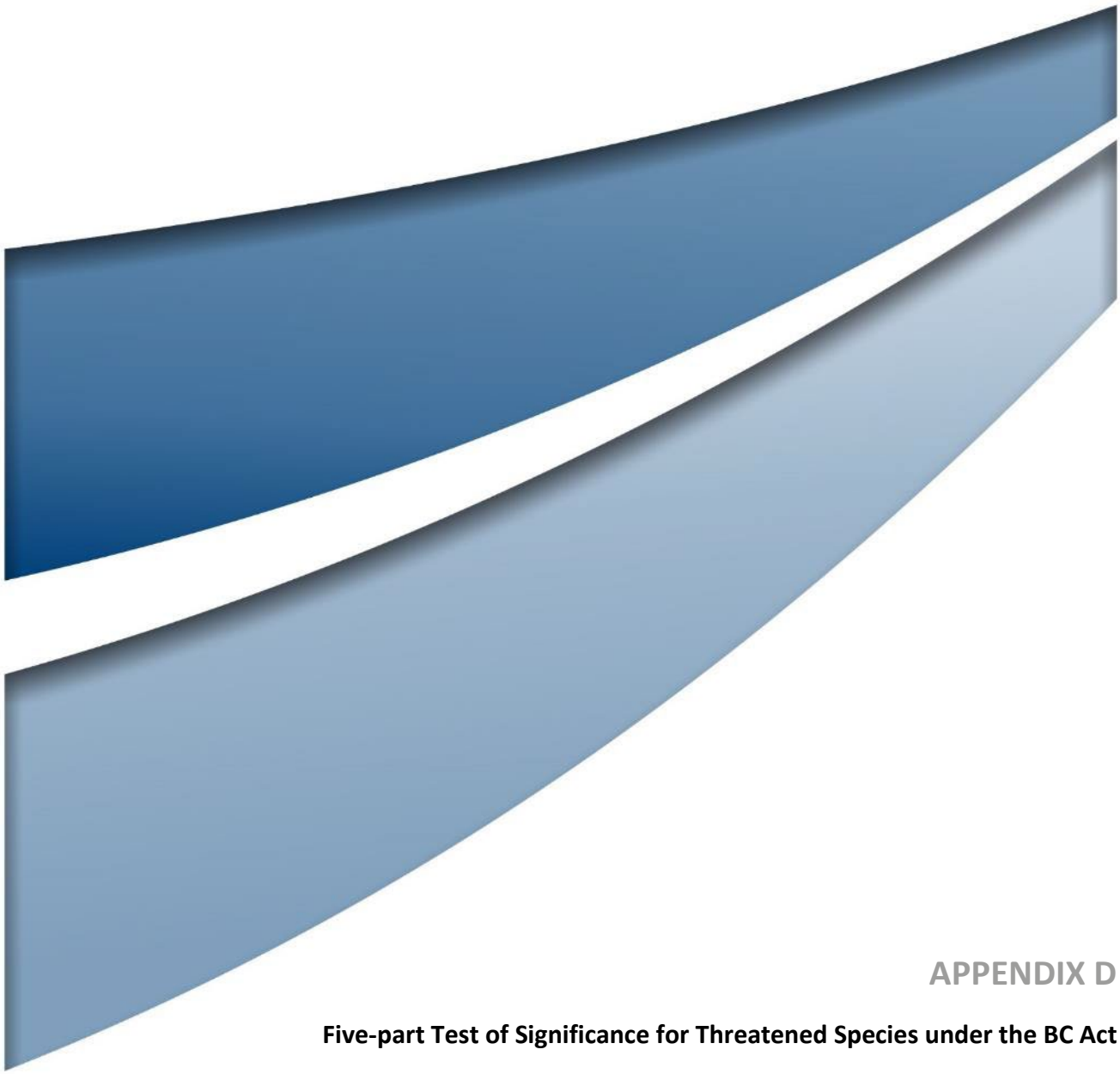
Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)	Widespread in eastern, southern and southwestern Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and groundcover of grasses or sedges and fallen woody debris. Also found in farmland, usually at the edges of forest or woodland.	V	-	E-C	2	Moderate	
Eastern Curlew (*Numenius madagascariensis*)	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	-	CE, M	E-C	0	None	
Eastern Grass Owl (*Tyto longimembris*)	In NSW they are more likely to be resident in the north-east. Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	V	-	E-C (F) S-C (B)	1	None	
Flame Robin (*Petroica phoenicea*)	In NSW, breeds in upland areas, and in winter many birds move to the inland slopes and plains, or occasionally to coastal areas. Likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgelands at high altitudes.	V	-	E-C	4	Moderate	
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee. Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.	V	-	E-C (F) S-C (B)	1	Low	
Glossy Black-Cockatoo (*Calyptorhynchus lathami*)	In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina. Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.	V	-	E-C (F) S-C (B)	0	Low	
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	In NSW, occurs on the western slopes of the Great Dividing Range, and as far as Louth and Balranald on the western plains. Also occurs in woodlands in the Hunter Valley and in some locations on the north coast. Open woodland habitats; favours Box-gum woodlands on the slopes and Box-cypress and open Box woodlands on alluvial plains.	V	-	E-C	166	Recorded	
Grey flacon (*Falco hypoleucos*)	Occurs primarily west of the Great Dividing Range throughout the Murray Darling Basin. Restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions.	E	V	E-C	0	None	New entry
Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*)	Found throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies picata. Open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas.	V	-	E-C	0	Moderate	
Little Eagle (*Hieraaetus morphnoides*)	Throughout the Australian mainland, with the exception of the most densely forested parts of the Dividing Range escarpment. Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW.	V	-	E-C (F) S-C (B)	2	Recorded	
Little Lorikeet (*Glossopsitta pusilla*)	In NSW, found from the coast westward as far as Dubbo and Albury. Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation.	V	-	E-C	6	High	
Masked Owl (*Tyto novaehollandiae*)	Recorded over approximately 90% of NSW, excluding the most arid north-western corner. Most abundant on the coast but extends to the western plains. Dry eucalypt forests and woodlands from sea level to 1100 m.	V	-	E-C (F) S-C (B)	4	Recorded (potential)	
Painted Honeyeater (*Grantiella picta*)	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	V	V	E-C	0	Low	
Powerful Owl (*Ninox strenua*)	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest.	V	-	E-C (F) S-C (B)	0	Low	
Red Goshawk (*Erythrotriorchis radiatus*)	In NSW, extends to ~30°S. Recent records confined to the Northern Rivers region north of the Clarence River. Open woodland and forest, often along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and coastal riparian Eucalyptus forest.	CE	V	S-C	0	Low	

Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Regent Honeyeater (*Anthochaera phrygia*)	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	CE	CE	E-C (F) S-C (B)	0	High	
Scarlet Robin (*Petroica boodang*)	In NSW, it occurs from the coast to the inland slopes. Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	V	-	E-C	4	Moderate	
Speckled Warbler (*Chthonicola sagittata*)	From south-eastern Qld, the eastern half of NSW and into Victoria, as far west as the Grampians, mostly on hills and tablelands of the Great Dividing Range and rarely on coast. Eucalyptus-dominated communities with a grassy understorey and sparse shrub layer, often on rocky ridges or in gullies.	V	-	E-C	44	High	
Spotted Harrier (*Circus assimilis*)	Found throughout the Australian mainland, except in densely forested or wooded habitats, and rarely in Tasmania. Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands.	V	-	E-C	4	Moderate	
Swift Parrot (*Lathamus discolor*)	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and southwest slopes. On the mainland they occur in areas where eucalypts are flowering profusely; favoured feed trees include winter flowering species.	E	CE	E-C (F) S-C (B)	2	High	
Turquoise Parrot (*Neophema pulchella*)	Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range. Eucalypt and cypress pine open forests and woodlands, ecotones between woodland and grassland, or coastal forest and heath.	V	-	E-C	0	Low	
Varied Sittella (*Daphoenositta chrysoptera*)	Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, mallee and Acacia woodland.	V	-	E-C	1	Moderate	
White-bellied Sea-Eagle (*Haliaeetus leucogaster*)	Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.	V	-	E-C (F) S-C (B)	4	Moderate	
Wompoo fruit-dove (*Ptilinopus magnificus*)	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests located east of the divide.	V		E-C	1	Low	New
White-throated Needletail (*Hirundapus caudacutus*)	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	-	V,M	E-C	3	High	
Mammals							
Brush-tailed Phascogale (*Phascogale tapoatafa*)	In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide. Dry sclerophyll open forest, heath, swamps, rainforest and wet sclerophyll forest.	V	-	S-C	72	Recorded	
Brush-tailed Rock-wallaby (*Petrogale penicillata*)	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	E	V	S-C	0	None	
Corben's Long-eared Bat (*Nyctophilus corbeni*)	Distribution coincides approximately with the Murray Darling Basin; the Pilliga Scrub region is the distinct stronghold for this species. Mallee, Allocasuarina luehmannii (bulloke) and box eucalypt- dominated communities, especially box/ironbark/cypress-pine vegetation.	V	V	E-C	0	Low	
Eastern Cave Bat (*Vespadelus troughtoni*)	Found in a broad band on both sides of the Great Dividing Range south to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. Dry open forest and woodland, near cliffs or rocky overhangs, cliff-lines in wet eucalypt forest and rainforest.	V	-	S-C	2	Recorded (potential -Call analysis)	
Eastern Coastal Freetailed-bat (*Micronomus norfolkensis*)	Found along the east coast from south Qld to southern NSW. Dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range.	V	-	E-C	14	Recorded (Call analysis)	
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range. Tall (greater than 20m) moist habitats.	V	-	E-C	2	Recorded (potential-Call analysis)	

Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	Both sides of the great divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands. Woodland, moist and dry eucalypt forest and rainforest.	V	-	E-C	5	Likely	
Greater Glider (*Petauroides volans*)	Largely restricted to eucalypt forests and woodlands with an abundance of tree hollows.		V	S-C	0	Moderate	
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	V	V	E-C (F) S-C (B)	564	Recorded (foraging record)	
Koala (*Phascolarctos cinereus*)	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands. Eucalypt woodlands and forests.	V	V	E-C (F) S-C (Important habitat)	4	Moderate	
Large Bentwinged-bat (*Miniopterus orianae oceanensis*)	In NSW it occurs on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Wagga Wagga. Rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland.	V	-	E-C (F) S-C (B)	19	Recorded (Call analysis)	
Large-eared Pied Bat (*Chalinolobus dwyeri*)	In NSW it occurs along a patchy distribution on both sides of the Great Dividing Range, from the coast inland to Moree, Dubbo and Bungonia in the Southern Highlands. Roosts in caves, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin. Low to mid-elevation dry open forest and woodland close to these features.	V	V	S-C	0	Moderate	New entry
Little Bentwing-bat (*Miniopterus australis*)	East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.	V	-	E-C (F) S-C (B)	8	Recorded (Call analysis)	
New Holland Mouse (*Pseudomys novaehollandiae*)	Fragmented distribution across eastern NSW. Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes.	-	V	E-C	0	None	
Parma Wallaby (*Notamacropus parma*)	In NSW, found scattered along the Great Dividing Range in forest with escarpment up to 1000m above sea level. Occurs in wet sclerophyll forest with a thick, shrubby understory and nearby grassy patches, as well as occasionally in dry sclerophyll forest with a dense understorey and occasionally in rainforest.	V	V	S-C	0	None	New entry
Southern Myotis (*Myotis macropus*)	In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers. Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation.	V	-	S-C	3	Recorded	
Spotted-tailed Quoll (*Dasyurus maculatus*)	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld. Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	V	E	E-C	13	Moderate	
Squirrel Glider (*Petaurus norfolcensis*)	Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern Qld to western Victoria. Mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas.	V	-	S-C	6	Recorded	
Yellow-bellied glider (*Petaurus australis australis*)	In NSW this species has a patchy distribution along the east coast, extending inland to the western slopes of the Great Dividing Range. Occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests. Abundance is highly dependent on habitat suitability, preferring large patches of mature old growth forest that provide suitable trees for foraging and shelter.	V	V	S-C	0	None	New entry
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	There are scattered records of this species across the New England Tablelands and North West Slopes. Rare visitor in late summer and autumn to south-western NSW. Almost all habitats, including wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies.	V	-	E-C	3	Moderate	
Amphibians							
Booroolong Frog (*Litoria booroolongensis*)	Restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. Several populations have recently been recorded in the Namoi catchment. Permanent streams with some fringing vegetation cover such as ferns, sedges or grasses.	E	E	S-C	0	None	

Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Giant Burrowing Frog (*Heleioporus australiacus*)	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	V	V	S-C	0	None	
Green and Golden Bell Frog (*Litoria aurea*)	Since 1990, recorded from ~50 scattered sites within its former range in NSW, from the north coast near Brunswick Heads, south along the coast to Victoria. Records exist west to Bathurst, Tumut and the ACT region. Marshes, dams and stream-sides, particularly those containing Typha sp. (bullrushes) or Eleocharis sp. (spikerushes). Some populations occur in highly disturbed areas.	E	V	S-C	0	Low	
Reptiles							
Pink-tailed legless lizard (*Aprasia parapulchella*)	In NSW, occurs only from the Central and Southern Tablelands, and the South Western Slopes. Sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass and found beneath small, partially embedded rocks and appear to spend considerable time in burrows below these rocks.	V	V	S-C	0	None	New entry
Striped legless lizard (*Delma impar*)	In NSW, occurs Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Natural Temperate Grassland, secondary grassland and Box-gum woodland, as well as modified grasslands with a significant content of exotic grasses, grasslands with significant amounts of surface rocks, and agricultural land.	V	V	S-C	0	Low	New entry
Migratory Species							
Black-faced Monarch (*Monarcha melanopsis*)	In New South Wales and the Australian Capital Territory, the species occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park, Wombeyan Caves and Canberra. It generally occurs in rainforest habitats.	-	M	-	0	Low	
Common Greenshank (*Tringa nebularia*)	Widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions. Generally, occurs in sheltered coastal mudflats and saltmarsh.	-	M	-	0	None	
Common Sandpiper (*Actitis hypoleucos*)	Found along all coastlines of Australia and in many areas inland, the species is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia. Occurs in coastal wetland habitats.	-	M	-	0	None	
Curlew Sandpiper (*Calidris ferruginea*)	Occurs along the entire coast of NSW, and sometimes in freshwater wetlands in the Murray-Darling Basin. Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes, and lagoons on the coast and sometimes inland.	E	CE, M	S-C	0	None	
Eastern Curlew (Numenius madagascariensis)	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	-	CE, M	S-C	0	None	
Fork-tailed Swift (*Apus pacificus*)	Recorded in all regions of NSW. Riparian woodland, swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland, and inland and coastal sand-dunes.	-	M	-	1	Moderate	
Latham's Snipe (*Gallinago hardwickii*)	Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline, or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands.	-	M	-	1	Moderate	
Oriental Cuckoo (*Cuculus optatus*)	Generally found in wet eucalypt forest, river margins and near mangroves.	-	M	-	0	Low	
Osprey (*Pandion haliaetus*)	The breeding range of the species extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in NSW; with a second isolated breeding population on the coast of South Australia, extending from Head of Bight east to Cape Spencer and Kangaroo Island. This species generally occurs in coastal and terrestrial wetland habitats.	V	M	E-C (F) S-P (B)	0	Low	
Pectoral Sandpiper (*Calidris melanotos*)	In NSW, the species is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Generally, occurs in coastal wetlands and estuaries.	-	M	-	0	None	
Red-necked Stint (*Calidris ruficollis*)	Summer migrant to Australia, widespread coastal and inland NSW. Tidal mudflats, saltmarshes, sandy and shelly beaches, saline, and freshwater wetlands, saltfields, sewage ponds.	-	M	-	1	None	

Common Name (*Scientific Name*)	Habitat Requirements	BC Act	EPBC Act	Credit Type	Number of records within 10 km (BioNet)	Likelihood of occurrence	Updated since 2019?
Rufous fantail (*Rhipidura rufifrons*)	Occurs in coastal and near coastal districts of northern and eastern Australia. mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (Eucalyptus microcorys), Mountain Grey Gum (E. cypellocarpa), Narrow-leaved Peppermint (E. radiata), Mountain Ash (E. regnans), Alpine Ash (E. delegatensis), Blackbutt (E. pilularis) or Red Mahogany (E. resinifera), usually with a dense shrubby understorey often including ferns.	-	M	-	0	Low	
Satin Flycatcher (*Myiagra cyanoleuca*)	In NSW, this species is widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Generally, occurs in tall, moist gully forest habitats.	-	M	-	0	Low	
Sharp-tailed Sandpiper (*Calidris acuminata*)	Widespread in most regions of NSW and Victoria, especially in coastal areas, but they are sparse in the south-central Western Plain and east Lower Western Regions of NSW, and north-east and north-central Victoria. Generally, occur in wetlands with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	-	M	-	0	None	
White-throated Needletail (*Hirundapus caudacutus*)	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	-	V,M	E-C	3	High	
Yellow Wagtail (*Monarcha trivirgatus*)	Generally, occurs in damp habitats, such as wet pastures, grazing marshes and river valleys.	-	M	-	0	Moderate	



APPENDIX D

Five-part Test of Significance for Threatened Species under the BC Act

The revised impact area and ancillary facilities cover an area of approximately 147.49 ha, with the project expected to result in the removal of 42.89 ha of native vegetation and 101 hollow-bearing trees.

