NSW Public Works

Jerrabomberra Water Supply Reservoir and Electrical Building

Review of Environmental Factors

November 2024

Prepared for Queanbeyan-Palerang Regional Council

Document Control

Report Number: P-FY20231658

Version	Author(s)	Reviewer	Approved for issue by	Date
Draft	Sarah Clarke	Liz Mathieson	L Mathieson	19 June 2023
Draft v2	Sarah Clarke	Kristen Parmeter	L Mathieson	10 January 2024
Final	Sarah Clarke	L Mathieson	L Mathieson	26 November 2024

Sarah Clarke

Environmental Scientist

NSW Public Works, 7023 Gwydir Highway, Inverell NSW 2360

Locked Bag 5022, Parramatta NSW 2124

p: 0459 318 345

e: sarah.clarke@pwa.nsw.gov.au | w: www.publicworks.nsw.gov.au

Cover Image: Jerrabomberra water supply reservoir site aerial view, ePlanning Spatial Viewer, accessed May 2023

Certification

This Review of Environmental Factors (REF) has been prepared by NSW Public Works, Department of Primary Industries and Regional Development on behalf of Queanbeyan-Palerang Regional Council. The report presents the assessment of potential impacts that may result from the proposed new Jerrabomberra water supply reservoir, electrical building and temporary construction compound.

Queanbeyan-Palerang Regional Council is a public authority and a determining authority as defined in the *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal satisfies the definition of an activity under the Act, and as such must assess and consider the environmental impacts of the proposal before determining whether to proceed.

This REF has been prepared in accordance with Sections 5.5 and 5.7 of the EP&A Act and Section 171 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Reg). It provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activity.

On the basis of the information presented in this REF it is concluded that:

1) The proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
2) The proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore, a Species Impact Statement (SIS) / Biodiversity Development Assessment Report (BDAR) is not required.
3) The proposed activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any matters of national environmental significance.

Subject to implementation of the measures to avoid, minimise or manage environmental impacts listed in this REF, the proposed activity is recommended to proceed.

Author & Qualifications	Sarah Clarke B UrbRegPlan
Designation	Environmental Planning Officer
I certify that I have reviewed and endorsed the contents of this REF document and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under section 170 of the EP&A Regulation, and the information it contains is neither false nor misleading.	
Reviewer and Qualifications	Liz Mathieson B Sc
Designation	Principal Scientist
Organisation	NSW Public Works, Department of Primary Industries and Regional Development
Signature	
Date	27 November 2024

Verification

I have examined this Review of Environmental Factors and the Certification and accept the report on behalf of Queanbeyan-Palerang Regional Council.

Name	
Designation	
Organisation	Queanbeyan-Palerang Regional Council
Signature	

Decision Statement

I, *(insert name)*, as an authorised person on behalf of Queanbeyan-Palerang Regional Council, have examined and considered the REF for the proposed new Jerrabomberra water supply reservoir, electrical building and temporary construction compound in accordance with Section 5.5 of the *Environmental Planning and Assessment Act 1979*.

The proposed activity comprises the construction of a new water supply reservoir, electrical building and the establishment of temporary construction compound.

A number of temporary construction-related impacts are predicted, associated predominantly with access and noise. It has been assessed that these impacts can be either managed or avoided altogether by implementing appropriate mitigation measures.

Overall, based on a review of the contents of the REF and an understanding of the impacts of the proposed activity, it is considered that:

- The proposed Activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
- The proposed Activity will not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats or impact biodiversity values, meaning a Species Impact Statement and/or Biodiversity Development Assessment Report is not required.
- The proposed Activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any matters of national environmental significance.
- By adopting the identified safeguards, it is unlikely that the proposal would result in significant adverse environmental impacts, and therefore the proposed Activity may proceed subject to the implementation of the mitigation measures identified in Section 5 of the REF.

Authorised Representative	
Designation	
Organisation	Queanbeyan-Palerang Regional Council
Signature	
Date	

Executive Summary

This Review of Environmental Factors (REF) has been prepared by NSW Public Works, Department of Primary Industries and Regional Development. The report presents the assessment of potential impacts that may result from the proposed new Jerrabomberra water supply reservoir, appurtenant works and temporary construction compound.

Proposal Summary

Queanbeyan-Palerang Regional Council (QPRC) is the local water supply authority for the local government area. QPRC is proposing to construct a new water supply reservoir and temporary construction compound within Mount Jerrabomberra Reserve, Jerrabomberra. A suitable road for truck access and turning will also be constructed at the reservoir site entrance.

Environmental Planning

The applicable environmental planning instrument for the proposal is *State Environmental Planning Policy (Transport and Infrastructure) 2021* (SEPP (Transport and Infrastructure) 2021). Sections 2.159(1) and 2.159(6)(g) of the SEPP (Transport and Infrastructure) 2021 allows development for the purpose of water reticulation systems and power supply to water supply systems to be carried out by or on behalf of a public authority without consent on any land.

As SEPP (Transport and Infrastructure) 2021 removes the need for development consent for the Proposal, these works are assessed under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). QPRC is the determining authority for the development.

This REF provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activity.

Impacts and Mitigation

Some minor impacts associated with access and noise are predicted. It has been assessed that these impacts can either be managed or avoided altogether by implementing appropriate mitigation measures. The impacts associated with the construction works would be short term and can be managed so as not to result in adverse environmental impacts. No adverse operational impacts are anticipated as a result of the works.

Based on the outcomes of the assessment presented in this REF, it is concluded that by adopting the identified safeguards it is unlikely that the proposal would result in significant adverse environmental impacts.

Contents

Figures

Tables

Abbreviations

ADDA	Aboriginal Due Diligence Assessment
AHIP	Aboriginal Heritage Impact Permit
BAR	Biodiversity Assessment Report
BC Act	Biodiversity Conservation Act 2016
CEMP	Construction Environmental Management Plan
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Reg	Environmental Planning and Assessment Regulation 2021
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
ESCP	Erosion Sediment Control Plan
GSV	Ground Surface Visibility
HBT	Hollow-Bearing Trees
KTP	Key Threatening Processes
LEP	Local Environmental Plan
LG Act	Local Government Act
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NPW Act	National Parks and Wildlife Act 1974
NPW Regulation	National Parks and Wildlife Regulation 2019
OEMP	Operational Environmental Management Plan
PCT	Plant Community Types
QPRC	Queanbeyan-Palerang Regional Council
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy

TEC	Threatened Ecological Community
WM Act	Water Management Act 2000
WMP	Waste Management Plan

1. Introduction

This section provides details on the background of the Proposal, the objectives, relevant statutory matters and consultation undertaken.

1.1. Background

The Jerrabomberra Reservoir forms part of the Queanbeyan water supply network which supplies water to a large part of the City of Queanbeyan, including the suburb of Jerrabomberra. Queanbeyan-Palerang Regional Council (QPRC) has an agreement with Icon Water to purchase potable water for the City of Queanbeyan which is transferred to the Jerrabomberra Reservoir from the Mount Stromlo and/or Googong Water Treatment Plants.

The existing 22ML welded steel service reservoir at Mt Jerrabomberra was constructed in the early 1980's and now serves the bulk of the city of Queanbeyan (including Jerrabomberra) as its sole source of potable water. The tank serves as the city's buffer against any potential service interruption from the ICON Water supply and as such is considered critical infrastructure. The existence of this single tank limits this buffer to 22ML and prevents any opportunity for major maintenance given that there is no alternate or duplicate tank. The existing reservoir has now been in service for some 40 years and now requires major rejuvenating maintenance.

1.2. Proposal

The Proposal will include the following works:

- Construction of a new water supply reservoir (reinforced concrete – 53m diameter x 10 m (floor to top of wall) within a cleared area adjacent to the existing Jerrabomberra Reservoir site at 114 Jerrabomberra Hill Road (Lot 1 DP 40407).
- Clearing of a small, vegetated area at the entry of the reservoir site to enable suitable truck access.
- Realignment of fences at the entry of the reservoir site.
- Establishment of a temporary construction compound at 32R Carolyn Jackson Drive (part Lot 126 DP 17204).

The site plan of the proposed new water reservoir is shown below in Figure 1-1. The finalised extent of works and exact footprint locations are yet to be determined by Council, however an indicative extent of clearing and generalised work areas are shown below in Figure 1-4.

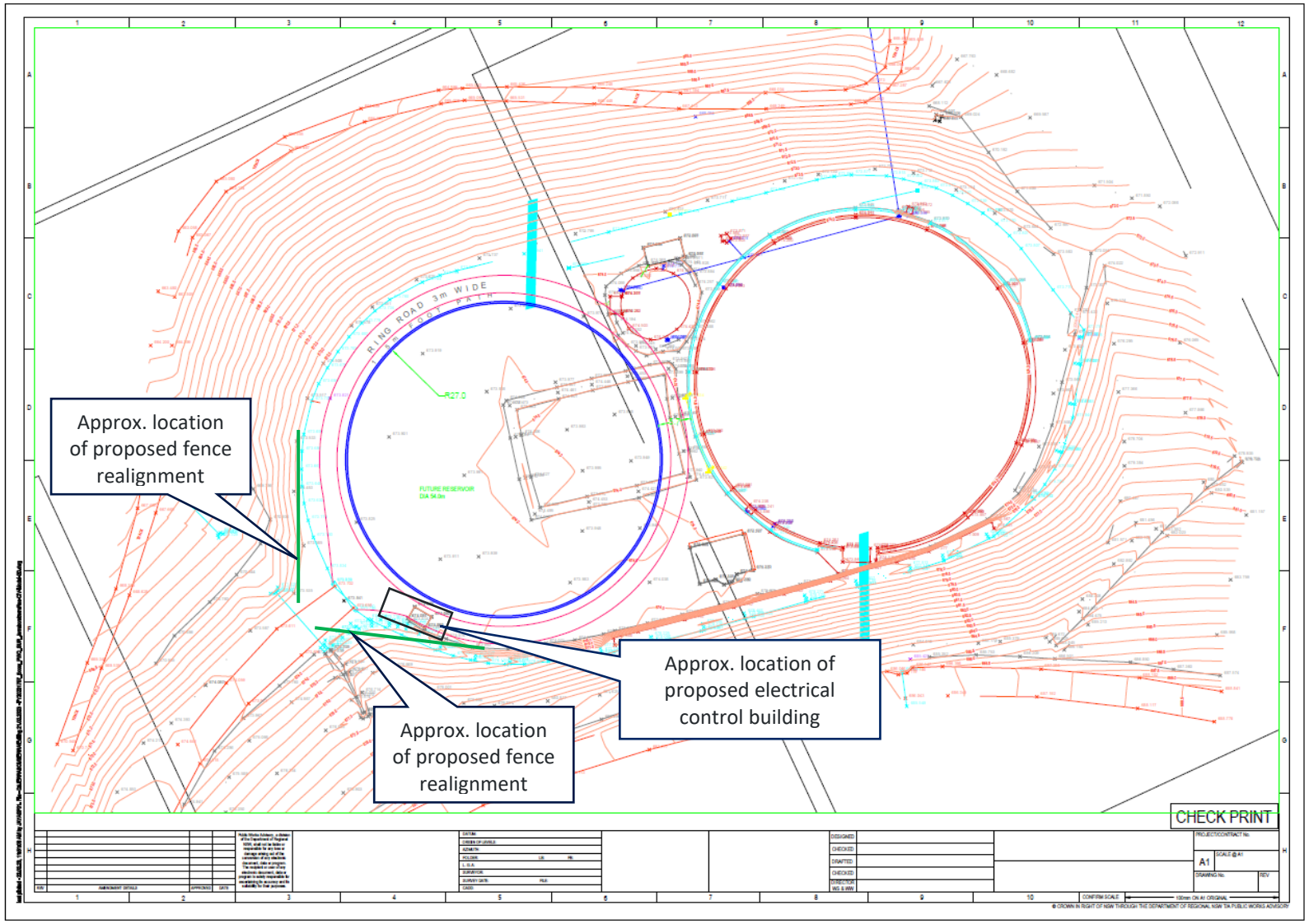


Figure 1-1: Site Plan for proposed new water reservoir and electrical building

Source: NSW Public Works, 2023

1.3. Location

Jerrabomberra is a suburb of Queanbeyan, which is located in the South East and Tablelands region of New South Wales, approximately 250 km south-west of Sydney and 12 km south-east of Canberra.

The existing Jerrabomberra Reservoir is located within the Mount Jerrabomberra Reserve (Lot 1206 DP 17204), approximately 3.5 km south-west of the Queanbeyan town centre. The proposed new reservoir and electrical building will be constructed immediately adjacent to the existing reservoir within the same lot.

The proposed temporary construction compound site will also be located within Mount Jerrabomberra Reserve within Lot 126 DP 17204.

The proposed construction compound site is accessible from Jerrabomberra Hill Road and the proposed reservoir is accessible from a short access road via Jerrabomberra Hill Road.

Location maps and aerial view of the subject site are provided in Figure 1-2 to Figure 1-4. Site photos are provided in Figure 1-5 to Figure 1-10.

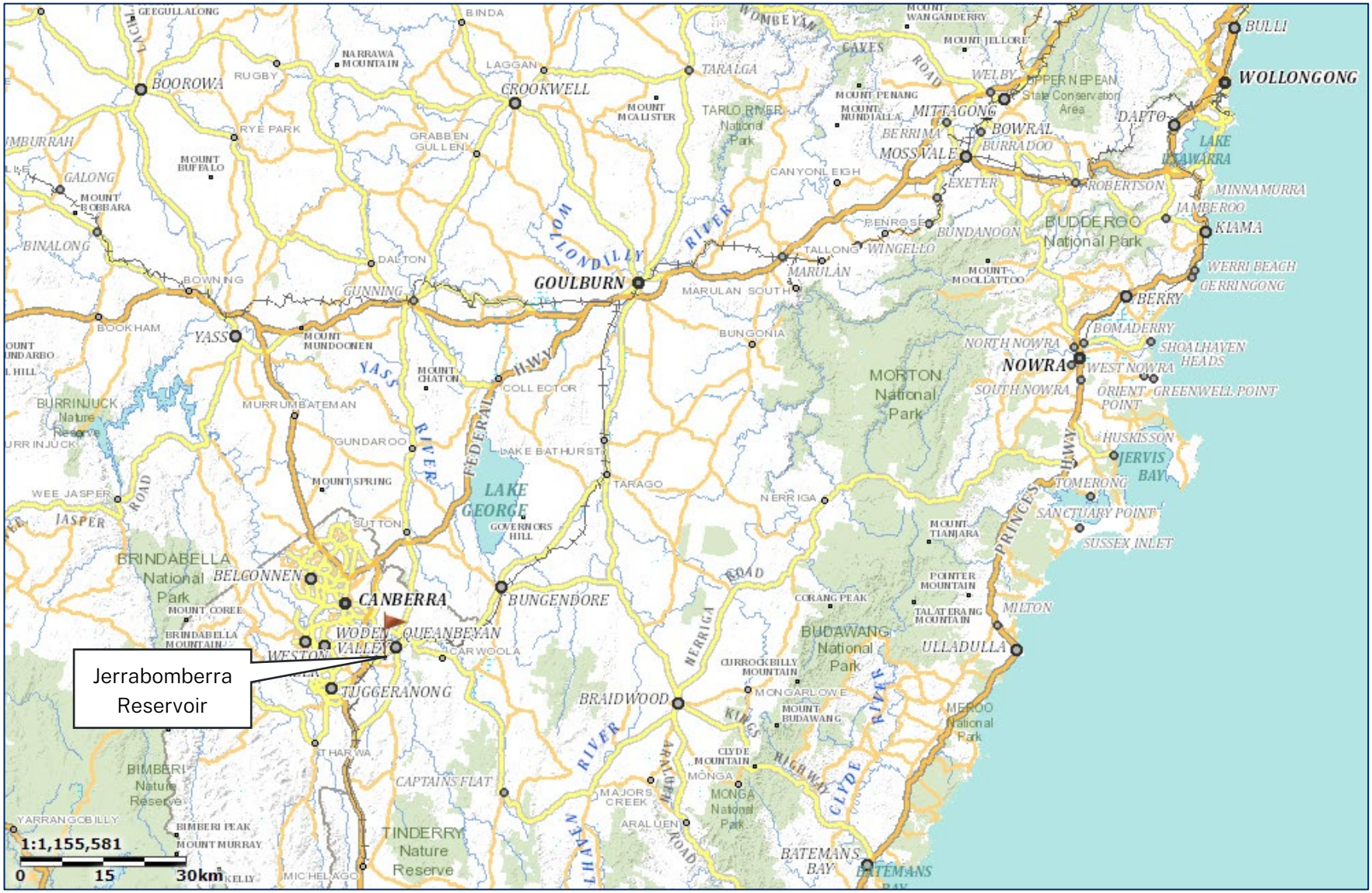


Figure 1-2: Jerrabomberra Reservoir Location Map

Source: Six Maps, accessed March 2023

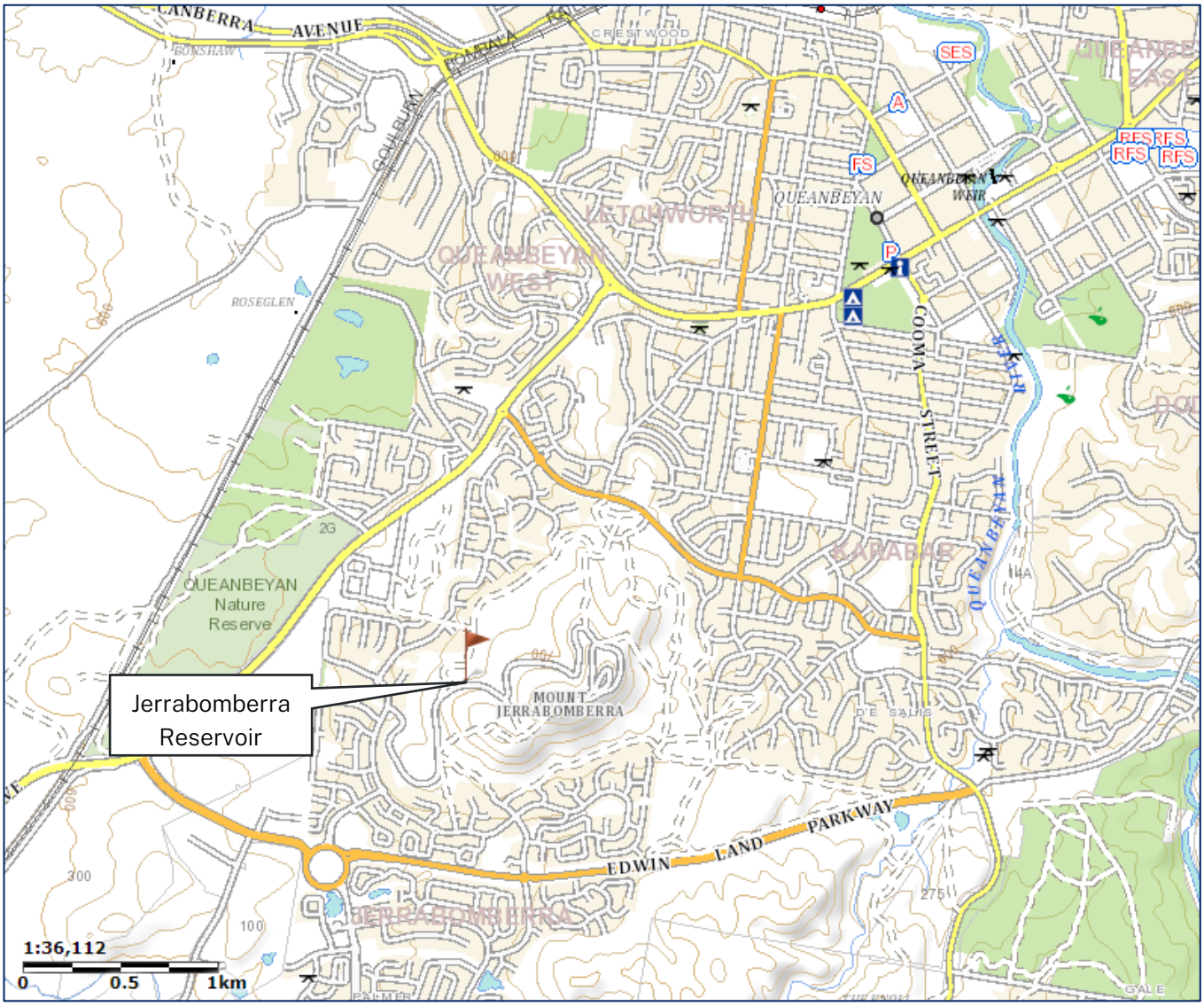


Figure 1-3: Jerrabomberra Reservoir Location Map

Source: Six Maps, accessed March 2023

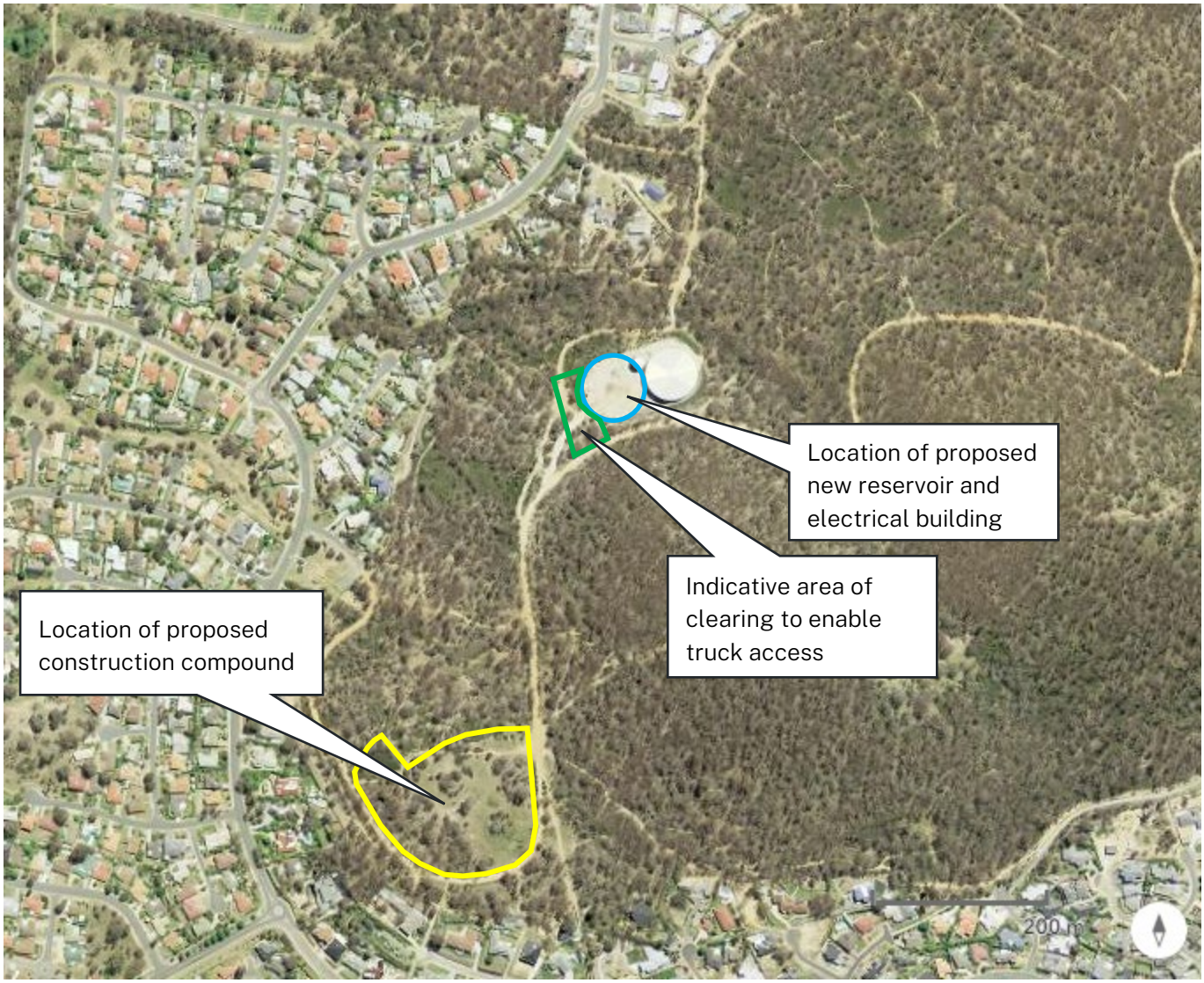


Figure 1-4: Jerrabomberra Reservoir Aerial Map

Source: ePlanning Spatial Viewer, accessed March 2023

Figure 1-5: View from southwest looking towards existing reservoir

Source: NSW Public Works, November 2022

Figure 1-6: View from existing reservoir looking towards southwest

Source: NSW Public Works, November 2022

Figure 1-7: North of existing reservoir looking towards west

Source: NSW Public Works, November 2022

Figure 1-8: North-west of existing reservoir looking southwest

Source: NSW Public Works, November 2022

Figure 1-9: View northeast across eastern half of proposed site compound area towards Jerrabomberra Hill Road

Source: NSW Public Works, May 2023

Figure 1-10: View northeast of study area adjacent to water reservoir fence

Source: NSW Public Works, May 2023

1.4. Land Ownership

The Proposal sites within Mount Jerrabomberra Reserve are owned by the following:

- Reservoir site and electrical building - 114 Jerrabomberra Hill Road, Jerrabomberra (Lot 1206 DP 17204) - QPRC Operational Land under the control of utilities.
- Temporary construction compound site - 32R Carolyn Jackson Drive (Lot 126 DP 17204) – private ownership (in principle agreement with owners obtained).

2. Statutory Considerations

2.1. Environmental Planning Instruments

2.1.1. Queanbeyan-Palerang Local Environmental Plan 2022

The Jerrabomberra Reservoir is located within the Queanbeyan-Palerang Local Government Area (LGA). The *Queanbeyan-Palerang Local Environmental Plan 2022* (LEP) applies to all land in the Queanbeyan-Palerang LGA. Under this LEP the proposed new reservoir and electrical building sites are zoned C2 Environmental Conservation (shown in Figure 2 1). The proposed works, which are defined as a type of water supply system, are prohibited within these zones under the LEP provisions.

However, as discussed in section 2.1.2, the proposed works are permitted without consent under the State Environmental Planning Policy (Transport and Infrastructure) 2021.

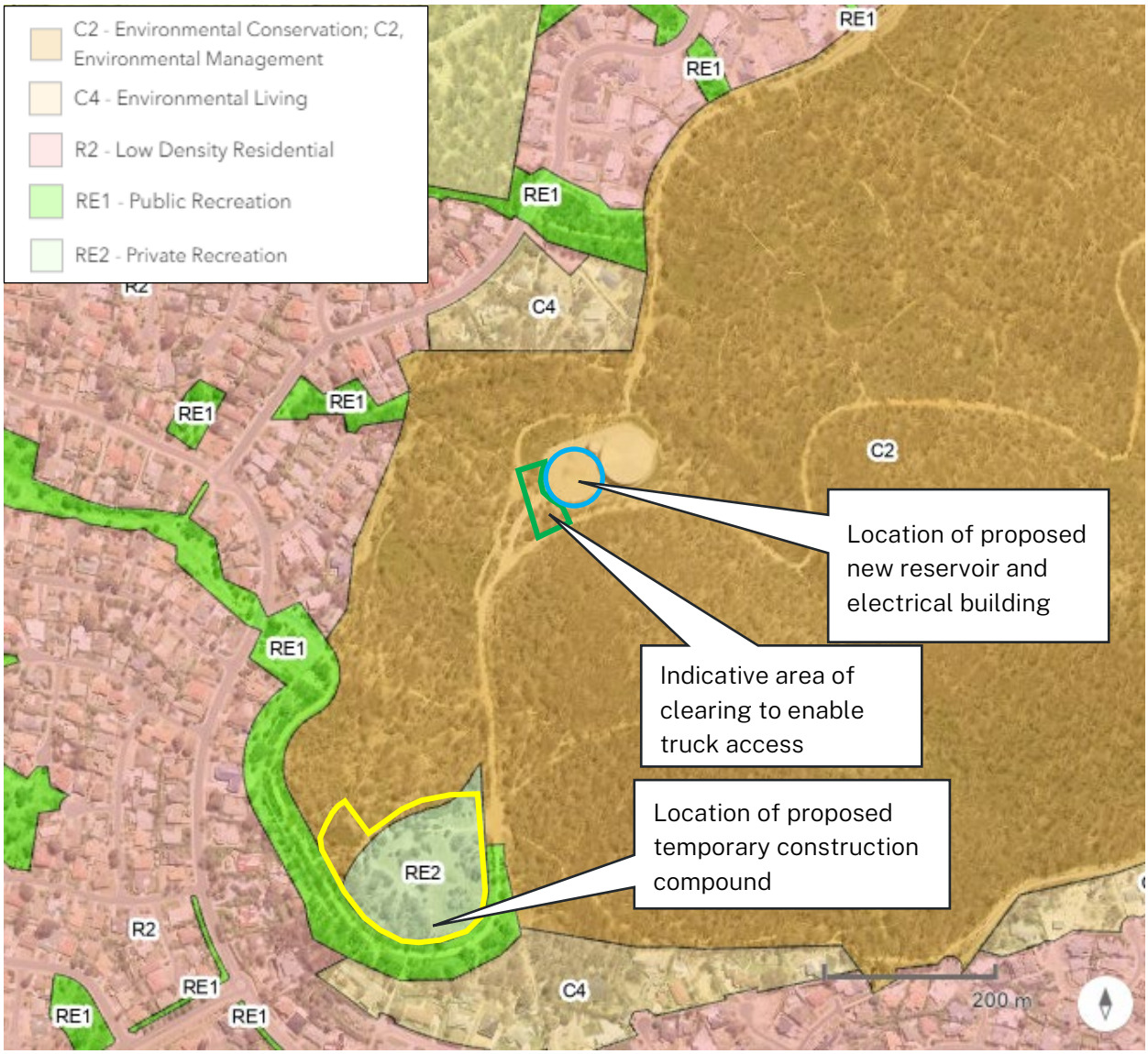


Figure 2-1: Extract of the Queanbeyan-Palerang LEP Zoning Map for the Proposal sites

Source: NSW ePlanning Spatial Viewer, accessed March 2023

Bushfire

The Proposal sites are mapped as bushfire prone land on the Bushfire Prone Land Map, certified by the NSW Rural Fire Services (Vegetation Category 1) (Figure 2-2). The bushfire hazard associated with the Proposal is discussed in section 5.11.

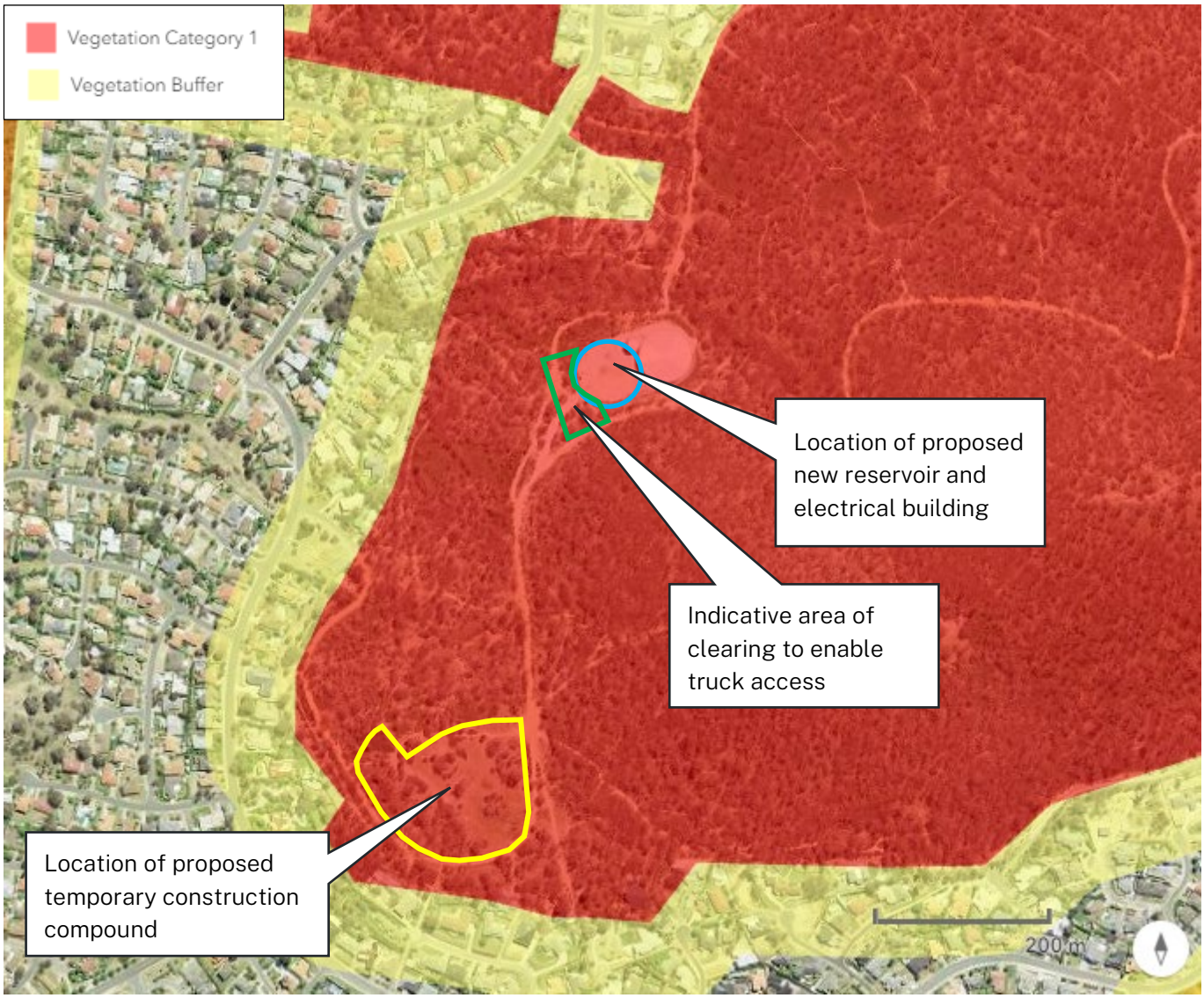


Figure 2-2: Extract of the Queanbeyan-Palerang LEP Bush Fire Prone Land Map for the Proposal sites

Source: NSW ePlanning Spatial Viewer, accessed March 2023

Terrestrial Biodiversity

The Proposal sites are mapped as “Environmentally Sensitive Land” under the Queanbeyan-Palerang LEP 2022 (Figure 2-3). A specialist Biodiversity Assessment was undertaken for the Proposal by Ecology Consulting in April 2023 (refer to Section 5.5 and Appendix A). Biodiversity impacts associated with the Proposal are discussed in Section 5.5.

Figure 2-3: Extract of the Queanbeyan-Palerang LEP Terrestrial Biodiversity Map for the Proposal sites

Source: NSW ePlanning Spatial Viewer, accessed March 2023

Scenic Protection

The proposal sites are mapped as “Scenic Protection Land” under the Queanbeyan-Palerang LEP 2022 (Figure 2-4). Under the LEP, development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that -

(a) measures will be taken, including in relation to the location and design of the development, to minimise the visual impact of the development on the natural environment and scenic amenity of the land, and

(b) the development will incorporate conservation and rehabilitation measures to preserve the scenic amenity of the land.

Development consent is not required for the proposal and therefore the provisions of the LEP do not apply. However, impacts on Scenic Protection are discussed in section 5.9.

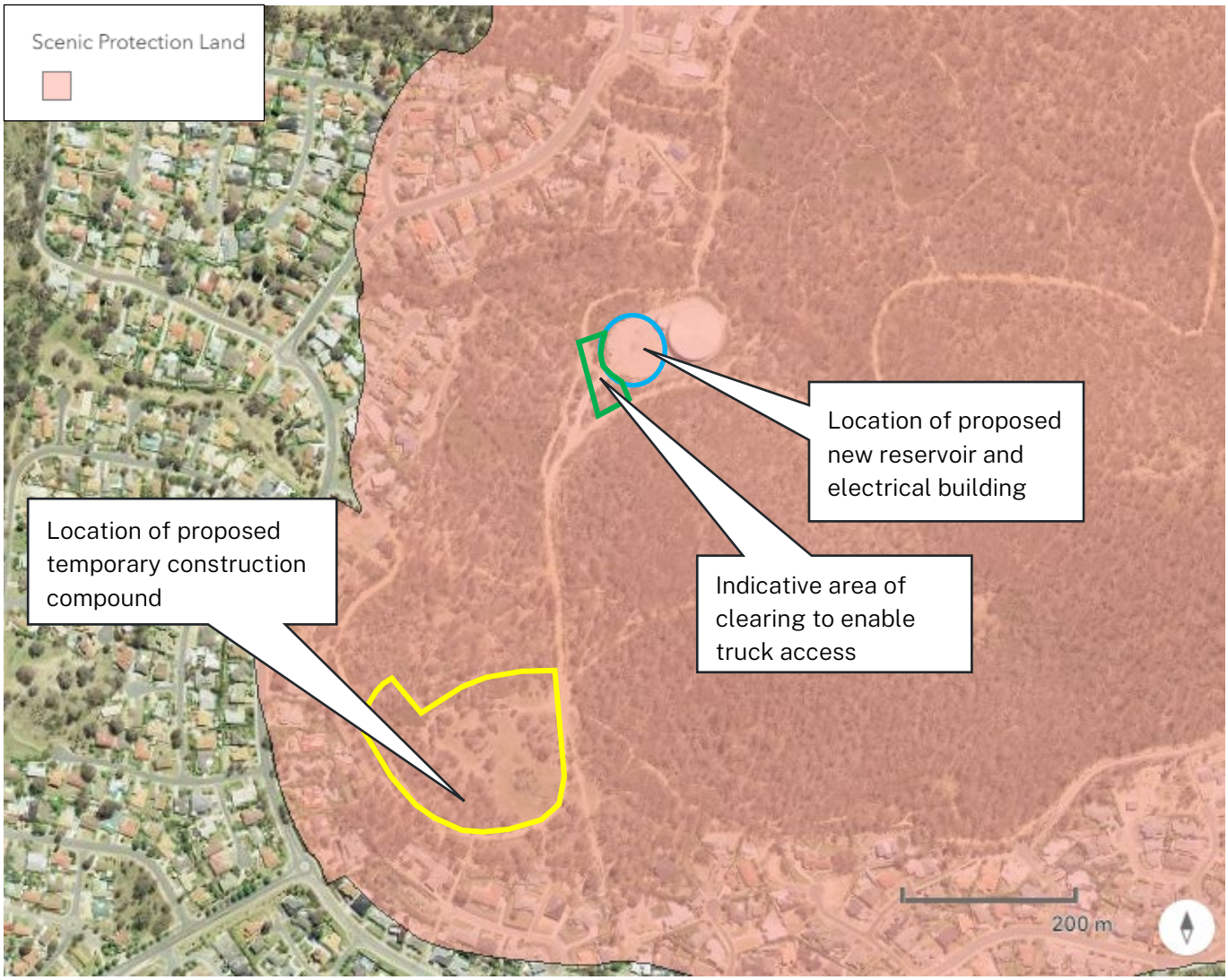


Figure 2-4: Extract of the Queanbeyan-Palerang LEP Scenic Protection Map for the Proposal sites

Source: NSW ePlanning Spatial Viewer, accessed March 2023

Heritage

The proposal sites are located on Mount Jerrabomberra which is listed as a local heritage item (Mount Jerrabomberra, Item: I304: Landscape – Natural) under the Queanbeyan-Palerang Local LEP 2022 (Figure 2-5). The LEP heritage listing states that the area provides habitat to a small number of plants of a nationally endangered daisy (*Rutidosis Leptorhynchoides*), as well as populations of two regionally uncommon plant species and stands of vulnerable native open forest and woodland.