The vegetation to be removed comprises woodland and forest, and grassland which may be utilised by threatened species. These are comprised of the plant community types shown in **Table D1**.

Table D1 Habitats within the revised impact area

Plant community type (PCT)	Area in revised impact area
Woodland and Forest Habitats	
VZ 1 - 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter - Moderate to Good Condition	0.37
VZ 3 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter - Moderate to Good Condition	8.61
VZ 4 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter - Thinned Canopy	6.69
VZ 6 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter - African Olive Infestation	0.46
VZ 8 - 42 River Red Gum / River Oak riparian woodland wetland in the Hunter Valley - Low Condition	1.21
VZ 9 - 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley - Low Condition	0.24
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter	0.06
MDHF – 1601 Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter	0.05
MDHF – 1731 Swamp Oak - Weeping Grass grassy riparian forest of the Hunter Valley	0.07
Total area of woodland and forest habitat	**17.76**
Grassland Habitats	
VZ 2 - 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter - Derived Native Grassland (DNG)	0.3
VZ 5 - 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum Shrub - Grass Woodland of the Central and Lower Hunter – DNG (Umwelt 2019)	22.39
MDHF – 1600 Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter - Derived Native Grassland	2.44
Total area of grassland habitat	**25.13**
Total area of native vegetation	**42.89**

The revision of the revised impact area has increased the removal of woodland and forest habitat from 15.28 ha to 17.76 ha and increased the removal of grassland habitat from 16.65 ha to 25.13 ha.

The following Five-Part Tests of Significance have been revised from those provided in the BAR (Umwelt 2019). The tests have addressed the questions provides in Section 7.3 of the *Biodiversity Conservation Act 2016* (BC Act) for the species identified as recorded and potentially occurring within the revised impact area and ancillary facilities in **Appendix C** and includes:

- Threatened Ecological Communities
- Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC.
- Endangered Populations
- *Eucalyptus camaldulensis* population in the Hunter catchment.
- Threatened Species
- southern myotis (*Myotis macropus*) – vulnerable.

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions - endangered ecological community (EEC)

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions EEC occurs on gentle slopes of depressions and drainage flats on the Hunter Valley floor, and is recorded between Muswellbrook, Beresfield, Mulbring and Cessnock. It typically comprises an open forest dominated by forest red gum (*Eucalyptus tereticornis*) and grey gum (*Eucalyptus punctata*) although other frequently occurring canopy species are smooth-barked apple (*Angophora costata*), spotted gum (*Corymbia maculata*), narrow-leaved ironbark (*Eucalyptus crebra*) and grey box (*Eucalyptus moluccana*). This TEC features a sparse native shrub layer and sparse to moderately dense ground cover dominated by native forbs and grasses (NSW Scientific Committee 2019).

The PCTs and vegetation zones described and mapped within the revised project area were assessed against the criteria that define this EEC, as described in the final determination (NSW Scientific Committee 2019). Based on this assessment Zone 1 – 1598 Forest Red Gum Grassy Open Forest on Floodplains of the Lower Hunter – Moderate to Good condition conform to the ***Hunter Lowland Redgum Forest*** EEC as they meet the following attributes:

- occurs on Permian sediments within the NSW Sydney Basin Bioregion
- occurs in the Singleton Local Government Area (LGA)
- dominated by the characteristic canopy species, dominated by *Eucalyptus tereticornis*, with occurrences of *Eucalyptus crebra*
- supports a reasonable proportion of species that are in the list of characteristic species for the EEC.