Under the Queanbeyan-Palerang LEP, development consent is required for any of the following:

> *(a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance)—*
>
> *(i) a heritage item,*
>
> *(ii) an Aboriginal object,*
>
> *(iii) a building, work, relic or tree within a heritage conservation area,*
>
> *(b) altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,*
>
> *(c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,*
>
> *(d) disturbing or excavating an Aboriginal place of heritage significance,*
>
> *(e) erecting a building on land—*
>
> *(i) on which a heritage item is located or that is within a heritage conservation area, or*
>
> *(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance,*
>
> *(f) subdividing land—*
>
> *(i) on which a heritage item is located or that is within a heritage conservation area, or*
>
> *(ii) on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.*

Development consent is not required for this proposal and therefore the provisions of the LEP do not apply. However, impacts on heritage are discussed in section 5.6.

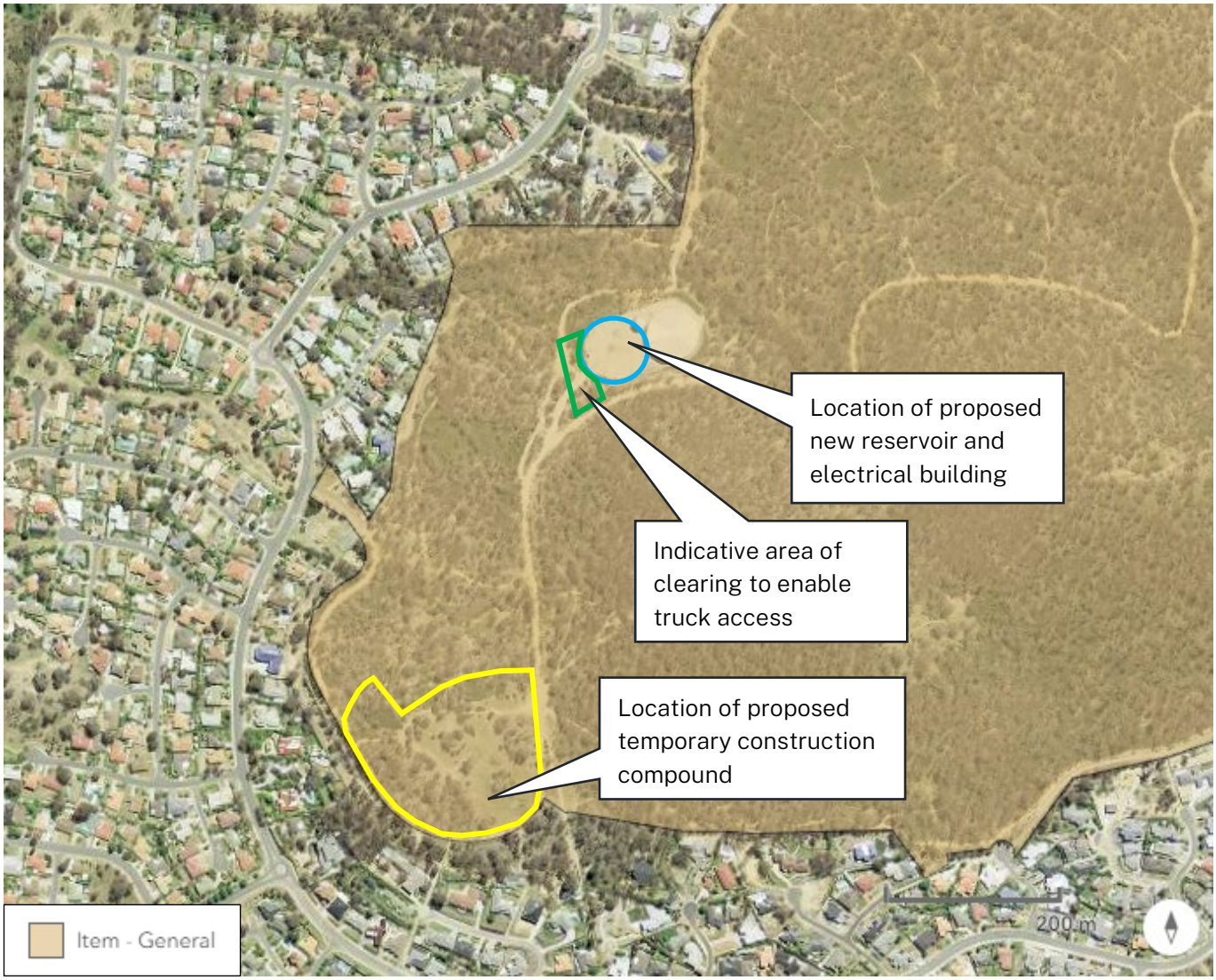


Figure 2-5: Extract of the Queanbeyan-Palerang LEP Heritage Map for the Proposal sites

Source: ePlanning Spatial Viewer, accessed March 2023

2.1.2. State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP (Transport Infrastructure) 2021) aims to assist in the effective delivery of public infrastructure by improving certainty and regulatory efficiency. It provides clear definition of the environmental assessment and approval process for public infrastructure and services facilities.

Division 24, section 2.159 (1) of the SEPP (Transport and Infrastructure) 2021 allows works for the purpose of a 'water reticulation system' to be carried out by or on behalf of a public authority without development consent on any land.

A water reticulation system is defined under the Standard Instrument LEP as a type of water supply system and means "a building or place used for the transport of water, including pipes, tunnels, canals, pumping stations, related electricity infrastructure and dosing facilities". The SEPP (Transport and Infrastructure) 2021 also defines a 'water supply reservoir' to be part of a 'water reticulation system'.

In addition, under section 2.159 (6)(g) of the SEPP (Transport and Infrastructure) 2021, a reference to development for the purpose of a water supply system of any kind includes a reference to development for power supply to the water supply system, if the development is in connection with the water supply system.

As the proposed water supply reservoir and electrical building is being constructed for the purposes of a water supply system constructed by a public authority (i.e. Council), the proposed works are permissible without consent under the provisions of the SEPP (Infrastructure and Transport) 2021.

2.2. NSW Statutes

2.2.1. Environmental Planning and Assessment Act 1979

The relevant environmental planning instrument for the Proposal is SEPP (Transport and Infrastructure) 2021 (refer to section 2.1.2), which removes the requirement to obtain development consent. Therefore, the Proposal has been assessed under Part 5 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act). QPRC is both the proponent and the determining authority for the Proposal.

This REF has been prepared in accordance with section 5.5 of the EP&A Act, which requires that the proponent take into account to the fullest extent possible all matters affecting or likely to affect the environment due to the proposed activity. Consideration of the factors listed under Part 8, Division 1, section 171(2) of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) has been used to assist in assessing the significance of the Proposal, and is provided in Appendix B.

Ecologically Sustainable Development

The encouragement of ecologically sustainable development (ESD) is one of the Objects of the EP&A Act. The principles of ESD are:

The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:

(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The works are considered to be consistent with these principles. Environmental safeguards have been proposed during the construction works to prevent long term and irreversible environmental degradation in accordance with the precautionary principle and inter-generational integrity. The proposed works would not significantly impact on biological diversity and ecological integrity at the site.

2.2.2. Local Government Act 1993

Under Section 59A(2) and 191A(1) of the *Local Government Act 1993* (LG Act), Council, as a water utility, is permitted to enter premises (excluding National Parks and Wildlife reserve land) without a licence or permit to undertake water supply and associated works. Accordingly, the Proposal works would be permissible by Council within both private and public land (excluding National Parks and Wildlife reserve land), subject to appropriate prior written notification by Council or prior consent from the landowner or relevant government authority. It is noted that the reservoir site is Council operational land and therefore no further approval is required under the LG Act.

2.2.1. Rural Fires Act 1997

The Proposal sites are on land identified as Bushfire Prone Land (Category 1) as identified on the Bushfire Prone Land Map, certified by the NSW Rural Fire Service (NSW RFS) (see Section 2.1.1).

Section 100B of the *Rural Fires Act 1997* requires RFS approval for development on bush fire prone land for a special fire protection purpose. The Proposal is not categorised as a special fire protection purpose; therefore, an approval from the NSW RFS is not required for the Proposal.

Nevertheless, to ensure protection of the proposed infrastructure, the design of proposed structures within bushfire prone land should consider any bushfire risks at the site. Refer to Section 5.11 for further details in this regard.

2.2.2. Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) regulates air, noise, land and water pollution. The Environment Protection Authority (EPA) is generally responsible for implementing the POEO Act and would be the appropriate regulatory authority for the Proposal.

The Proposal does not constitute a scheduled activity listed under Schedule 1 of the POEO Act and therefore an environment protection licence would not be required. Furthermore, as management measures would be implemented to prevent water pollution, it is considered unlikely that a licence would be required under Section 120 of the POEO Act for the pollution of waters.

Other relevant provisions of the POEO Act that the Proposal would need to comply with include:

- Section 115 – It is an offence to dispose of waste in a manner that harms or is likely to harm the environment.
- Section 116 – It is an offence to cause any substance to leak, spill or otherwise escape (whether or not from a container) in a manner that harms or is likely to harm the environment.
- Section 139 – The occupier of any premises who operates any plant (other than control equipment) at those premises in such a manner as to cause the emission of noise from those premises is guilty of an offence if the noise so caused, or any part of it, is caused by the occupier's failure: (a) to maintain the plant in an efficient condition, or (b) to operate the plant in a proper and efficient manner.

- Section 167 – The occupier of any premises must maintain any control equipment installed at the premises in an efficient condition. The occupier of any premises must operate any control equipment installed at the premises in a proper and efficient manner.

2.2.3. Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment Operations (Waste) Regulation 2014* sets out the provisions with regards to non-licensed waste activities and non-licensed waste transporting, in relation to the way in which waste must be stored, transported, and the reporting and record-keeping requirements. The proposed works (in particular aspects such as removal of spoil) would be undertaken to be consistent with the requirements of this regulation.

2.2.4. National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. Part 6 of the NPW Act provides specific protection for Aboriginal objects and declared Aboriginal places by establishing offences of harm. It is a defence against prosecution for unintentionally harming Aboriginal Objects if due diligence had been exercised to determine that no Aboriginal object would be harmed, or the harm or desecration was authorised by an Aboriginal heritage impact permit (AHIP).

Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86). Harm to an Aboriginal Place or Object includes any act or omission that destroys, defaces or damages the object or place, or, in relation to an Aboriginal object, moves the object from the land on which it had been situated. However, harm to an Aboriginal Object that is 'trivial or negligible' does not constitute an offence. Also, it is a defence against prosecution for unintentionally harming Aboriginal Objects if due diligence had been exercised to determine that no Aboriginal object would be harmed, or the harm or desecration was authorised by an Aboriginal Heritage Impact Permit (AHIP). The *National Parks and Wildlife Regulation 2009* made under the NPW Act advocates a Due Diligence process to determining likely impacts on Aboriginal objects.

The National Parks and Wildlife Regulation 2019 (NPW Regulation) made under the NPW Act allows a due diligence process in determining potential impacts of proposed works and actions to Aboriginal objects. The Aboriginal Due Diligence (ADD) process provides a defence to the offence of harming Aboriginal objects. The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW, 2010) outlines a series of low impact activities, definitions of disturbed land, and a series of 'steps' for the ADD process.

An Aboriginal Due Diligence Assessment (ADDA) was carried out by NSW Public Works Archaeologist in May 2023. The results are discussed in Section 5.6 of this report and a copy of the report is provided in Appendix C.

2.2.5. Heritage Act 1977

The *Heritage Act 1977* protects and aims to conserve the environmental heritage of New South Wales. Environmental heritage is broadly defined under section 4 of the *Heritage Act 1977* as consisting of "those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance" (Heritage Branch, DoP 2009:4). Aboriginal places or objects that are recognised as having high cultural value (potentially of local and State significance) can also be listed on the State Heritage Register and protected under the provisions of the *Heritage Act 1977*.

A search of the State Heritage Register and the section 170 Heritage and Conservation Register identified Mount Jerrabomberra as being of local significance (Listing No. I6).

Impacts on heritage are discussed further in section 5.6.

2.2.6. Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) protects species of threatened flora and fauna, endangered populations and endangered ecological communities and their habitats in NSW. It also lists Key Threatening Processes that adversely affects threatened species, populations or ecological communities or that may cause species, populations or ecological communities that are not threatened to become threatened. Amongst other matters, offences are established for damage to habitats of threatened species or threatened ecological communities. Defences to those offences include that the act was necessary for the carrying out of an activity by a determining authority within the meaning of, and after compliance with, Part 5 of the EP&A Act.

A Biodiversity Assessment has been prepared to assess impacts to threatened species and is attached in Appendix A. The assessment concluded that there is not likely to be a significant impact on the extent and viability of threatened species in the local area provided recommendations and mitigation measures are adopted (see Section 5.5). No approval under the BC Act is therefore required.

2.2.7. Water Management Act 2000

The objects of the *Water Management Act 2000* (WM Act) are to provide for the sustainable and integrated management of the water sources of the state for the benefit of both present and future generations.

Section 91B(1) of the WM Act requires a water supply works approval to be obtained for a number of works, including:

(b) a work (such as a tank or dam) for the purpose of capturing or storing water.

but does not include:

any work (other than a water supply work under the control or management of… a local water utility that receives water from a water supply work under the control or management of a local water utility.

As such, water supply works approval is not required for the reservoir as it receives water from an approved water supply work under the control of Queanbeyan-Palerang Regional Council, which is a local water utility.

2.2.8. Environmental Protection and Biodiversity Conservation Act 1999

The *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for Commonwealth involvement in development assessment and approval in circumstances where there exist 'matters of national environmental significance'. Matters of national environmental significance (MNES) include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance;
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- Nuclear actions (including uranium mining); and
- A water resource, in relation to coal seam gas development and large coal mining development.

A specialist Biodiversity Assessment was undertaken for the Proposal by Ecology Consulting (April 2023). The potential impacts of the proposed works were assessed against the MNES and no significant impact was considered likely (full report provided in Appendix A).

2.3. Consultation

Part 2, Division 1 of the SEPP (Transport and Infrastructure) 2021 specifies consultation requirements for development permitted without consent under the SEPP, including consultation with Council and other public authorities. However, notification under section 2.10 – 2.14 to the Council for whom the works is being carried out by or on behalf of is not required under section 2.17(c) of SEPP (Transport and Infrastructure) 2021. Consultation with other public authorities is also required for 'specified development' under sections 2.13 and 2.15. The Proposal is not specified development for the purposes of these sections.

Therefore, no statutory consultation was undertaken as part of this REF.

2.4. Summary of Approvals

A summary of the statutory approvals required for the proposal are listed in Table 1.

Table 1: Required Approvals

Agency	Requirements	Reference
Queanbeyan-Palerang Regional Council	Determination of Proposal	Part 5 of EP&A Act

3. Project Justification

This section reviews the existing infrastructure and provides the context and justification for the Proposal.

3.1. Need for the Proposal

The Jerrabomberra Reservoir is part of the Queanbeyan-Palerang Water Supply Scheme which supplies water to the bulk of the City of Queanbeyan, including the suburb of Jerrabomberra. The existing Jerrabomberra Reservoir is a steel reservoir with a storage capacity of 22ML. This reservoir has now been in continuous service for in excess of 40 years and is in need of refurbishment. In addition to this, the site lacks sufficient storage in the event of supply interruption from ICON, a shortcoming identified in Council's recently developed Queanbeyan IWCM. To address these concerns, QPRC is proposing to construct a new reservoir to provide for additional water storage and to enable rectification works to be undertaken to the existing reservoir. This REF has been prepared to assess the environmental impacts of the Proposal.

3.2. Do Nothing Option

The "do nothing" option would result in the continued operation of the existing reservoir, which will continue to degrade in condition over time, eventually to the risk of failure. It would also limit Council's capacity to guard against larger flow fluctuations and interruptions (either planned or unplanned) from ICON. This, therefore is not the preferred option.

3.3. Options for Reservoir Construction Techniques

3.3.1. Cast in-situ Reinforced Concrete

An option is to construct the new reservoir from cast in-situ reinforced concrete. Cast in-situ reinforced concrete reservoirs are the most commonly used reservoir type in NSW. If properly designed and constructed, cast in-situ reinforced reservoirs are expected to last in excess of 100 years. Issues associated with concrete structures include:

- Structural failures or rapid deterioration of the structure due to poor design.
- Deterioration of concrete structures due to poor construction methods and inappropriate quality controls.
- Deterioration of concrete due to environmental conditions such as acid sulphate soils, saline conditions, reactive soils etc.

3.3.2. Tilt-up Post Tensioned Concrete

A second option is to construct the new reservoir from tilt-up post tensioned concrete panels. In tilted panel construction, steel reinforcement is pre-stressed prior to concreting to prevent shrinkage cracks, and then post tensioned to take tensile load from water pressure. The bases of titled reservoirs are cast-in-situ without joints (i.e. monolithic) and post tensioned.

Walls are pre-cast with pre-stressed steel in panels either onsite or in a factory and then erected and post tensioned on-site. Factory casting of panels is preferred due to the greater control during the curing process. Onsite casting introduces greater variability in each panel, as they have the potential to cure differently based on the weather (temperature, humidity etc.) at the time of casting. Onsite casting of the panels is usually only considered over factory casting when transport of the panels to site from the factory would be difficult i.e. if the panels are very large or access to site is problematic.

The tilted panel technique enables thinner walls and fewer reinforcing bars, however, requires special machinery and crews for prestressing, panel assembly and post tensioning. Therefore, construction of tilted panel reservoirs requires a higher establishment cost and is often not considered economical for smaller reservoirs. For larger reservoirs they tend to be more economical than cast in-situ.

A risk associated with tilt-up panel construction lies in the narrow concrete in-fill sections between the panels. Honeycombing and leaks can result if concrete lifts in these sections are too high and are insufficiently compacted. This risk can be mitigated by limiting the height of pours to 2.5m in the specification.

3.3.3. Steel Reservoirs

Welded steel tanks have not been considered for the new reservoir at Jerrabomberra as maintenance intervals are more frequent at 20-30 years. The longer lived asset lives represented by concrete based tanks is considered the more attractive option.

3.4. Preferred Option

Tilt-up post tension concrete panel is the expected method for reservoir construction for this Proposal due to its size and location, however this may change to conventional reinforced concrete during the design and construction process.

4. Description of the Proposal

This section provides a description of the main components of the proposal.

4.1. Summary of the Proposed Works

The proposed works would consist of:

- A widened access point at the entry of the existing reservoir site
- Realignment of fences and the entry of the existing reservoir site
- Demolition of existing 1.8ML site steel reservoir
- A new 53m diameter, 10m high, water reservoir adjacent to the existing Jerrabomberra Reservoir
- A temporary construction compound area to be established on part Lot 126 DP 17204
- A new electrical control building (approximately 11 m x 4 m) within the footprint of the reservoir site.

The site plan of the proposed new water reservoir is shown in Figure 1-1. The finalised extent of works and exact footprint locations are yet to be determined by QPRC, however an indicative extent of clearing and generalised work areas are shown in Figure 1-4.

4.2. Construction Considerations

4.2.1. Methodology

The proposed construction methodology would be dependent on the contractor's method, equipment and program. Although the construction methodology is unknown at this stage, a construction methodology has been predicted based on past experience with construction of similar projects. The works are likely to involve:

Construction Compound

- Establishment of site preliminaries such as temporary security fencing, entry/exit points, erosion and sediment controls, site shed, toilet facilities, site signage, safe storage of hazardous materials etc. to meet SafeWork NSW requirements and current Australian Standards.
- Clearing of vegetation as necessary.
- General site clean-up at completion of the works.

Reservoir works:

- Establishment of site preliminaries such as temporary security fencing, entry/exit points, erosion and sediment controls, site signage, safe storage of hazardous materials etc. to meet SafeWork NSW requirements and current Australian Standards.

- Clearing of vegetation at reservoir entrance and laying of new material (e.g. crushed sandstone) at entry.
- Demolition of existing 1.8ML steel reservoir.
- Construction of the new concrete reservoir.
- Construction of reservoir ancillary features, which may include lockable ladders, reservoir roof, meters and overflow/scour valves.
- Construction of new scour (if required) and stormwater pipelines, including stripping and stockpiling of topsoil and replacement of spoil.
- Hydrostatic testing and chlorine disinfection of new reservoir prior to filling (Superchlorinated water would be dechlorinated within the reservoir and disposed of through the scour line to the environment (stormwater system)).
- Site stabilisation, including replacement/re-establishment of topsoil;
- General site clean-up;

Electrical Building:

- Establishment of site preliminaries such as temporary security fencing, entry/exit points, erosion and sediment controls, site shed, toilet facilities, site signage, safe storage of hazardous materials etc. to meet SafeWork NSW requirements and current Australian Standards.
- Clearing of vegetation as necessary.
- Construction of electrical building and conduit/wiring connections.
- Site stabilisation, including replacement/re-establishment of topsoil.
- General site clean-up.

Construction difficulties associated with groundwater are not envisaged. However, the presence of any seepage would depend on prevailing weather conditions at the time of construction.

The existing water supply system would remain operational during the proposed works.

4.2.2. Equipment

The types of equipment likely to be required for the Proposal would include the following:

- Bobcat or small excavator;
- Manual and power handtools;
- Large excavators with drill heads;
- Trucks carrying construction materials and for the transport of any excavated material from the site;
- Compressor, concrete vibrator, concrete mixer;

- Cranes;
- Backhoe/large excavator; and
- Passenger vehicles to transport construction workers

4.2.3. Environmental Management

Construction of the project would be undertaken in accordance with a Construction Environmental Management Plan (CEMP) that would be prepared by the construction contractor/s and reviewed by QPRC prior to commencement of construction. The CEMP would incorporate all of the mitigation measures identified in this REF as well as any conditions of approval and any other licence/approval conditions. The CEMP would also incorporate an emergency response plan in case of a pollution incident, a complaint handling procedure and a 24-hour telephone contact number. The complete list of the mitigation measures recommended in this REF is provided in Section 7 of this REF.

4.2.1. Timeframe

Proposal construction works are anticipated to commence in early 2025 and to conclude in early 2026 (approximately).

4.3. Operation

The proposed reservoir and associated infrastructure would be managed in accordance with the QPRC's adopted policies and Council's legislative and regulatory requirements. Specific mitigation measures to be included in the Operational Environmental Management Plan (OEMP) for the reservoir site have been listed in further detail in Section 6 of this REF.

5. Environmental Assessment

This section identifies and characterises the existing environment, the likely potential impacts associated with the construction and operational phases of the project and any associated mitigation measures. Where considered necessary, feasible mitigation measures are identified for implementation as part of the proponent's environmental management.

5.1. Assessment Methodology

The key objectives of this assessment are to:

- Identify those facets of the environment likely to be affected by the Proposal during both construction and operation;
- Identify the sensitivity of the site;
- Identify and characterise the associated impacts; and
- Identify and evaluate feasible mitigation measures for the identified impacts.

Environmental issues of potential relevance to the Proposal include:

- Location and Land use
- Traffic and access
- Soils, Erosion and Water Quality
- Biodiversity
- Heritage (Aboriginal cultural and historic)
- Noise and vibration
- Air quality
- Hazards
- Waste management
- Utilities and Services
- Socio-economic
- Cumulative impacts

5.2. Location and Land Use

The Proposal sites are located within the Mount Jerrabomberra Reserve. There has been limited development or impacts in the reserve, which are predominately associated with the access road/tracks and existing water storage tanks. The reserve is a popular location for recreation, providing a series of walking trails as well as a small viewing platform, and is surrounded by residential subdivisions.

The location of the Proposal sites is provided in Figure 1-2 to Figure 1-4.

5.2.1. Impact Assessment

The proposed new reservoir will be located adjacent to the existing reservoir and would therefore be consistent with the current land use. The new electrical building will be located within this same site. The use of the proposed construction site compound may have some temporary impacts on land use however once the works are complete, the site will be restored and rehabilitated. During construction, the works will cause some temporary disruption to the use and enjoyment of the Reserve through increased traffic, noise and dust. Further discussion of these impacts is provided below in Sections 5.3, 5.8 and 5.10.

Although the construction works may result in some disruptions to the local community, the works would be temporary only and would not significantly impact the use of the land. It is considered that an overall positive impact to the community would outweigh the temporary construction impacts. All construction activities would be carried out with due diligence, duty of care and best management practices. This would be documented in the project specific CEMP.

During operation, the Proposal would result in a positive impact to the local community through the provision of improved potable water supply security for the communities of Queanbeyan and Jerrabomberra.

5.2.2. Mitigation

Construction

- Neighbouring residents are to be informed of the construction works, predicted program and any access requirements. Council should consider informing the local community via their website or social media of the construction works and any associated impacts that may restrict / impact use of the area.
- Restoration of all areas disturbed during construction, including the compound site, would be undertaken in accordance with a rehabilitation plan.
- Best management construction impacts are to be documented in a project specific CEMP.

5.3. Traffic and Access

The Mount Jerrabomberra Reserve is a popular recreational area for the local community featuring multiple walking and cycling tracks and providing views over Queanbeyan and beyond. The site is accessible by the general public from Jerrabomberra Hill Road. Jerrabomberra Hill Road is a two-way dirt local road accessible off Halloran Drive.

The proposed construction compound site is accessible direct from Jerrabomberra Hill Road and the reservoir proposal site is accessible from a short access road via Jerrabomberra Hill Road.

5.3.1. Impact Assessment

Construction works are anticipated to commence in early 2025 and conclude toward the middle of 2026. The proposed works will generate additional traffic movements within the local area associated with construction vehicles and staff who would enter the sites via Jerrabomberra Hill Road. The construction workforce would vary according to the work being carried out, the construction method and contractor's program. Indicative average numbers during construction would be in the order of 15-20 employees (based on the construction of a similar sized reservoir).

It is estimated that the construction of the reservoir would involve an average of 6-10 truck movements per day plus additional traffic associated with construction employees during the construction period. Some activities would require more frequent truck movements, for example:

- delivery of materials; and
- concreting operations, which would require deliveries of large quantities of concrete.

The proposed works may temporarily restrict / limit public access along Jerrabomberra Hill Road and the dirt access track off Carolyn Jackson Road. Increased construction traffic on Jerrabomberra Hill Road and surrounding local roads may result in an increased risk to public safety.

Prior to the construction works commencing, Council would inform the local community of the proposed works including the anticipated duration of the construction works and any access restrictions or limitations to the Reserve. Appropriate signage and notification would also be installed by the Contractor at the work sites and along the access road as well as any walking / cycle trails to inform users of the increased risk associated with traffic movements on Jerrabomberra Hill Road and associated work areas.

Provided appropriate measures are adopted to address risks and inform the community and given the temporary duration of the construction works, impacts to users of the Reserve would be minimal, localised and short-term.

During operation of the reservoir, an operator would be required to occasionally access the site to undertake routine operational and maintenance works similar to the existing access requirements. Access to the site would generally be infrequent and no adverse impacts due to traffic and access during operation are expected. Manproof fencing will be maintained around the Reservoir site and the electrical building to prevent unauthorised access.

5.3.2. Mitigation

Construction

- The contractor would prepare a Traffic Management Plan (TMP) as part of the CEMP, to be reviewed by Council prior to commencement of works. The TMP would include measures to minimise traffic impacts to ensure public safety and would be prepared in accordance with:
  - Transport for NSW's Traffic Control at Work Sites Manual, Issued February 2022, and
  - Australian Standard 1742.3 - 2019 Traffic Control for Works on Roads.

- Trucks would not access the sites in weather conditions where damage to tracks or property may occur.
- All traffic would comply with all applicable traffic laws and regulations including speed limits. All construction vehicles would comply with the speed limits set for the roads accessing the site.
- Signage is to be erected at the entrance to the Mount Jerrabomberra Reserve advising of the construction works and any temporary access restrictions. Warning signs should also be installed along Jerrabomberra Hill Road to advise walkers and cyclists of increased traffic and any safety requirements.
- The construction compound and work sites are to be fenced to prevent unauthorised access and appropriate signage installed. Suitable security fencing is to be erected and maintained around the Reservoir site.

5.4. Soils, Erosion and Water Quality

The Proposal sites are situated on two different soil landscape types. The reservoir site is located on Campbell variant b soil landscape whilst the temporary construction compound site is located on Queanbeyan soil landscape.

The geology of the Campbell soil landscape consists of Silurian volcanics and sediments of the Canberra Block. The Campbell variant b soil landscape is characterised by rounded steep to rolling volcanic mountains and hills. Soils typical for this landscape is an A1 horizon of brownish black loam (0–10 cm in depth), and A2 horizon for dark brown loam (10–18 cm in depth) and a B horizon (18–48 cm in depth) of dull reddish brown light clay. Variant B of the Campbell soil landscape indicates that the soils will be stony (Jenkins 2002: 52–54).

The geology of the Queanbeyan soil land consists of Ordovician metasediments of the Pittman formation with interbedded sandstone, siltstone, shale and chert. Bedrock tends to be highly weathered, steeply dipping and highly fractured. The complicated lithology includes various tuffs, siltstones, sandstones, rhyolites, dacites and limestones. The Queanbeyan soil landscape is characterised by rolling to undulating low hills and rises on metasediments of the Canberra Lowlands. A typical soil profile for the Queanbeyan soil landscape includes an A1 horizon of dark brown loam (0–5 cm), an A2 Horizon of brown loam (5–30 cm in depth), and a B Horizon of bright reddish brown medium clay (30–70+ cm) (Jenkins 2000: 119–120).

5.4.1. Impact Assessment

Earthworks and general ground disturbances associated with the construction works could result in sediment and other materials leaving the site via wind or water movement. Aspects of the Proposal identified as potentially impacting on water quality include:

- Clearing of vegetation and trees
- transportation of imported fill to the site;

- excavations for works including foundations and site levelling;
- stockpiling of excess spoil;
- general construction waste entering drainage lines; and
- cleaning and maintenance of the reservoir during operation.

The contractor would establish appropriate controls, including erosion and sediment fencing, to stabilise active work sites and prevent or minimise the likelihood of erosion. It would be necessary to retain these controls until a vegetative cover had been re-established.

The reservoir and new pipeline connections would require disinfection as part of reservoir pre-commissioning process prior to operation. This would involve cleaning the interior of the reservoir and pipes with super-chlorinated water. The super-chlorinated water would be dechlorinated within the reservoir prior to disposal through the scour line to the environment. Alternatively this water may be reused into the reticulation subject to further investigations. Any discharge from the scour pipeline will be monitored and appropriate measures implemented to reduce and prevent inadvertent impacts (i.e. rock / rubble placed at scour discharge to reduce water flow). Therefore, any impacts to soils or water quality during the pre-commissioning process are anticipated to be minimal.

The Proposal will involve only shallow excavation and as such the works are not anticipated to impact any groundwater.

With implementation of the recommended mitigation measures, potential impacts on soils and water during construction are considered minor and unlikely to be significant.

During its operation, the new reservoir would be emptied on occasion for maintenance. The reservoir water would be discharged via the existing scour pipeline and in accordance with standard operating procedures. It is intended that the majority of this water will be reused where possible.

5.4.2. Mitigation

Construction

- A detailed Erosion and Sediment Control Plan (ESCP) shall be prepared as part of the CEMP. The ESCP would describe the site-specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication Managing Urban Stormwater: Soils and Construction, 4th edition (“The Blue Book”) and Managing Urban Stormwater: Soils and Construction, Volume 2a Installation of Services. The ESCP would need to be site specific and would need to address the following issues to prevent erosion, sediment loss and water quality impacts:
    - requirements for vegetation clearing to be kept to a minimum.
    - retention of all surface runoff on-site, and where possible stormwater from off site would be diverted around the construction site.

    - backfilling and stabilising of trenches once scour lines are installed.
    - Location and management of stockpiles, such as locating stockpiles away from any drainage lines near the works areas.
    - All erosion and sediment controls would be regularly inspected, especially when rain is expected and directly after any rain events.
    - All areas where ground disturbance has occurred would be stabilised following completion of works to ensure there is no erosion hazard and restored to their pre-construction condition. This would involve, where required, reshaping the ground surface, covering it with topsoil excavated from the site and re-establishing an appropriate vegetation cover.
    - Any excess spoil would either be spread across the ground in adjoining cleared area in such a manner as to avoid creating an erosion hazard, or removed off site for disposal in accordance with relevant Council and EPA requirements.
- A site specific spill management plan would be prepared and include the following requirements:
    - Emergency spill kits are to be kept at the site (vehicle kits).
    - Refuelling of machinery to be undertaken within the construction compound and appropriately protected as outlined in the spill management plan.
- Workers would be trained in the spill management plan and the use of the spill kits.
- Any hazardous materials stored on site would be stored in the compounds and within impervious and bunded enclosures capable of storing 120% of the volume of material stored there.
- All sealed roads leading to the Reserve would be kept clean and free of dust and mud at all times. Roads must be left clean at the end of every working day. Where excavated material is tracked onto roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable. Roads would, where necessary, be swept with a vacuum sweeper to remove all this material. Where hosing of the road surface is carried out loose material should be trapped to prevent it from being discharged into drains and waterways.

Operation

- The reservoir would be internally cleaned prior to discharging any reservoir water to nearby waterways. Any water discharged must be consistent with the requirements of the *Protection of the Environment Operations Act 1997* and suitable erosion and sediment control measures implemented to prevent damage to the surrounding environment.

5.5. Biodiversity

A specialist Biodiversity Assessment was undertaken for the Proposal by Ecology Consulting (April 2023). This section is a summary of the assessment's results, with the full report provided in Appendix A.

The study area is located within the Mount Jerrabomberra Reserve which comprises of 93.5 ha of largely native vegetation across an elongated hill with three peaks. The Reserve is connected to a larger patch of vegetation in the south-east, with a major road separating the Reserve from even larger patches of native vegetation further east. West of the study area are multiple patches of native vegetation including the Queanbeyan Nature Reserve (approx. 0.9 km), Jerrabomberra East Grasslands Nature Reserve (approx. 1.5 km) and the Jerrabomberra Wetlands Nature Reserve (approx. 8 km).

Under the *Mount Jerrabomberra Site Specific Plan of Management 2021* the native vegetation with the reserve is considered to be in excellent condition with isolated occurrences of significant weeds. The area is noted to contain locally and regionally significant flora and fauna that contribute to the diversity of the region.

The native vegetation of the area is characterised by a canopy of Inland Scribbly Gum (*Eucalyptus rossii*), Red Stringybark (*Eucalyptus macrorhyncha*) and Red Box (*Eucalyptus polyanthemos*) with a high diversity of shrubs accompanies by a grassy understory. The area is mapped as Scenic Protection Land and Terrestrial Biodiversity however it does not contain any Biodiversity Mapped values.

The vegetation within the study area is comprised of areas of varying composition and condition, including areas of good condition native vegetation with high biodiversity. Historical clearing and recreational activities have resulted in areas of largely removed canopy, reduced diversity of mid story and disturbed understory, particularly along the Jerrabomberra Hill Road, Reservoir site and the proposed site compound area. These areas have an increased occurrence of exotic species including important weed species in low abundance.

The proposal area contains three Plant Community Types (PCT): PCT 3747 (Southern Tablelands Western Hills Scribbly Gum Forest), PCT3375 (Monaro-Queanbeyan Rolling Hills Grassy Forest) and PCT353 (Central West Stony Hills Stringybark-Box Forest). These PCTs are not associated with any Threatened Ecological Community (TEC) and no TEC listed under the NSW BC Act or the Commonwealth EPBC Act occurs or is likely to occur within the study area. The study area was also observed to have a low to moderate diversity of native fauna with suitable habitat observed to vary across the study area reflecting disturbance to the site.

5.5.1. Impact Assessment

The proposal has been assessed with the potential to impact the entire 3.15 ha of the study area, however clearing or otherwise direct impacts would likely be concentrated within already degraded

areas of vegetation. Through field assessment and vegetation mapping it has been determined that there is 1.33 ha of degraded native vegetation within the study area and works should be contained within these areas where possible. Additionally, important habitat in the form of hollow-bearing-trees have been mapped within these areas to help further identify habitat to avoid within the areas of degraded vegetation.

Threatened fauna and flora species with potential to be present on the site have been identified and assessed. Although no threatened flora or fauna species were observed within the study area during field surveys, a number have been assessed to have potential to utilise habitats within the proposal area. A Threatened Species Test of Significance (TOS) for impacts of the proposal on threatened species known or likely to occur within the proposal area or immediate surrounds has determined that if recommendations from this report are followed, there is not likely to be a significant impact on the extent and viability of threatened species in the local area.