The total area of the Hunter Lowland Redgum Forest EEC within the revised impact area and ancillary facilities is approximately 0.37 ha.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
Not applicable.
In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Approximately 0.61 ha that conforms to the TEC was identified within the revised project area with the portion of a single small patch about 0.37 ha within the revised impact area and will be directly impacted by the project. Additional remnants of the EEC are also known to occur within land adjacent to the revised impact area. The total mapped area of *Hunter Lowland Redgum Forest* EEC is about 500 ha (NSW Scientific Committee 2019). The EEC occurs widely in the Singleton district. The permanent loss of about 0.37 ha of the EEC, estimated to be about 0.07 per cent of the extent of the community, represents a negligible reduction in the estimated extent of the community across its range. It is unlikely that the project will have a significant adverse effect on this ecological community such that its local occurrence is likely to be placed at risk of extinction.
Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
The project will remove about 0.37 ha of the *Hunter Lowland Redgum Forest EEC*. This reduction in the extent of the EEC is not expected to result in a substantial change in native species composition, or any other form of composition, in the wider locality such that the composition of species in adjacent areas of EEC is affected.
In relation to the habitat of a threatened species or ecological community:
The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
About 0.37 ha that conforms to the EEC occur within the revised impact area and ancillary facilities and will be directly impacted by the project.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
This ecological community has been heavily cleared across most of its range. The remaining extent of the ecological community is highly fragmented and occurs in small, isolated patches (NSW Scientific Committee 2019). Vegetation occurring within the revised impact area represents the edge of a single patch that is currently highly fragmented due to historic agricultural land practices and separated from another patch within the revised project area by Maison Dieu Road. The removal of 0.37 ha from one patch of *the Hunter Lowland Redgum Forest EEC* is not considered to increase the fragmentation of the community such that 0.24 ha will remain in the surrounding revised project area.
The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
The removal of about 0.37 ha from one patch of *Hunter Lowland Redgum Forest EEC* is considered unlikely to affect the long-term survival of the in the locality, with about 0.24 ha not disturbed by the project.
Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
No declared areas of outstanding biodiversity value are located in, or near, the revised impact area or ancillary facilities. The project will not impact any declared areas of outstanding biodiversity value.
Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.
Four key threatening processes are relevant to the project, being: • Clearing of native vegetation • Loss of hollow-bearing trees • Removal of dead wood and dead trees • Invasion of native plant communities by exotic perennial grasses. Given that a total of 0.37 ha will be removed, the implications of these KTPs are not considered to be significant.
Conclusion
The project includes the removal of about 0.37 ha *of Hunter Lowland Redgum Forest EEC* . The project will result in the clearing of about 0.07 per cent of the current mapped area of the ecological community across its range, will negligibly decrease the area of habitat of the EEC and includes several key threatening processes. The project is unlikely to result in a significant impact on the *Hunter Lowland Redgum Forest EEC* listed under the BC Act.

***Eucalyptus camaldulensis* population in the Hunter catchment – endangered population**

River red gum (*Eucalyptus camaldulensis*) is the most widespread eucalypt in Australia, found in all mainland states and territories. In NSW, river red gum occurs along the western flowing rivers but is known from only one coastal catchment, the Hunter. It has been recorded in the local government areas of Lithgow, Maitland, Mid-Western Regional, Muswellbrook, Port Stephens, Singleton and Upper Hunter (OEH 2017).

River red gum may occur with forest red gum (*Eucalyptus tereticornis*), yellow box (*Eucalyptus melliodora*), river oak (*Casuarina cunninghamiana* subsp. c*unninghamiana*) and rough-barked apple (*Angophora floribunda*). The species was recorded in the revised project area, adjacent to the revised impact area. It occurs within the revised project area along the Hunter River where PCT 42 has been mapped.

About 1.21 ha of this PCT will be cleared for the project. While it is not expected that any river red gums will be removed, the population may be indirectly impacted given the steep slope and short distance separating the threatened population to the revised impact area, works may exacerbate natural erosion process and result in the damage or loss to individuals.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction
River red gum within the revised project area forms part of the *Eucalyptus camaldulensis* population in the Hunter catchment - endangered population. The project will involve removal of 1.21 ha of potential habitat for this species associated with PCT 42, however no individuals of this species will require removal as part of the project. A total of 39 individuals have been recorded adjacent to the revised impact area along the Hunter River. As part of **Section 5.2** mitigation measures are proposed to minimise indirect impacts, including containing works outside the dripline of trees. The project will not significantly affect the endangered population such that it is likely to be placed at risk of extinction.
In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable.
Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not applicable.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
In relation to the habitat of a threatened species or ecological community:
The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
The project will require removal of 1.21 ha of potential habitat for this species associated with PCT 42. However, the project will not require the complete removal of any river red gum. It is unlikely that the project will affect the extent of *Eucalyptus camaldulensis* population in the Hunter catchment.
Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
Vegetation occurring within the revised impact area is currently highly fragmented as a result of historic agricultural land practices. The removal of 1.21 ha of habitat for the *Eucalyptus camaldulensis* population in the Hunter catchment will result in a negligible increase in the existing fragmentation.
The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
The project will not require the removal of any river red gum. The occurrence of low quality habitat for this endangered population within the development area is not any more important to the survival of the population than any other location.
Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
No declared areas of outstanding biodiversity value are located in, or near, the revised impact area. The project will not impact any declared areas of outstanding biodiversity value.
hether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.
One key threatening process is relevant to the project, being: • Clearing of native vegetation. Given that a total of 1.21 ha will be removed, the implications of these KTPs are not considered to be significant.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Conclusion
The project includes the removal of about 1.21 ha of PCT 42 that provides habitat for the *Eucalyptus camaldulensis* population in the Hunter catchment - endangered population. No river red gums will be removed. This will negligibly increase the level of fragmentation of habitat for this endangered population, will negligibly decrease the area of habitat of the endangered population and includes a single key threatening process. As part of **Section 5.2** mitigation measures are proposed to minimise indirect impacts, including containing works outside the dripline of trees. The project is unlikely to result in a significant impact on the *Eucalyptus camaldulensis* population in the Hunter catchment - endangered population listed under the BC Act.