Direct Impacts

- **Vegetation clearing**

The native vegetation that has the potential to be cleared varies in composition and condition, with distinct areas of high biodiversity value and areas where historic clearing and disturbances have degraded the biodiversity value of the native vegetation. Despite any potential clearing, the woodland surrounding the proposal site would still retain connectivity to other areas of native vegetation and fall within a large, continuous patch of protected native vegetation within Mount Jerrabomberra Reserve. It is therefore unlikely that the potential clearing attributed to the proposal would cause fragmentation or reduce the overall connectivity of the wider patch.

Potential clearing would cause the removal of many non-threatened individual plant species, particularly within the highly diverse mapped PCTs. Additionally, potential clearing may require the removal of old growth trees, mature trees (some containing hollows) and areas where canopy regeneration is occurring.

Recommendations have been made in section 5.5.2 to avoid and minimise the impacts associated with any potential vegetation clearing works.

- **Removal of habitat**

The proposal has the potential to remove up to 3.15 ha of native vegetation and the associated habitat resources that native fauna utilise, this may include threatened fauna species likely to occur within or nearby the study area. The removal of these food, foraging and breeding resources has the potential to adversely impact local fauna abundance and diversity. Reduction in habitat services can change resource-driven interactions between species, whether it be loss of food resources, loss of breeding habitat, increased competition, or changes to predatory relationships. However, these impacts can be reduced or avoided if the recommendations in section 5.5.2 are adhered to.

- **Fauna injury or mortality**

Potential clearing works are likely to result in the injury or mortality of individual fauna, including less mobile species or small hidden fauna. Ground dwelling fauna, such as reptiles and frogs, have been found beneath rocks and debris within the study area, and may be at risk during clearing activities. Many hollows have been observed within the study area, there is a potential risk of injury or mortality to native fauna such as birds, bats, reptiles and arboreal mammals that may be sheltering within. Recommendations have been made in section 5.5.2 to avoid and minimise the risk of vegetation clearing works causing injury or mortality to native fauna.

Indirect impacts

- Erosion and sedimentation

The proposal will require construction activities that may cause erosion, sedimentation, pollution or contaminated runoff within the study area, and through nearby waterways. Potential sources of soil and water pollution may include,

- Increased erosion potential in areas cleared of vegetation,
- Soil disturbances during any potential earthworks or construction,
- Inappropriate management of material stockpiles,
- Spills of leaks from incorrect storage of fuel, oil, and other chemicals, or from any uncovered loads coming to and exiting the project site.

Measures to mitigate the risk for pollution from construction activities are described in section 5.5.2.

- Weed invasion and edge effect

Disturbance associated with vegetation clearing, vehicle traffic and general day to day operations during construction increases the potential for the introduction, spread, and establishment of weed and pest species. Weed species are effective competitors for food and habitat resources and have the potential to exclude native species and modify the composition and structure of vegetation communities.

The 'edge effect' includes any increased disturbance or pollution as a result of altered environmental conditions within an adjacent area. Changes such as removal of native vegetation, increased traffic, light, noise, erosion or sedimentation can have impacts that bleed into neighbouring areas. The proposal likely will increase the impact from edge effects though native vegetation clearing and various construction activities. It is likely that the proposal will create new edges along areas of native vegetation that currently has minimal disturbance, increasing the potential for weed invasion and spread. Management strategies to minimise impacts from weed invasion and edge effect can be found in section 5.5.2, including recommendation to develop a weed management sub-plan as a part of the proposals CEMP.

- Introduction and spread of pests and pathogens

Construction activities have the potential to introduce or spread pathogens such as Phytophthora (Phytophthora cinnamomi), Myrtle Rust (Uredo rangelii) and Chytrid fungus (Batrachochytrium

dendrobatidis) into nearby native vegetation through vegetation disturbance and increased site visitation. Phytophthora and Myrtle Rust may result in the dieback or modification of vegetation and damage to fauna habitats.

The potential for significant or new impacts associated with these pathogens is relatively low, given the creation of exclusion zones to ensure limited access to areas outside areas to be directly impacted. To help mitigate any risk of pathogens being brought onto and/or spread through the site all machinery brought to site and leaving the site should be washed down and inspected to be free of soils, seeds, and other organic material in accordance with section 5.5.2.

- Noise, vibration and light impacts on fauna

In the short term, construction vehicles and machinery will increase in noise and vibrations in and around the proposal area. The increase in noise and vibrations may disrupt fauna changing foraging behaviour, impacting breeding success and changing species occurrences. Fauna in close proximity to construction activities are more likely to be impacted, particularly species which are nesting, roosting or denning.

Given the temporary nature of the works and the availability of alternate habitat in the surrounding Mount Jerrabomberra Reserve, it is unlikely that the temporary increase of these disturbances produced by construction activities will significantly impact fauna that occur within or near to the study area. However, recommendations to mitigate potential impacts are specified in section 5.5.2.

Cumulative impacts

- Fragmentation and isolation of vegetation

The proposal has the potential to remove or otherwise directly impact up to 3.15 ha of native vegetation within the 93.5 ha Mount Jerrabomberra Reserve. The areas proposed for potential clearing are comprised largely of already disturbed sites at the edge of the reserve, and will not disrupting connectivity within the surrounding native vegetation. It is therefore unlikely that the clearing of native vegetation for the proposal would significantly fragment or reduce the overall connectivity of the patch, given the extent of vegetation removal anticipated and its location. Additionally, Mount Jerrabomberra Reserve is a protected patch of native vegetation valued for conservation and recreation, ensuring no further native vegetation removal will occur.

- Fragmentation and isolation of habitat

Habitat loss through clearing of native vegetation, removal of particular strata or features within an area can create barriers to the movement of fauna and diminish their access to habitat resources. Although there are areas within the proposal site that have historically been cleared, mature HBTs have been retained in these areas.

Although additional removal of habitat within the proposal area might constitute a small area within Mount Jerrabomberra Reserve, the habitat present in the proposal area is likely valuable at a local scale. It is recommended that removal or significant disturbance to hollow bearing trees (HBTs) is avoided wherever possible and other recommendations in section 5.5.2 are adhered too. If these

recommendations are followed it is unlikely that the proposal will create anysignificant fragmentation or isolation of habitat.

- Impacts on threatened biota and migratory species

The proposal has the potential to result in adverse impacts on threatened species and their habitats within the proposal site. Impacts to native vegetation, and therefore threatened biota, should be minimised as much as practically possible through refinement of proposal design, including location of works footprint, infrastructure location and ensuring prioritisation of utilising existing disturbed sites.

- Threatened ecological communities

There are no TECs listed under the BC Act or EPBC Act within the study area and therefore no impacts are likely.

- Threatened species

Threatened flora

There is broadly suitable habitat for six threatened flora species within the study area. Although no threatened flora species were observed during field assessment, the presence or absence of four of the threatened species cannot be confidently determined as surveys could not be conducted during the optimal survey period.

As the study area consists of areas of high and lower quality habitat (historically cleared and disturbed), of which the degraded habitat found within the study area is considered less likely to contain the above-mentioned species. It has therefore been recommended that works remain within the areas of higher disturbance, however if works are required within areas of high biodiversity targeted surveys at the optimal time of year (September to December) should be conducted. If the proposal adheres to these recommendations, it is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction.

Threatened fauna

Assessments of significant impacts mandated by the BC Act (5-part test) and EPBC Act have been prepared for impacts on the threatened fauna species that have a high to moderate likelihood of occurring in the proposal site on occasion and where impact is likely due to habitat removal. There is broadly suitable habitat and close records available for 19 threatened bird species, one threatened insect, two threatened mammals and two threatened reptiles.

Generally, it has been determined that the proposal, and any potential clearing, is considered likely to have an adverse effect on the above-mentioned species if they are present locally. A range of measures have been recommended to avoid and minimise the impacts of the proposal on the above species. These include recommendations for works to be confined to degraded areas, avoidance of HBT and pre-clearing surveys. Provided these measures found in section 5.5.2 are adhered to and works remain in the recommended areas (lower quality), the proposal is not considered likely to have

a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction.

Migratory species

The only migratory species considered likely to be occasionally present is the White-throated Needletail (*Hirundapus caudacutus*). This species spends much of its time foraging for insects high above the canopy. Although there is potential that the species forages in the vicinity of the proposal area, it is unlikely that the proposal would have any impacts on the species.

Key threatening processes

Key threatening process (KTP) is a process that threatens or threaten the abundance or survival of a native species or ecological community. A process can be listed as a KTP under the BC Act or EPBC Act under slightly different criteria, but generally as a result of:

- causing a native species or ecological community to become eligible for inclusion in a threatened list (other than the conservation dependent category); or
- causing an already listed threatened species or threatened ecological community to become more endangered; or
- adversely affect two or more listed threatened species or threatened ecological communities.

KTP's of relevance to the proposal include:

Feral Animals

The proposal is located very close to residential and urban area which likely means many of these species are already prevalent. The proposal is considered very unlikely to increase the impact of this KTP as the area which the proposal is located is already very close to urban landscape where these pests have already been introduced.

Weeds

There is an absence or low abundance of noted weed species within the proposal area. Construction activities have the potential to introduce and facilitate the establishment of various weed species within the proposal area and immediate surrounds. Impacts will be mitigated by appropriate weed control measures prior to, and rehabilitation efforts post, construction.

Overall, it is unlikely that the proposal will significantly contribute to this KTP given appropriate measures are implemented as recommended.

Habitat modification

The proposal may require the removal of native vegetation or habitat features within the study area, however if recommendations to keep works within the areas already degraded and avoid the removal of hollow-bearing trees the proposal is not likely to result in the loss, or long-term modification, of the structure, composition and ecological function of the area. Additionally, mitigation and rehabilitation measures will minimise any long-term impacts.

5.5.2. Mitigation

Pre-Construction

- The Proposal works are to be designed to minimise vegetation and habitat removal (including removing of hollow bearing trees) as much as possible. The works impacts should be concentrated within the already degraded areas of vegetation as identified in Figure 10 of the BAR. By limiting impacts to these areas, the proposal is unlikely to cause any significant impacts to native vegetation or threatened biota within the proposal area.
- Where impacts are likely to extend into areas of good condition vegetation, targeted surveys at the optimal time of year (i.e. September to December) should be employed to confidently determine presence of threatened species and avoid impacts.
- A Construction Environmental Management Plan (CEMP) is to be developed to identify measures to be undertaken before, during and after construction to minimise the direct impact of the proposal on matters of biodiversity. Such measures may include (as necessary):
    - Erosion and Sediment Control Plan,
    - Weed Management and Restoration Plan,
    - Nest Box Installation and Monitoring Plan, and
    - Landscaping Plan.

Construction

- To avoid unnecessary removal or damage to areas of high biodiversity, ecologically valuable habitats and other retained vegetation, the clearing area (construction footprint) should be clearly demarcated with temporary fencing and signage where appropriate.
- Contractors, workers, and visitors to the proposal site are to be made aware of clearing limits and any no-go zones as part of their site induction.
- All cleared vegetation (with the exception of weeds) should be mulched and spread on site to assist in regeneration of the site. Large branches should remain in-situ and be retained on site.
- Where habitat trees (e.g., trees containing stick nests, hollows, cavities, and other features likely to contain residing fauna) are to be removed, a pre-clearance survey should be undertaken by a suitability qualified ecologist ahead of any clearing. Pre-clearing surveys would consist of:
    - inspection of trees and habitat features for the presence of residing fauna,
    - demarcation, mapping and recording of key habitat features (e.g., hollow-bearing trees, fallen logs and bush rock),

- identification and nomination of hollow-bearing trees, bush rock or hollow logs to be salvaged and relocated to adjacent vegetation or landscape areas where appropriate, and
- reporting requirements following the completion of pre-clearing surveys, detailing the location and type of each habitat feature.

Pre-clearing surveys would also be undertaken as a final check for threatened flora and fauna potentially present. A follow-up, rapid survey should be conducted immediately prior to vegetation clearing in order to identify any new habitat features that could not be accounted for during initial pre-clearing surveys.

- In the case that a threatened species is identified utilising a tree or other habitat feature during construction, removal will only be once the ecologist determines the breeding period for that species has ended and all juveniles have moved on. Furthermore, adaptive management of the threatened species is to be applied as determined by the ecologist, a tree may also be removed after a pre-clearance inspection if a qualified ecologist determines no hollow-dwelling or nesting species are present at that time.
- Upon completion of pre-clearing inspections and rapid surveys outlined above, all clearing should be supervised by an ecologist and conducted utilising a two-stage clearing process as follows:
  - Stage 1: This stage consists of clearing trees, and other native vegetation identified by the ecologist as not comprising key habitat features likely to contain residing fauna. Habitat trees (as marked) are not to be removed during this stage and consequently would be isolated for removal during Stage 2. Other habitat features (e.g., bush rock, hollow logs, and man-made structures) may be removed during this stage under the supervision of an ecologist.
  - Stage 2: Clearing for Stage 2 is to be undertaken at a minimum of one day following Stage 1 clearing. This is to provide a chance for residing fauna to voluntarily disperse overnight. After habitat trees have been left overnight, the identified trees may be cleared using the following best practice techniques.
    - ▪ trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any residing fauna to leave the hollows.
    - ▪ trees containing stick nests will be inspected and nest carefully removed by a tree climbing arborist or personnel qualified to use an elevated working platform (EWP).
    - ▪ a bulldozer or excavator is to carefully push the tree over.
    - ▪ the tree is to be left in its cleared position until completion of an inspection by an ecologist for the presence of fauna (the ecologist may require the tree to be rolled over to undertake a detailed inspection of all hollows).

▪ the cleared habitat tree may be left overnight to allow any remaining fauna time to leave the hollows and disperse from the construction area.

▪ branches containing hollows and sections of trunk will be set aside for salvage including immediate transfer to a dedicated storage area. Following construction tree materials over 10 cm DBH will be relocated to a suitable area in the locality to be utilised for habitat.

- A suitably qualified and vaccinated ecologist should be engaged to supervise removal of all native vegetation and habitat features for the proposal in order to minimise the chance of harm to fauna, and to rescue or relocate any fauna displaced during the clearing process.
- Where hollow bearing trees are to be removed, nest boxes are to be installed and monitored in accordance with a Nest Box Installation and Monitoring Plan. The plan should provide for the replacement of hollows removed and unsalvageable with at a minimum, one similar sized artificial hollow (nest box).
- A suitable Erosion and Sediment Control Plan (ESCP) is to be prepared and included in a site-specific CEMP to reduce sedimentation of the ephemeral drainage line.
- Weeds are to be managed in a strategic and coordinated manner across the proposal area:
    - identification, mapping, and treatment of priority weeds before clearing commences,
    - manual weed removal is preferable to the use of herbicides where appropriate,
    - advise all workers and visitors of biosecurity measures in place,
    - weed infested plant material to be disposed in accordance with waste management legislation,
    - e.g., appropriate disposal of weed material, including seeds, into bags or plastic sheeting to prevent the spread of existing weed species,
    - hygiene controls such as cleaning and inspecting for soil or organic material on plant, equipment, and clothing prior to site arrival, including clean vehicles and tyres,
    - implement frog hygiene and pest control protocols,
    - monitor high-risk and high- traffic areas such as roads and bare ground,
    - control the movement of plant, equipment, and workers to minimise the potential for the spread of weeds within and outside the proposal area, and
    - continued monitoring and follow-up treatments where necessary within proposal area.

Post Construction and Operation

- All disturbed areas should be stabilised prior to the removal of any erosion and sediment controls.

- The site construction compound should be allowed to regenerate. Where necessary, Council should develop a Weed Management Strategy to remove and control weeds on this site.
- Where removal of trees and other significant vegetation is necessary, Council should consider providing replacement planting to offset any potential impacts. Any replacement plantings should be guided by the indicative planting list associated with the relevant PCT's contained in the BAR.

5.6. Aboriginal Heritage

Aboriginal Heritage

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) was conducted on 27 March 2023. A total of 83 previously recorded sites were identified within the AHIMS search area which covered approximately 3 km zone around the Proposal sites. The majority of the recorded sites were artefact scatters followed by isolated finds. The closest recorded AHIMS sites to the Proposal sites was located approximately 735m southwest. There are no sites registered on the AHIMS in the study area or inside Jerrabomberra Mountain reserve.

5.6.1. Impact Assessment

Aboriginal Heritage

Due to the sensitivity of the surrounding site, NSW Public Works prepared an Aboriginal Due Diligence Assessment (ADDA) (May 2023), including a site survey, to consider the potential impact the proposed works may have on items of Aboriginal heritage. The Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW, 2010) was used in assessing the likelihood of encountering items of Aboriginal cultural heritage during the construction works. A copy of the ADDA is provided in Appendix C.

A visual inspection focused on the two study areas and any areas clear of grass within them as part of the ADDA. The inspection revealed that:

- The proposed construction site compound (laydown area) is located north and west of a bend of Jerrabomberra Hill Road, approximately 330 m south of the reservoir site. The road in this area has been cut in the top and middle of the slope from the small knoll in the centre of the laydown area. The area has been partially cleared of trees previously, especially closest to the road and in its centre. GSV was variable, with high visibility across the previously cleared area where there was minimal trees and scattered grasses, and moderate GSV across the remaining area due to leaf litter and ground cover. There is a high density of raw stone across the area, including some small outcrops eroding from the ground surface.
- The study area adjacent to the fenced water reservoir location is located on a slope between the track into the fenced water reservoir site and another unnamed track which runs north along the outer edge of the mountain reserve. The GSV in this area was high, and there is a

concrete water culvert and drain running parallel to the north of the track. The area has also been affected by water wash and erosion and there is limited or no topsoil remaining.

- The existing water reservoir location is located on a on large bench which has been cut into the side slope of the mountain. The area is fenced and there is a large steel water reservoir present and a security fence. This location has been previously gravelled and is heavily disturbed, with no natural ground surface visible.

No Aboriginal sites or objects have been recorded inside the study area. The study area has a low potential for archaeological deposits to be present. Based on the results of this assessment, no further archaeological assessments are necessary. The results of the Aboriginal due diligence assessment have determined the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community.

The ADDA recommended:

- The Proposal may proceed at the study area with no further archaeological investigation. The Proposal and all land and ground disturbance activities must be confined to inside the study area. Should the Proposal extent outside the study area then further archaeological assessment may be required.
- All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols.
- This assessment has concluded that Aboriginal objects are unlikely to be harmed by the proposed works. However, if during works, Aboriginal objects, artefacts, or skeletal material are noted the Unanticipated Finds Protocol should be followed.

5.6.2. Mitigation

Construction

- All workers (including contractors) should be made aware that it is illegal to harm an Aboriginal object or historic relics, and if a potential Aboriginal object or historic relic is encountered during activities, then all work at the site will cease and Heritage NSW, Department of Premier and Cabinet will be contacted.
- All workers (including contractors) should be inducted concerning Aboriginal cultural heritage values and basic training should be provided for identifying Aboriginal objects.
- In the event that known or suspected Aboriginal objects, artefacts or skeletal remains are encountered during the activity, the following unexpected finds protocol will be followed:
    - All work in the immediate vicinity will cease;
    - The find will be immediately reported to the work supervisor who will immediately advise the Environment Manager or other nominated senior staff member;

- The Environment Manager or other nominated senior staff member will promptly notify the police and the state coroner (as required for all human remains discoveries);
- The Environment Manager or other nominated senior staff member will contact Heritage NSW, Department of Premier and Cabinet for advice on identification of the skeletal material as Aboriginal and management of the material; and
- If the skeletal material is of Aboriginal ancestral remains, the Local Aboriginal Land Council will be contacted and consultative arrangements will be made to discuss ongoing care of the remains.

- All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols
- All land and ground disturbance activities must be confined to inside the study area.

5.7. Historic Heritage

The proposal sites are located on Mount Jerrabomberra which is listed as a local heritage item (Mount Jerrabomberra, Item: I304: Landscape – Natural) under the Queanbeyan-Palerang LEP 2022. The LEP heritage listing states that the area provides habitat to a small number of plants of a nationally endangered daisy (*Rutidosis Leptorhynchoides*), as well as populations of two regionally uncommon plant species and stands of vulnerable native open forest and woodland.

5.7.1. Impact Assessment

The Biodiversity Assessment Report (BAR) (Ecology Consulting, April 2023) prepared for the Proposal considered the impact the works may have on the landscape features identified within the heritage listing. As identified in the BAR and discussed further in section 5.5, the study area was observed to contain potential habitat for six threatened plant species, including the endangered *Rutidosis Leptorhynchoides*. The survey period was optimal for the *Rutidosis Leptorhynchoides* however no species were identified on the site and it was determined that this species was not present within the study area. The BAR further identified that no threatened populations or ecological communities occurred on the site.

The BAR concluded that the Proposal would not have significant impacts on vegetation within the study area provided the clearing of vegetation is minimised and restricted to areas of lower quality vegetation and recommended mitigation measures adopted.

The proposed works are considered unlikely to impact on the heritage significance of the Mount Jerrabomberra Reserve for the following reasons:

- The proposed new reservoir and electrical building will be constructed in a previously disturbed and degraded area adjacent to the existing reservoir. No vegetation removal will be required.

- Clearing for the proposed truck access at the entrance to the reservoir facility would be minimised to that necessary to enable the works to proceed.
- Clearing for the construction compound will be limited to the areas identified as 'degraded' on Figure 10 of the BAR. Mature trees and trees containing hollows will be retained wherever possible.
- Upon completion of the works, the site compound and any previously disturbed areas will be restored and allowed to rehabilitate.

Provided the below recommendations are adopted, the impact on the heritage listing of the site would be negligible.

5.7.1. Mitigation Measures

- Works shall be designed and sited to minimise clearing of vegetation as much as possible.
- Works should be designed and restricted to areas identified as previously disturbed as marked as 'degraded' on Figure 10 of the BAR. This includes the site compound.
- Upon completion of the works, the site compound and any previously disturbed areas will be restored and allowed to rehabilitate.

5.8. Noise and Vibration

The Proposal site is surrounded by residential subdivisions to the west and south and bushland extends to the north and east. The closest sensitive receivers are located approximately 143 m west of the reservoir site and 63 m south of the proposed construction compound.

No background noise monitoring has been undertaken in the general area of the Proposal; however, given the nature of the surrounding area, the background noise level is anticipated to be relatively low, dominated by birds and local traffic noises. The background noise levels in the Proposal area are anticipated to be 35 dB(A).

5.8.1. Impact Assessment

Construction

The reservoir construction works are anticipated to occur over a period of approximately 18 months. The greatest noise impact is likely to be associated with the temporary increase in construction traffic along Limestone, Halloran and Jerrabomberra Hill Roads as well as the use and operation of the construction site compound. These impacts would be intermittent and temporary only whilst construction works are occurring.

The typical A-weighted sound power levels for equipment which may be required to undertake the construction works are listed in Table 2 below (it is noted that this list is not definitive and these levels are taken from the *Australian Standard AS2436-2010 Guide to Noise Control on Construction, Demolition and Maintenance Sites*).

Under the *Interim Construction Noise Guideline* (DECCW, 2009) construction noise criteria for residences where the construction duration is greater than three weeks is the rating background noise plus 10 dB(A), and therefore the resultant noise management level for the proposed works would be 45 dB(A) (internal). Based on the typical sound power levels in Table 2 and using the methodology in the *Australian Standard Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites* and the *Interim Noise Construction Guideline*, the maximum predicted noise levels at the closest residence to the construction site compound (63 m away), being the area most likely to generate noise, may exceed the recommended noise affected level at times. The construction works are however unlikely to exceed the highly affected noise level (75 dB(A)) above which there may be strong community reaction to noise (DECCW, 2009).

Noise levels would vary depending on the nature of the activities being undertaken. The use of several items of construction equipment simultaneously is only expected to occur intermittently and works are the work sites would not be continuous, requiring only intermittent use of machinery and equipment. In addition, construction hours would be restricted to the normal daytime construction hours as specified by EPA and the nature of the works would be temporary. Overall, impacts are not anticipated to be significant given the distance to the nearest sensitive receivers, limited duration and temporary nature of the works.

Table 2: Construction Equipment Sound Power Level

Equipment	Typical Sound Power Levels (dB)	Sound Pressure Level at 63m distance (dB(A))	Sound Pressure Level at 85m distance (dB(A))	Sound Pressure Level at 143m distance (dB(A))
Excavator	118	71	68	64
Truck	117	70	67	63
Light vehicles	106	59	56	52
Jackhammer	121	74	71	67
Rock breaker	118	71	68	64
Compressor (silenced)	101	54	51	47
Concrete agitator truck	109	62	59	55
Hand Tools	102	55	52	48
Crane (mobile)	104	57	54	50

The use of the construction equipment listed in Table 2 also has the potential to cause some vibration impacts, although it should be noted that no blasting would be undertaken during the works. The vibration generated from construction works would vary depending on the level and type of activity carried out at each site during each activity. Potential vibration generated to receivers for the works would be dependent on separation distances, the intervening soil and rock strata, dominant frequencies of vibration and the receiver structure.

Dominant vibration generating plant include:

- Bulldozer
- Excavator
- Compactor

Given the distance of the nearest receivers to the work site and limited potential for vibration generating equipment to be in operation, vibration impacts are not considered to be significant. Control measures will however be implemented to minimise vibration impacts during construction of the Proposal as part of the contractor's Construction Environmental Management Plan (CEMP).

Once construction works are complete, the site compound will no longer be operational and any associated noise sources would cease.

Operation

Noise from the operation of the reservoir would be negligible and no change in operation or associated noise levels is expected.

The proposed electrical building will be fully enclosed, constructed of brick or reinforced concrete blocks which would limit any noise from the operation or maintenance of this facility.

5.8.2. Mitigation

Construction

- Works would generally be undertaken during normal work hours i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; and no work would be undertaken on Sundays, Public Holidays or outside these work hours without notification to affected community. Notification would provide the following details:
- Community notification would be undertaken prior to the construction works commencing and where work is likely to cause vibration or offensive noise and impact the public and nearby residents.
- Control measures to minimise noise and vibration impacts on adjoining land would be implemented during construction as part of the contractor's CEMP, which would require review by QPRC prior to commencement of works. The CEMP would address site specific issues, including limited work hours and noise and vibration reduction practices, taking into consideration DECCW's Interim Construction Noise Guideline (in particular Tables 4 – 10) and

Assessing Vibration: A Technical Guideline (in particular mitigation measures in Section 3). Mitigation measures to minimise noise and vibration impacts may include the following:

- Optimum siting of work areas, vehicle and plant parking areas, materials stockpiles and equipment storage areas in locations where potential acoustic and vibration impacts would be minimised;
- Regular maintenance of all plant and machinery used for the project;
- Identify locations where construction noise and vibration is most intrusive and develop strategies to reduce impacts for these areas.
- All construction machinery is to be turned off when not in use.
- Use quieter and less noise emitting construction methods where feasible and reasonable.
- All plant and equipment to be appropriately maintained to ensure optimum running conditions, with periodic monitoring.
- Plant used intermittently to be throttled down or shut down when not in use where practicable.
- Non-tonal reversing beepers (i.e. quackers or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site for periods of over two months where practicable.
- High noise generating plant and equipment, such as rock hammers, should be used only when required (if hard rock is encountered).

5.9. Visual

The Proposal sites are located within the Mount Jerrabomberra Reserve which is mapped as a Scenic Protection area under Council's LEP. The reservoir site is situated on large bench which has been cut into the side slope of the mountain. The site contains an existing large water reservoir and associated security fencing.

The proposed site compound is located on the western side of Jerrabomberra Hill Road and portions of the site have been previously cleared of trees. The road itself has been cut into the top and middle of the slope in this location.

5.9.1. Impact Assessment

The new reservoir will be installed immediately adjacent to the existing water reservoir and will be similar in size and scale to the existing reservoir. The area has been previously cleared and levelled to facilitate the new reservoir. The site is visible from the publicly accessible access road and users of the Reserve. However, the site is screened from view elsewhere by the existing bushland that is protected by the Reserve. Therefore, overall the impact of the proposal on the scenic qualities of the landscape are considered to be minimal.

The new reservoir will have an off-form concrete finish, with the roof of the reservoir painted in a natural green colour. The existing fencing around the reservoirs and proposed electrical building site will be replaced with a black steel framed fence, and a gabion retaining wall at the entrance to the site filled with natural grey stone, as shown in Figure 5-1. The colours and textures of the materials for the Proposal have been selected to blend and integrate sympathetically with the surrounding natural environment.

Figure 5-1: Proposed colour scheme for new water supply infrastructure at the reservoir site

Source: NSW Public Works, 2023

The proposed new electrical building will be constructed within the area of the proposed reservoir and immediately adjacent to the existing compound vehicular gate entrance. The proposed reservoir will screen the proposed electrical building.

Visual impacts associated with the use of the construction compound will be temporary only. Upon completion of the works, the compound area will be rehabilitated and allowed to regenerate.

Based on the above, it is considered that the Proposal is unlikely to have a significant long term visual impact and will have no more than a minimal impact on the scenic qualities and attributes of the Mount Jerrabomberra Reserve.

5.9.2. Mitigation

- The clearing of vegetation would be kept to the minimum required for the works
- Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas.
- All disturbed area should be rehabilitated and allowed to regenerate after completion of the works.

5.10. Air Quality

Air quality in the region is generally very good, however, it is impacted by a number of pollutant sources including dust and vehicle movements. There are no point sources of emissions in the general vicinity.

5.10.1. Impact Assessment

The main impact to air quality during construction is expected to arise from the generation of airborne localised dust associated with earthworks and from trucks transporting materials to and around the site. This is not anticipated to cause notable adverse environmental impacts unless the weather is particularly windy. Dust suppression methods, including the use of water carts, would be applied on windy days to prevent dust being transported off site.

Local air quality may be affected by emissions from construction traffic. These emissions would, however, occur only intermittently, and are expected to be minor and temporary. It would be unlikely that they would contribute to a permanent detectable reduction in local air quality.

With implementation of the recommended mitigation measures, potential air quality impacts during construction are considered minor and unlikely to be significant.

5.10.2. Mitigation

Construction

- Construction vehicles and equipment would be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period to meet EPA air quality requirements.
- The excessive use of vehicles and powered construction equipment is to be avoided.
- All construction machinery would be turned off when not in use to minimise emissions.
- Construction contractors would monitor dust generation potential.
- Dust suppression methods including the use of water carts would be applied where required (i.e. on windy days when earthworks and vehicle movements are generating dust).

- Any stockpiled spoil/fill would be protected to minimise dust generation to avoid sediment moving offsite.
- Vehicles transporting spoil from the sites would be covered.
- Reduced speed limits on the access track will be enforced within the CEMP to minimise dust generated from traffic movements.

5.11. Hazards

5.11.1. Impact Assessment

Bushfire

The proposal sites are located on land identified as bushfire prone (Category 1) (refer to Figure 2-2). The reservoir will be constructed of concrete, which is a non-combustible material, and designed to withstand a bushfire. The electrical building will be constructed of concrete blocks, brick, precast concrete panels or other non-combustible materials. Maintenance of an Asset Protection Zone, clear of vegetation, for a distance of 10m is recommended which will also ensure that a defendable space is provided around each of the proposed structures.

Construction works at the Proposal site are not anticipated to pose a bushfire risk. Any fire risks associated with works should be incorporated into the Contractors CEMP and safe work method statements. The design of the above ground structures should take into consideration the potential bushfire risk at the site, in accordance with the relevant principles of the NSW RFS publication *Planning for Bushfire Protection 2019*.

The Proposal is not a special fire protection purpose and therefore does not require approval from the NSW Rural Fire Service (RFS) under the *Rural Fires Act 1997*.

Contamination

Super chlorination of the reservoir may be required to clean and disinfect the reservoir prior to commissioning. This material has the potential to spill and cause contamination of land and waterways. However, the water would be dechlorinated prior to disposal to the environment and appropriate erosion and sediment controls will be installed to prevent sediment and erosion resulting from any discharge.

Naturally Occurring Asbestos

A review of the SafeWork NSW Naturally Occurring Asbestos (NOA) mapping for the Queanbeyan area has indicated that NOA is unlikely to be present at the reservoir site. As such, it is anticipated that that NOA would not be encountered during excavation works at the site and therefore there would be no impacts associated with NOA due to the proposed works.

5.11.2. Mitigation Measures

Construction

Bushfire

- Construction staff to be made aware of the location of the proposed works in bushfire prone land and the potential for bushfire risk.
- No hot works to be undertaken on Total Fire Ban days or days of undue risk (eg high winds).
- The electrical building should be sited to minimise the risk of fire or impeding firefighting efforts. Combustible elements are to be suitable screened with non-combustible materials to protect from radiant heat or contained within the building.
- An asset protection zone should be provided around each structure and maintained as an Inner Protection Area (IPA), free from surface fuel and elevated fuel with minimal canopy cover. The APZ shall meet the requirements of Appendix 4 of PBP 2019.
- Access roads shall be constructed or upgraded in accordance with Appendix 3 of PBP 2019 to provide firefighters with access to structures for bush fire firefighting and hazard mitigation purposes.

Contamination

- If chlorinated water is to be discharged to the environment, the OEMP will incorporate appropriate measures for the de-chlorination process. Water containing chlorine shall be dechlorinated effectively to bring down the free chlorine level to zero prior to the release to the environment. (Refer to NSW Water Solutions' document "Disposal of Chlorinated Water, Report Number: 10049, May 2011).
- The Contractor would carry out a risk assessment as part of the CEMP for any disposal of chlorinated water to the environment.
- Chlorine level testing equipment shall be available on site to test chlorine levels in the water during the chlorination process.
- All necessary equipment required for the chlorination process shall be reliable and accurate.
- The personnel involved in the chlorination process shall be suitably qualified and have sufficient knowledge and skills in using chlorination chemicals, dosing equipment and water quality testing.

5.12. Waste Management

5.12.1. Impact Assessment

The construction of the Proposal would result in waste in the form of excess spoil, green waste and general building wastes such as packaging, off cuts, excess materials and workers wastes such as drinks containers, food scraps, etc. Portable toilets would be provided for workers at the construction site.

To ensure that environmental harm does not occur as a result of uncontrolled or inappropriate collection, transport and disposal the relevant provisions of the following Acts would be implemented:

- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (Waste) Regulation 2014*
- *Waste Avoidance and Resource Recovery Act 2001*

The waste management and contamination control procedures and/or measures listed below would be implemented for the proposed works.

5.12.1. Mitigation

- The contractor undertaking the works would detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated. Adequate procedures should be established and detailed in the CEMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001*. Namely, to:
    - Avoid unnecessary resource consumption;
    - recover resources (including reuse, reprocessing, recycling and energy recovery); and
    - dispose (as a last resort).
- No batched concrete mixing plants would be established in the works areas. Any required concrete would be mixed off-site and transported to the construction areas.
- Following completion of the works, excess concrete would be removed off-site for recycling.
- All waste removed from the site would be classified and disposed of appropriately, and all non-recyclable waste would be disposed of at an appropriate licensed waste disposal facility.
- If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.
- Cleared vegetation (devoid of weeds) would be mulched and re-used on site as part of site stabilisation and revegetation. Tree branches and trunks will be retained and laid on site.
- If practicable, surplus excavated materials/fill would be reused onsite as part of rehabilitation and restoration works. Any surplus spoil disposed of in this manner would be seeded to minimise the likelihood of it being transported offsite through wind or water action.

5.13. Utilities and Services

5.13.1. Impact Assessment

Works would be undertaken so as not to impact on existing infrastructure unless required to carry out the proposed works. During construction of the existing reservoir will remain operational to maintain supply to Jerrabomberra customers.

5.13.2. Mitigation

Construction

- The location of any underground services and utilities would be accurately identified and avoided to ensure these are not damaged during construction works.
- During construction all necessary arrangements would be put in place to maintain water supply to affected properties.

5.14. Socio-economic

5.14.1. Impact Assessment

The Proposal is unlikely to cause significant adverse socio-economic impacts during construction. There may be a minor increase in temporary employment in the area due to construction works. Appropriate mitigation measures to minimise impacts to the surrounding area are listed in previous sections of this REF. The Proposal would result in a positive impact to the local community through the provision of improved potable water supply security for the community of Jerrabomberra.

5.14.2. Mitigation

No mitigation measures required.

5.15. Cumulative Impacts

5.15.1. Impact Assessment

No other construction projects are planned at the same time in the area of the proposed works, and therefore no cumulative impacts are anticipated.

5.15.2. Mitigation

No mitigation measures required.

6. Environmental Management

6.1. Construction Environmental Management Plan

Preparation of a Construction Environmental Management Plan (CEMP) is mandatory for all projects undertaken by or on behalf of government agencies or where funding is being provided by the government.

The CEMP would be developed to ensure that appropriate environmental management practices are followed during a project's construction and/or operation. Council would review the CEMP for this Proposal, which should include the following elements, as described in the Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004):

Table 3: Construction Environmental Management Plan Structure

Background	Introduction to the document
	Description of the proposal and project details
	The context for the CEMP in relation to the overall project
	The CEMP objectives
	The contractor's environmental policy
Environmental Management	Environmental management structure of the organisation and specific team responsibilities with respect to the CEMP and its implementation
	Approval and licensing requirements relevant to the project
	Reporting requirements
	Environmental training
	Emergency contacts and response
Implementation	A project specific risk assessment
	A detailed list of environmental management safeguards and controls
	CEMP sub plans for specific environmental controls
	A detailed schedule assigning responsibility to each environmental management activity and control
Monitor and Review	Environmental monitoring
	Environmental auditing
	Corrective action
	CEMP review and document control procedures

The CEMP would include a risk assessment which ensures that the safeguards identified in this REF, as well as any others that are considered relevant, are effectively translated into actual construction techniques and environmental management activities, controls, and monitoring/verification to prevent or minimise environmental impacts. The CEMP should also identify the requirements for compliance with relevant legislation and any other regulatory requirements to ensure environmental safeguards described throughout this REF are implemented. The environmental management objectives and supporting actions presented in this section are intended to assist in this process.

The following details the environmental objectives during construction and the proposed mitigation to be included in the CEMP. This list is not definitive, and additional measures detailed as part of the determination of the project and conditions of any other approvals must also be included. Operational safeguards are also included.

6.2. Environmental Management Measures

6.2.1. Landuse

Objective(s)

- Minimise impacts to surrounding land and other users of the site.