Southern myotis (*Myotis macropus*) – Vulnerable

The southern myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. This species generally roosts close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The southern myotis forages over streams and pools, catching insects and small fish by raking their feet across the water surface (OEH 2017j).

This species was recorded in the revised project area, captured in an existing a sandstone block culvert adjacent (within about 30 m) to the revised impact area, during targeted harp-trapping surveys in October 2021. A total of 17 individuals were recorded in a harp trap set at the southernmost culvert west of the rail corridor. The presence of pregnant females as well as one female carrying a young pup confirms that the culverts support a maternity roost for this species.

In addition to the sandstone block culvert, potential foraging and breeding habitat for this species in the revised impact area and ancillary facilities includes woodland and riparian areas which make up about 12.34 ha (Table D1). A number of mitigation measures considered for the species have been included as part of the following assessment as well as those detailed in **Section 5.2**.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

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

Of the 17 southern myotis captured in a harp trap exiting a culvert within the revised project area (located about 30 m from the revised impact area) 10 females showing signs of pregnancy, one female carrying a young pup and one male with swollen testes. The presence of pregnant females as well as one female carrying a young pup confirms that the large sandstone culverts within the revised project area supports a maternity roost for this species.

Other confirmed roosting sites include a culvert adjacent to the revised impact area (within about 50 m), where the species was previously recorded however, no evidence of breeding (i.e., dependent young, lactating females) was observed during inspections of the roost (Niche 2019).

The revised impact area supports 101 hollow-bearing trees potentially suitable for roosting occur in the northern section of the revised impact area with several small, scattered farm dams suitable for foraging, and potential foraging habitat occurs along the Hunter River. The southern two culverts where southern myotis were recorded, are located about two km north of the Hunter River, and about 300 m from a small farm dam.

Test pits and the sampling (by water injection) for contaminated material will be undertaken along the old northern railway prior to the relocation of telecommunication services. Sample locations have been adjusted to not occur within 20 m of culverts. No direct or indirect impacts are expected from these early works which are expected to take place during the known breeding period in November 2022.

The new telecommunication services trenches will be established along the old northern highway using a small excavator. Trenches, being 0.5 m wide and 1 – 2 m deep, will be located at the top of the embankment and run directly above the culverts. Although these works will occur in proximity, not direct impacts are expected to micro-bats, or the roosting habitat features within the culverts. Indirect impacts of these works include noise and vibration and are considered to be temporary.

The construction activities will occur a minimum of 30 m from the western entrances to culverts. High risk activities such as vegetation clearance work and land form establishment will likely result in indirect impacts to these culverts including removal of foraging habitat, changes to drainage into the sandstone block culverts, disruption of flight paths into culverts, potential for increased weeds at the entrances due to increased runoff which could obstruct access/egress, potential for increased sedimentation within the sandstone block culverts resulting in loss of roosting habitat, increased noise, vibration and light impact.

AECOM had confirmed the following in terms of indirect impacts to the sandstone block culverts for the BAR (Umwelt 2019):