Actions

Action/Phase	Responsibility
Pre-construction	
Neighbouring residents are to be informed of the construction works, predicted program and any access requirements. Council should consider informing the local community via their website or social media of the construction works and any associated impacts that may restrict use of the area.	Council
Best management construction impacts are to be documented in a project specific CEMP.	Contractor
Construction	
Restoration of the areas disturbed during construction would be undertaken in accordance with a rehabilitation plan.	Contractor

6.2.2. Traffic and Access

Objective(s)

- Minimise disruption to the community.
- Ensure appropriate traffic safety measures are implemented.

Actions

Action/Phase	Responsibility
Pre-construction	
Prepare a Traffic Control Plan as part of the CEMP, to be reviewed by Council prior to commencement of works. The Traffic Management Plan would include measures to minimise traffic impacts ensure public safety and would be prepared in accordance with: • Transport for NSW's Traffic Control at Work Sites Manual, Issued February 2022, and • Australian Standard 1742.3 - 2019 Traffic Control for Works on Roads.	Contractor
Signage is to be erected at the entrance to the Mount Jerrabomberra Reserve advising of the construction works and any temporary access restrictions. Warning signs should also be installed along Jerrabomberra Hill Road to advise walkers and cyclists of increased traffic and any safety requirements.	Contractor
The construction compound and work sites are to be fenced to prevent unauthorised access and appropriate signage installed. Suitable security fencing is to be erected and maintained around the Reservoir site and Electrical building site.	Contractor
Construction	
Trucks would not access the sites in weather conditions where damage to tracks or property may occur.	Contractor
All traffic would comply with all applicable traffic laws and regulations including speed limits. All construction vehicles would comply with the speed limits set for the roads accessing the site.	Contractor

6.2.3. Erosion and Sediment Control and Water Quality

Objective

- Prevent/minimise impacts to soils and surface waters.

Actions

Action/Phase	Responsibility
Pre-construction	
Prepare a detailed Erosion and Sediment Control Plan (ESCP) as part of the CEMP. The ESCP would describe the site-specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication Managing Urban Stormwater: Soils and Construction, 4th edition ("The Blue Book") and Managing Urban Stormwater: Soils and Construction, Volume 2a Installation of Services. The ESCP would need to be site specific and would need to address the following issues to prevent erosion, sediment loss and water quality impacts: • Requirements for vegetation clearing to be kept to a minimum. • Retention of all surface runoff on-site, and where possible stormwater from off site would be diverted around the construction site. • Backfilling and stabilising of trenches once scour lines are installed. • Location and management of stockpiles, such as locating stockpiles away from any drainage lines near the works areas. • All erosion and sediment controls would be regularly inspected, especially when rain is expected and directly after any rain events. • All areas where ground disturbance has occurred would be stabilised following completion of works to ensure there is no erosion hazard and restored to their pre-construction condition. This would involve, where required, reshaping the ground surface, covering it with topsoil excavated from the site and re-establishing an appropriate vegetation cover. • Any excess spoil would either be spread across the ground in adjoining cleared area in such a manner as to avoid creating an erosion hazard or removed off site for disposal in accordance with relevant Council and EPA requirements.	Contractor
A site-specific spill management plan would be prepared and include the following requirements: • Emergency spill kits are to be kept at the site (vehicle kits).	

Action/Phase	Responsibility
• Refuelling of machinery to be undertaken within the construction compound and appropriately protected as outlined in the spill management plan.	
Any hazardous materials stored on site would be stored in the compounds and within impervious and bunded enclosures capable of storing 120% of the volume of material stored there.	
Workers would be trained in the spill management plan and the use of the spill kits.	
Construction	
All roads leading to the Reserve would be kept clean and free of dust and mud at all times. Roads must be left clean at the end of every working day. Where excavated material is tracked onto roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable. Roads would, where necessary, be swept with a vacuum sweeper to remove all this material. Where hosing of the road surface is carried out loose material should be trapped to prevent it from being discharged into drains and waterways.	Contractor
Appropriate measures will be implemented to reduce and prevent inadvertent impacts to the surrounding environment when discharging from the scour pipeline. Such measures may include placement of rock / rubble at the discharge location to reduce water flow, placement of erosion and sediment controls downstream and monitoring of discharge point. These measures should be detailed in the Contractors CEMP.	Contractor
Operation	
The reservoir would be internally cleaned prior to discharging any reservoir water to the stormwater system. Any water discharged to the stormwater system must be consistent with the requirements of the Protection of the Environment Operations Act 1997.	Council

6.2.4. Biodiversity

Objective

- Minimise impacts to flora and fauna.

Actions

Action/Phase	Responsibility
Pre-construction	
The Proposal works are to be designed to minimise vegetation and habitat removal (including removing of hollow bearing trees) as much as possible. The works impacts should be concentrated within the already degraded areas of vegetation as identified in Figure 10 of the BAR. By limiting impacts to these areas, the proposal is unlikely to cause any significant impacts to native vegetation or threatened biota within the proposal area.	Council / Contractor
Where impacts are likely to extend into areas of good condition vegetation, targeted surveys at the optimal time of year (i.e. September to December) should be employed to confidently determine presence of threatened species and avoid impacts.	Contractor
A Construction Environmental Management Plan (CEMP) is to be developed to identify measures to be undertaken before, during and after construction to minimise the direct impact of the proposal on matters of biodiversity. Such measures may include (as necessary): o Erosion and Sediment Control Plan, o Weed Management and Restoration Plan, o Nest Box Installation and Monitoring Plan, and o Landscaping Plan.	Contractor
Construction	
To avoid unnecessary removal or damage to areas of high biodiversity, ecologically valuable habitats and other retained vegetation, the clearing area (construction footprint) should be clearly demarcated with temporary fencing and signage where appropriate.	Contractor
Contractors, workers, and visitors to the proposal site are to be made aware of clearing limits and any no-go zones as part of their site induction.	Contractor
All cleared vegetation (with the exception of weeds) should be mulched and spread on site to assist in regeneration of the site. Large branches should remain in-situ and retained on site.	Contractor
Where habitat trees (e.g., trees containing stick nests, hollows, cavities, and other features likely to contain residing fauna) are to be removed, a	Contractor

Action/Phase	Responsibility
pre-clearance survey should be undertaken by a suitability qualified ecologist ahead of any clearing. Pre-clearing surveys would consist of: o inspection of trees and habitat features for the presence of residing fauna, o demarcation, mapping and recording of key habitat features (e.g., hollow-bearing trees, fallen logs and bush rock), o identification and nomination of hollow-bearing trees, bush rock or hollow logs to be salvaged and relocated to adjacent vegetation or landscape areas where appropriate, and o reporting requirements following the completion of pre-clearing surveys, detailing the location and type of each habitat feature. Pre-clearing surveys would also be undertaken as a final check for threatened flora and fauna potentially present. A follow-up, rapid survey should be conducted immediately prior to vegetation clearing in order to identify any new habitat features that could not be accounted for during initial pre-clearing surveys.	
In the case that a threatened species is identified utilising a tree or other habitat feature during construction, removal will only be once the ecologist determines the breeding period for that species has ended and all juveniles have moved on. Furthermore, adaptive management of the threatened species is to be applied as determined by the ecologist, a tree may also be removed after a pre-clearance inspection if a qualified ecologist determines no hollow-dwelling or nesting species are present at that time.	Contractor
Upon completion of pre-clearing inspections and rapid surveys outlined above, all clearing should be supervised by an ecologist and conducted utilising a two-stage clearing process as follows: o Stage 1: This stage consists of clearing trees, and other native vegetation identified by the ecologist as not comprising key habitat features likely to contain residing fauna. Habitat trees (as marked) are not to be removed during this stage and consequently would be isolated for removal during Stage 2. Other habitat features (e.g., bush rock, hollow logs, and man-made structures) may be	Contractor

Action/Phase	Responsibility
removed during this stage under the supervision of an ecologist. o Stage 2: Clearing for Stage 2 is to be undertaken at a minimum of one day following Stage 1 clearing. This is to provide a chance for residing fauna to voluntarily disperse overnight. After habitat trees have been left overnight, the identified trees may be cleared using the following best practice techniques. ▪ trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any residing fauna to leave the hollows. ▪ trees containing stick nests will be inspected and nest carefully removed by a tree climbing arborist or personnel qualified to use an elevated working platform (EWP). ▪ a bulldozer or excavator is to carefully push the tree over. ▪ the tree is to be left in its cleared position until completion of an inspection by an ecologist for the presence of fauna (the ecologist may require the tree to be rolled over to undertake a detailed inspection of all hollows). ▪ the cleared habitat tree may be left overnight to allow any remaining fauna time to leave the hollows and disperse from the construction area. ▪ branches containing hollows and sections of trunk will be set aside for salvage including immediate transfer to a dedicated storage area. Following construction tree materials over 10 cm DBH will be relocated to a suitable area in the locality to be utilised for habitat.	
A suitably qualified and vaccinated ecologist should be engaged to supervise removal of all native vegetation and habitat features for the proposal in order to minimise the chance of harm to fauna, and to rescue or relocate any fauna displaced during the clearing process.	Contractor

Action/Phase	Responsibility
Where hollow bearing trees are to be removed, nest boxes are to be installed and monitored in accordance with a Nest Box Installation and Monitoring Plan. The plan should provide for the replacement of hollows removed and unsalvageable with at a minimum, one similar sized artificial hollow (nest box).	Contractor
A suitable Erosion and Sediment Control Plan (ESCP) is to be prepared and included in a site- specific CEMP to reduce sedimentation of the ephemeral drainage line.	Contractor
Weeds are to be managed in a strategic and coordinated manner across the proposal area: o identification, mapping, and treatment of priority weeds before clearing commences, o manual weed removal is preferable to the use of herbicides where appropriate, o advise all workers and visitors of biosecurity measures in place, o weed infested plant material to be disposed in accordance with waste management legislation, o e.g., appropriate disposal of weed material, including seeds, into bags or plastic sheeting to prevent the spread of existing weed species, o hygiene controls such as cleaning and inspecting for soil or organic material on plant, equipment, and clothing prior to site arrival, including clean vehicles and tyres, o implement frog hygiene and pest control protocols, o monitor high-risk and high- traffic areas such as roads and bare ground, o control the movement of plant, equipment, and workers to minimise the potential for the spread of weeds within and outside the proposal area, and o continued monitoring and follow-up treatments where necessary within proposal area.	Contractor

Action/Phase	Responsibility
Post Construction and Operation	
All disturbed areas should be stabilised prior to the removal of any erosion and sediment controls.	Contractor
The site construction compound should be allowed to regenerate. Where necessary, Council should develop a Weed Management Strategy to remove and control weeds on this site.	Council
Where removal of trees and other significant vegetation is necessary, Council should consider providing replacement planting to offset any potential impacts. Any replacement plantings should be guided by the indicative planting list associated with the relevant PCT's contained in the BAR.	Council

6.2.5. Aboriginal Heritage

Objective

- Avoid impacts to Aboriginal and European heritage items/sites in the works area.

Actions

Action/Phase	Responsibility
Pre-construction	
All workers (including contractors) should be made aware that it is illegal to harm an Aboriginal object or historic relics, and if a potential Aboriginal object or historic relic is encountered during activities, then all work at the site will cease and Heritage NSW will be contacted.	Contractor
All workers (including contractors) should be inducted concerning Aboriginal cultural heritage values and basic training should be provided for identifying Aboriginal objects.	Contractor
All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols	Contractor
Construction	

Action/Phase	Responsibility
In the event that known or suspected Aboriginal skeletal remains are encountered during the activity, the following procedure will be followed: • all work in the immediate vicinity will cease; • the find will be immediately reported to the work supervisor who will immediately advise the Environment Manager or other nominated senior staff member; • the Environment Manager or other nominated senior staff member will promptly notify the police and the state coroner (as required for all human remains discoveries); • the Environment Manager or other nominated senior staff member will contact Heritage NSW for advice on identification of the skeletal material as Aboriginal and management of the material; and • if the skeletal material is of Aboriginal ancestral remains, the Local Aboriginal Land Council will be contacted and consultative arrangements will be made to discuss ongoing care of the remains.	Contractor
All land and ground disturbance activities must be confined to inside the study area.	Contractor

6.2.6. Historic Heritage

Objective

- Minimise impacts on historic heritage listed items

Actions

Action/Phase	Responsibility
Pre-construction	
Works shall be designed and sited to minimise clearing of vegetation as much as possible.	Contractor
Works should be designed and restricted to areas identified as previously disturbed as marked as ‘degraded’ on Figure 10 of the BAR. This includes the proposed temporary site compound.	Contractor
Post Construction	

Action/Phase	Responsibility
Upon completion of the works, the site compound and any previously disturbed areas will be restored and allowed to rehabilitate.	Contractor

6.2.7. Noise

Objective

- Compliance with relevant recommendations specified in the Interim Construction Noise Guideline (DECCW, 2009).
- Minimise noise impacts on nearby receivers.

Actions

Action/Phase	Responsibility
Pre-construction	
Community notification would be undertaken where appropriate and where work is likely to cause vibration or offensive noise and impact the public and nearby residents.	Contractor
Construction	
Works would be undertaken during normal work hours i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; and no work would be undertaken on Sundays, Public Holidays or outside these work hours without notification to affected community, local Council and the EPA. Notification would provide the following details: • The locations and types of surrounding receivers likely to be affected; • The nature of the proposed works; • The noise characteristics of any powered equipment likely to be used; • Measures to be taken to reduce noise emissions; and • All reasonable practical steps shall be undertaken to reduce noise and vibration from the site.	Contractor
Control measures to minimise noise impacts on adjoining land would be implemented during construction as part of the contractor's CEMP, which	Contractor

Action/Phase	Responsibility
would require review by Council prior to commencement of works. The CEMP would address site specific issues, including limited work hours and noise reduction practices, taking into consideration the Interim Construction Noise Guideline (DECCW, 2009) and in particular Tables 4 – 10 of this guideline. Mitigation measures to minimise noise impacts would include: • Optimum siting of work areas, vehicle and plant parking areas, materials stockpiles and equipment storage areas in locations where potential acoustical impacts would be minimised; • Regular maintenance of all plant and machinery used for the project; • Identify locations where construction noise is most intrusive and develop strategies to reduce impacts for these areas. • All construction machinery is to be turned off when not in use. • Use quieter and less noise emitting construction methods where feasible and reasonable. • All plant and equipment to be appropriately maintained to ensure optimum running conditions, with periodic monitoring. • Plant used intermittently to be throttled down or shut down when not in use where practicable. • Non-tonal reversing beepers (i.e. quackers or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site for periods of over two months where practicable. • High noise generating plant and equipment, such as rock hammers, should be used only when required (if hard rock is encountered).	

6.2.8. Visual

Objective

- Minimise visual impacts.

Actions

Action/Phase	Responsibility
Construction	

Action/Phase	Responsibility
The clearing of vegetation would be kept to the minimum required for the works.	Contractor
Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas.	Contractor
Consideration should be given to painting the proposed new electrical building in a suitable colour to blend into the surrounding landscape.	
Post-construction	
All disturbed area should be rehabilitated and allowed to regenerate after completion of the works.	Council

6.2.9. Air Quality

Objective

- Avoid local air quality impacts where practicable, where unavoidable, ensure any such impacts are properly managed.
- Minimise adverse impacts to air quality.

Actions

Action/Phase	Responsibility
Pre-construction	
Construction vehicles and equipment would be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period to meet EPA air quality requirements.	Contractor
Construction	
The excessive use of vehicles and powered construction equipment is to be avoided.	Contractor
All construction machinery would be turned off when not in use to minimise emissions.	Contractor
Construction contractors would monitor dust generation potential.	Contractor

Action/Phase	Responsibility
Dust suppression methods including the use of water carts would be applied where required (i.e. on windy days when earthworks and vehicle movements are generating dust).	Contractor
Any stockpiled spoil/fill would be protected to minimise dust generation to avoid sediment moving offsite.	Contractor
Vehicles transporting spoil from the sites would be covered.	Contractor
Reduced speed limits on the access track will be enforced within the CEMP to minimise dust generated from traffic movements.	Contractor

6.2.10. Waste Management

Objective

- Minimise waste resulting from construction activities.
- Maximise reuse/recycling of waste material and minimise waste disposed to landfill.

Actions

Action/Phase	Responsibility
Pre-construction	
The contractor undertaking the works would detail waste management procedures in a Waste Management Plan to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated. Adequate procedures should be established and detailed in the CEMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the Waste Avoidance and Resource Recovery Act 2001. Namely, to: • avoid unnecessary resource consumption; • recover resources (including reuse, reprocessing, recycling and energy recovery); and • dispose (as a last resort).	Contractor
Construction	

Action/Phase	Responsibility
No batched concrete mixing plants would be established in the works areas. Any required concrete would be mixed off-site and transported to the construction areas.	Contractor
Following completion of the works, excess concrete would be removed off-site for recycling.	Contractor
All waste removed from the site would be classified and disposed of appropriately, and all non-recyclable waste would be disposed of at an appropriate licensed waste disposal facility.	Contractor
If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.	Contractor
Cleared vegetation (devoid of weeds) would be mulched and re-used on site as part of site stabilisation and revegetation. Excess mulch would be removed off site and disposed of in accordance with EPA requirements.	Contractor
If practicable, surplus excavated materials/fill would be reused onsite as part of rehabilitation and restoration works. Any surplus spoil disposed of in this manner would be seeded to minimise the likelihood of it being transported offsite through wind or water action.	Contractor

6.2.11. Hazards

Objective

- Comply with Planning for Bushfire Protection requirements
- Prevent contamination of the local environment.

Actions

Action/Phase	Responsibility
Pre-construction	
Construction staff to be made aware of the location of the proposed works in bushfire prone land and the potential for bushfire risk.	**Contractor**

Action/Phase	Responsibility
Construction	
No hot works to be undertaken on Total Fire Ban days.	Contractor
The Electrical building should be sited to minimise the risk of fire or impeding firefighting efforts. Combustible elements are to be suitable screened with non-combustible materials to protect from radiant heat or contained within the building.	Contractor
An asset protection zone should be provided around each structure and maintained as an Inner Protection Area (IPA), free from surface fuel and elevated fuel with minimal canopy cover. The APZ shall meet the requirements of Appendix 4 of PBP 2019.	Contractor
Access roads shall be constructed or upgraded in accordance with Appendix 3 of PBP 2019 to provide firefighters with access to structures for bush fire firefighting and hazard mitigation purposes.	Contractor
If chlorinated water is to be discharged to the environment, water containing chlorine shall be dechlorinated effectively to bring down the free chlorine level to zero prior to the release to the environment. (Refer to NSW Water Solutions' document "Disposal of Chlorinated Water, Report Number: 10049, May 2011).	Contractor
The Contractor would carry out a risk assessment as part of the CEMP for any disposal of chlorinated water to the environment.	Contractor
Chlorine level testing equipment shall be available on site to test chlorine levels in the water during the chlorination process.	Contractor
All necessary equipment required for the chlorination process shall be reliable and accurate.	Contractor
The personnel involved in the chlorination process shall be suitably qualified and have sufficient knowledge and skills in using chlorination chemicals, dosing equipment and water quality testing.	Contractor

6.2.12. Utilities and Services

Objective

- Avoidance of impacts to existing underground services and existing water customers.