- Impacts to drainage within the culverts is expected to be minor. There would be a relatively small increase in impermeable surface within the upstream catchments and so a potential increase in runoff. Conversely a section of catchment would also be diverted to drain down the project through the large cut area and empty into another catchment to the south, offsetting this increase.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
• The closest part of the project to the sandstone block culverts is about 120 m, noting that the revised impact area is within 30 to 50 m of the two southern sandstone block culverts. • Standard provisions for weed management would be incorporated into the Construction Environmental Management Plan (CEMP) to minimise dispersal during construction. • Erosion and sedimentation would be managed during construction using standard measures to prevent sediment leaving the construction site. It is highly unlikely that there would be offsite sediment transfer of a nature that could obstruct the culverts. There would be no ongoing source of sediment once the bypass is operational and exposed soils have been stabilised and landscaped. • Given that the road is generally in a cutting near the culverts both noise and light from the bypass would be somewhat shielded. It should be noted that there is no street lighting along the alignment in this location. Lighting is only provided at the connection points.
To reduce the impact of the above listed indirect impacts on the species, a range of mitigation measures would be undertaken, including: • Preparation of a micro-bat management plan to address the above listed indirect impacts, or any additional identified indirect impacts. • As part of the micro-bat management plan a monitoring strategy would be undertaken for both during and outside breeding periods to monitor the population. • Consideration of timing and nature of immediately adjacent works in relation to known breeding periods. According to Churchill (2008), populations of southern myotis in northern NSW produce two litters of single young in October and January, with young still occupying breeding habitat as late as April. The potential for the project to impact this species is substantially higher during this breeding season due to the presence of dependent young and/or juveniles. Dependent young are less likely to vacate the roost and there is a high risk that juveniles would be abandoned in the roost by adults. • If test pits and sampling for contaminated materials are required during breeding season for threatened microbats, works are to include a pre-disturbance survey (similar to a pre-clearance survey) and are to be completed under the supervision of a suitably qualified and experienced ecologist. • Trenching of telecommunication services to be completed outside of the breeding period to mitigate indirect impacts. Trenching works in proximity to culverts should commence under supervision of a suitably qualified ecologist. • Mitigation measures to be implemented during construction, including regular inspections of impacts from sedimentation and weed encroachment to culvert entrances, timing immediately adjacent works outside the known breeding period of relevant threatened microbats. • Adaptive management measures to be implemented if monitoring indicates a decline in bat numbers or if bats are observed leaving the roost during construction activities.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
Additionally, extensive areas of similar or higher quality foraging and breeding habitat for this species occur in the surrounding locality and region, some of which are protected. These include Yengo National Park (NP) and Wollemi NP to the west, which occur adjacent to Wollombi Brook. Over 200 ha of suitable forested habitat supporting suitable mature canopy growth with hollow density greater than or equal to that being impacted occur adjacent to the revised impact area (Niche 2019). Based on the appropriate utilisation of the mitigation measures described above, the project is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable.
Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction
Not applicable.
In relation to the habitat of a threatened species or ecological community:
The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and
The project will result in the removal of about 12.34 ha of native vegetation which forms potential foraging and breeding habitat for the southern myotis, and indirect impacts as described above to a sandstone block culvert containing individuals of the species assumed to precautionarily represent a maternity roost. The impact area is likely to form part of a larger territory for this species.
Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and
Vegetation occurring within the revised impact area is currently highly fragmented as a result of historic agricultural land practices. The removal of 12.34 ha of potential foraging and breeding habitat for the southern myotis is not likely to cause existing areas of habitat to become isolated given the highly mobile nature of this species, and the effects are considered to be negligible.

The following is to be considered for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:
The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,
A maternity roost for this species was confirmed during targeted surveys of culvert structures adjacent to the revised impact area. It is assumed that the three large sandstone culverts located within the revised project area provide important breeding sites for the southern myotis and the above recommended mitigation measures are required to minimise any indirect impacts. Extensive areas of similar or higher quality foraging and breeding habitat for this species occur in the surrounding locality and region, some of which are protected. These include Yengo NP and Wollemi NP to the west, which occur adjacent to potential foraging habitat along Wollombi Brook. Over 200 ha of suitable forested habitat supporting suitable mature canopy growth with hollow density greater than or equal to that being impacted occur adjacent to the revised impact area (Niche 2019). The occurrence of this habitat within the revised impact area is not any more important to the survival of the species than any other similar or higher quality habitat in the locality.
Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)
No declared areas of outstanding biodiversity value are located in, or near to, the revised impact area. The project will not impact any declared areas of outstanding biodiversity value.
Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.
Three key threatening processes are relevant to the project, being: • Clearing of native vegetation • Loss of hollow-bearing trees • Removal of dead wood and dead trees. Given that a total of 12.34 ha will be removed, the implications of these KTPs are not considered to be significant.
Conclusion
The project includes the removal of about 12.34 ha of potential foraging and breeding habitat for the southern myotis and indirect impacts to two large sandstone block culverts (located about 30 to 50 m from the revised impact area) which support a known maternity roost. Considering the mitigation measures and level of direct and indirect impacts, the project is considered unlikely to result in a significant impact on the southern myotis. Residual impacts to this species will be offset.

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