Actions

Action/Phase	Responsibility
Pre-construction	
The location of any underground services and utilities would be accurately identified and avoided to ensure these are not damaged during construction works.	Contractor
Construction	
All necessary arrangements would be put in place to maintain water supply to the Jerrabomberra community.	Council

7. Conclusions

The Proposal to construct a new Jerrabomberra water supply reservoir will provide for additional water storage and enable timely rectification works to be undertaken to the existing reservoir, which is not in an adequate condition to continue serving the area.

The Proposal sites are located within Mount Jerrabomberra Reserve, which consists of 93.5 ha of largely native vegetation comprised of areas of varying composition and condition, including areas of good condition native vegetation with high biodiversity. The Reserve is a popular location for recreation with walking trails and a viewing platform and is surrounded by residential subdivisions.

During construction, the works will cause some temporary disruption to the use and enjoyment of the Reserve through increased traffic, noise and dust. These disruptions however would be relatively short term in nature, and it is considered that an overall positive impact to the community would outweigh the temporary construction impacts.

A Biodiversity Assessment by Ecology Consulting found that impacts of the Proposal on threatened species known or likely to occur within the Proposal area or immediate surrounds are not likely to be significant provided the recommended mitigation measures are implemented. The ADDA by NSW PW concluded that the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community.

Adverse environmental impacts associated with the operational phase of the new reservoir are considered to be minimal. Potential operational impacts have generally been mitigated as part of the design of the works.

This REF has been prepared in accordance with Sections 5.5 and 5.7 of the *Environmental Planning and Assessment Act 1979* and Part 8, Division 1, Section 171 of the *Environmental Planning and Assessment Regulation 2021.*

This REF provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposed activity.

On the basis of the information presented in this REF it is concluded that:

(1) the proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.

(2) the proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore, a Species Impact Statement (SIS) / Biodiversity Development Assessment Report (BDAR) is not required.

(3) the proposed activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any Matters of National Environmental Significance.

Subject to implementation of the measures to avoid, minimise or manage environmental impacts listed in this REF, the proposed activity is recommended to proceed

8. References

Australian Standard AS2436 - *2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*

Ecology Consulting (2023) *Biodiversity Assessment Report, Jerrabomberra Reservoir and Chlorination Building*

Jenkins, B.R. (2000) *Soil Landscapes of the Canberra 1:100 000 Sheet*. Department of Land and Water Conservation, Sydney.

Landcom (2004) *Managing Urban Stormwater* – Soils and Construction

SafeWork NSW (2023) *Naturally Occurring* Asbestos (NOA) GIS Mapping. Accessed via https://www.safework.nsw.gov.au/hazards-a-z/asbestos2/what-is-asbestos-and-where-to-find-it/naturally-occurring-asbestos-noa

Appendix A – Biodiversity Assessment

Biodiversity Assessment Report

Jerrabomberra Reservoir and Chlorination Building

Jerrabomberra Hill Road, Jerrabomberra NSW 2619

Prepared for Liz Mathieson | Principal Scientist

Department of Regional NSW - Public Works

21 April 2023

Ecology CONSULTING

About this document

This document has been approved for release to client by Senior Ecologist, Simon Vinson, Accredited Biodiversity Assessor NSW licence BAAS23004.

Disclaimer

This document may only be used for the purposes for which it was commissioned. Ecology Consulting accepts no liability for any damages or loss incurred if this report is used for any other purpose, or because of any inaccuracies or omissions in information that is identified as having been obtained from a third party.

Acknowledgement of Traditional Owners

Ecology Consulting acknowledges Australia's Traditional Owners and pays respect to Elders past and present. We honour and celebrate the spiritual, cultural, and customary connections of Traditional Owners to Country and to the biodiversity that forms part of Country.

Document Tracking

Version	Document Author	Reviewer	Date of review
v1.0	Finbar Shields, Emily Zouch	Simon Vinson	21/04/2023
v1.1	Finbar Shields, Emily Zouch	Simon Vinson (minor changes post review)	15/05/2023

About Ecology Consulting

Accredited

We are NSW-accredited Biodiversity Assessors, licensed to do scientific fieldwork in NSW, and accredited with the national Land for Wildlife program.

Local knowledge

We specialise in the ecosystems of southern NSW, so we can survey, assess, and document your site efficiently and accurately.

Solutions - Not just science

We have helped hundreds of landholders find information, contacts, events, and funding to achieve better environmental outcomes.

Support for major projects

We partner with business, government, and not-for-profit organisations to deliver major construction, species conservation, and site rehabilitation projects.

Ecology Consulting Pty Ltd | 42 Goulburn Street Crookwell NSW 2583
ecologyconsulting.au | ABN 68 647 633 163

Table of Contents

List of Figures

List of Tables

Abbreviations and common terms

ACT	Australian Capital Territory
agg	aggregate
AOBV	Area of Biodiversity Value declared under the NSW BC Act
BAM	Biodiversity Assessment Method
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BV	Biodiversity Value
BVM	Biodiversity Values Map
BOS	Biodiversity Offset Scheme
BOSET	Biodiversity Offset Scheme Entry Threshold
CE	denotes a species, population or ecological community listed as Critically Endangered under Commonwealth and/or State legislation
Cwlth	Commonwealth
DA	Development Application
DPIE	Department of Planning, Industry and Environment
E	denotes a species, population or ecological community listed as Endangered under Commonwealth and/or State legislation
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
FM Act	Fisheries Management Act 1994
ha	Hectare
HTE	High Threat Exotic - a type of declared weed in NSW
IBRA	Interim Biogeographic Region of Australia
km	kilometres
KTP	Key Threatening Process listed under Commonwealth and/or State legislation
LEP	Local Environmental Plan–a type of planning instrument made under the EP&A Act
LGA	Local Government Area
m	Metres
MNES	Matters of National Environmental Significance
NSW	New South Wales
PCT	Plant Community Type
QPRC	Queanbeyan-Palerang Regional Council
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy–a type of planning instrument made under the EP&A Act
sp./spp.	species (singular) / species (plural)
SVTM	NSW State Vegetation Type Map
study area	the area described in Study area of this report
subsp.	Subspecies
TEC	Threatened Ecological Community or equivalent (terms may vary across jurisdictions)
V	denotes a species, population or ecological community listed as Vulnerable under Commonwealth and/or State legislation
var.	Variety
WONS	Weeds of National Significance

1 Introduction

1.1 Background

Queanbeyan-Palerang Regional Council (QPRC) is proposing to construct a new water supply reservoir, chlorination building and associated temporary construction compound within Mount Jerrabomberra Reserve, Jerrabomberra, NSW, 2619. The proposal is to be assessed in accordance with Part 5 of the Environment Planning and Assessment Act 1979 which involves the preparation of a Review of Environmental Factors (REF).

Ecology Consulting Pty Ltd has been commissioned by the Department of Regional NSW – Public Works to prepare a Biodiversity Assessment Report (BAR) in support of the REF for the proposed works.

1.2 Study area

The proposal site (study area) is located approximately between 660 - 685 m above sea level, 3.5 km southwest of Queanbeyan CBD and 12 km southeast of Canberra CBD (see Figure 1). It is within the:

- Queanbeyan-Palerang Regional Council local government area (LGA),
- South East Local Land Services (SE LLS) Management Area, and

Monaro Subregion within the South-Eastern Highlands Region according to the Interim Biogeographic Regionalisation of Australia (IBRA). The study area consists of approximately 3.15 hectares (ha) and is separated into three areas within Mount Jerrabomberra Reserve, including (see Figure 2):

- an area to the west of the entry to the existing Reservoir site (approx. 0.15 ha),
- proposed site compound area (approx. 2.5 ha), and
- proposed chlorination building area (approx. 0.5 ha).

According to the Queanbeyan-Palerang Regional Local Environmental Plan 2022 (the LEP), the study area is:

- zoned C2 Environmental Conservation, and
- owned by Queanbeyan-Palerang Council, managed by Council under the *LG* Act.

Mount Jerrabomberra Reserve is being managed under the *Mount Jerrabomberra Site Specific Plan of Management* 2021. The area is considered to be of significant conservation and recreation value.

The study area currently consists of largely native vegetation in varying conditions, one hydro line, and access via walking tracks and dirt roads within or adjacent to the area.

FIGURE 1: STUDY AREA IN ITS REGIONAL CONTEXT

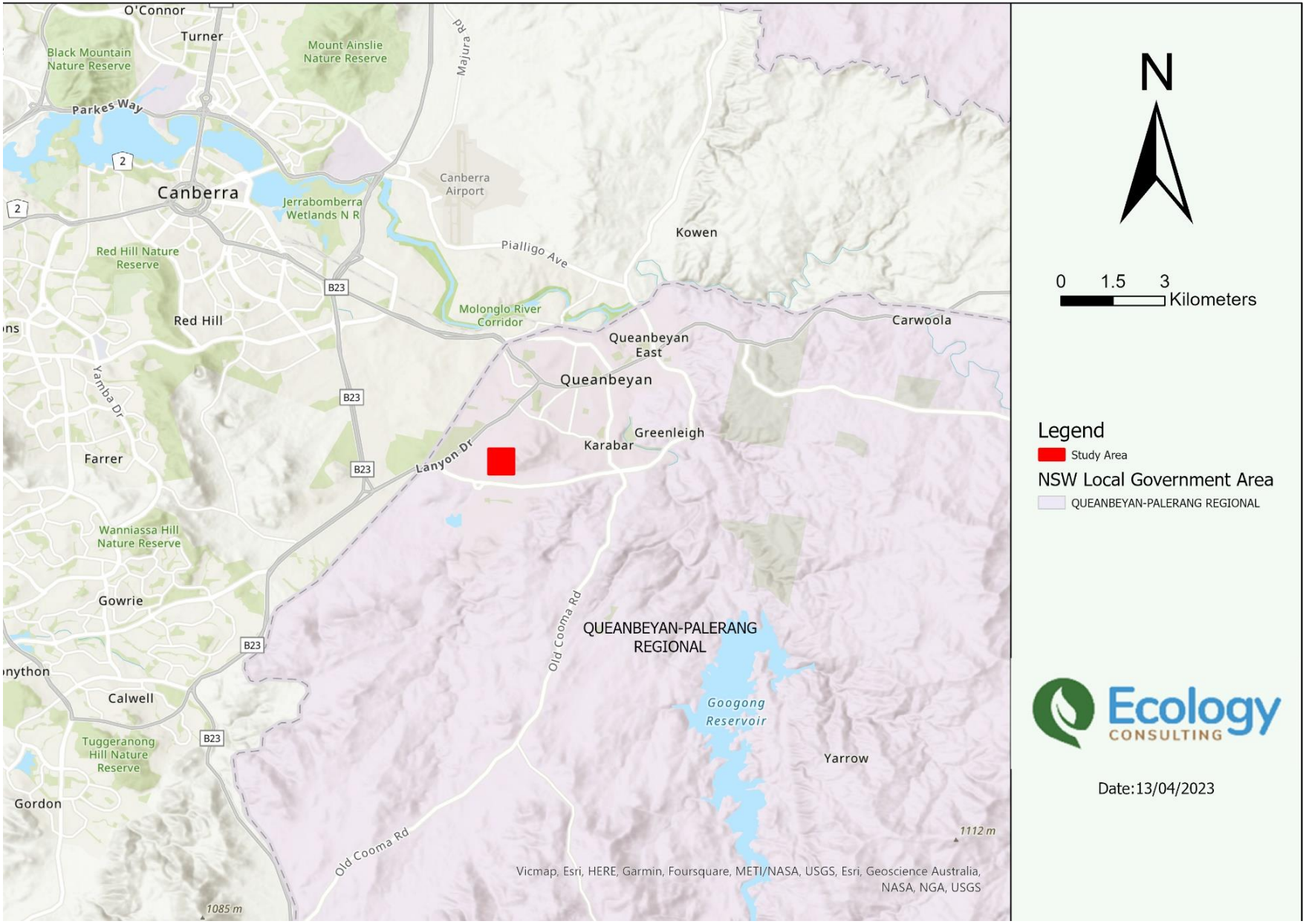


FIGURE 2: AERIAL VIEW OF THE STUDY AREA AND SURROUNDS

1.3 Proposed Works

The proposed works will require clearing and ground disturbance to facilitate the following proposed activities:

- construction of a new water supply reservoir (RF Concrete - 55m diameter) within a cleared area adjacent to the existing Jerrabomberra Reservoir site at 114 Jerrabomberra Hill Road (main lot - Lot 1 DP 40407). Whilst the area is predominantly cleared, a small, vegetated area at the entry to the reservoir site will require clearing to enable suitable truck access for construction purpose;
- construction of a new chlorination building to be constructed at 12 Minda Place (Lot 872 DP 1060706); and
- establishment of a temporary construction compound at 32R Carolyn Jackson Drive (main lot – Lot 126 DP 17204).

The finalised extent of works and exact footprint locations are yet to be determined by QPRC or NSW Public Works, however an indicative extent of clearing and generalised work areas as supplied by NSW Public Works can be seen in Figures 3 – 5.

1.4 Purpose and scope of this report

The purpose of this BAR is to provide an expert assessment of:

- biodiversity present or likely to be present in the study area and surrounds,
- likely ecological impacts of the proposed works, both before and after mitigation, and
- requirements of key biodiversity legislation, including whether the proposal meets certain thresholds for significant impacts on biodiversity.

FIGURE 3: INDICATIVE WORKS EXTENT – RESERVOIR ENTRY (SUPPLIED BY NSW PUBLIC WORKS)

Figure 2 – Jerrabomberra Reservoir (114 Jerrabomberra Hill Road, Jerrabomberra)

FIGURE 4: INDICATIVE EXTENT – CONSTRUCTION COMPOUND (SUPPLIED BY NSW PUBLIC WORKS)

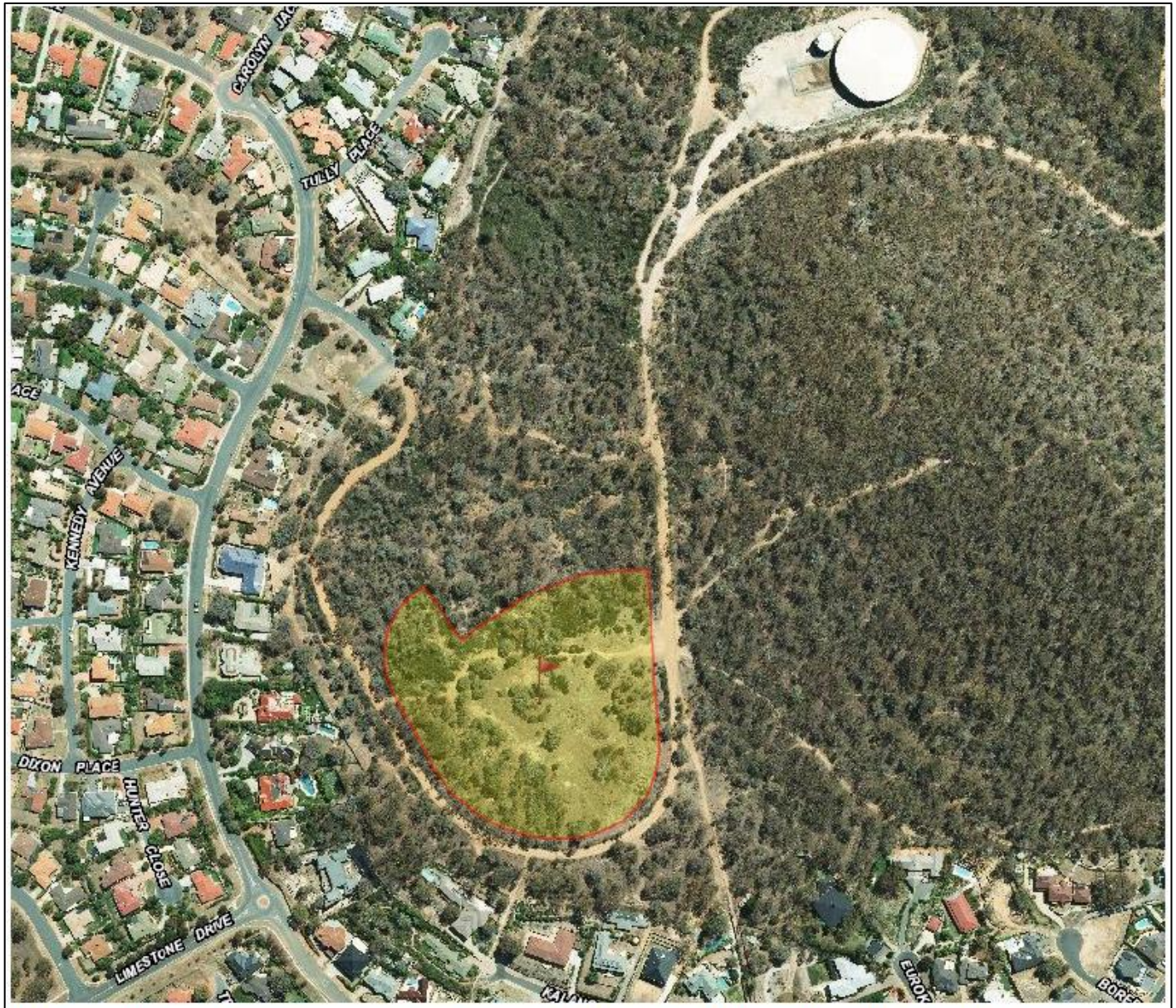


Figure 3 – Proposed temporary site compound – 32R Carolyn Jackson Drive, Jerrabomberra

FIGURE 5: INDICATIVE EXTENT – CHLORINATION BUILDING (SUPPLIED BY NSW PUBLIC WORKS)

Figure 4 - Proposed Chlorination Building site (12 Minda Place, Jerrabomberra)

2 Methodology

This report was prepared, based on:

- desktop data published by relevant publications and data bases, and
- field data collected on site by professional ecologists.

2.1 Desktop assessment

Desktop research was undertaken to identify site characteristics, landscape context and threatened species and ecological communities known or likely to occur within 10 km of the study area. Databases and search tools included the:

- Commonwealth EPBC Act Protected Matters Search Tool (pmst.awe.gov.au);
- National Species Profiles and Threats (SPRAT) database (https://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl);
- National Atlas of Living Australia (ala.org.au);
- BioNet Atlas of NSW Wildlife (bionet.nsw.gov.au);
- NSW Threatened Biodiversity Profile tool (www.environment.nsw.gov.au/threatenedSpeciesApp);
- NSW Biodiversity Values Map (www.environment.nsw.gov.au/biodiversity/biodiversity-values-map.htm);
- NSW eSpade soil and land information database (espade.environment.nsw.gov.au);
- SEED environmental data portal (seed.nsw.gov.au); and
- eBird hotspots West Hume Woodland and Wetlands, and Jerrabomberra Grasslands Nature Reserve (https://ebird.org/hotspot/L13157982 and https://ebird.org/hotspot/L2541592).

2.2 Field inspections (Ground truthing)

Field inspection of the study area was undertaken on 4th April 2023 by Ecologists Finbar Shields, Emily Zouch, Gerard Dwyer, and Rowan Webster. Survey work was undertaken to assess the general biodiversity values, potential habitat features, and the type and condition of vegetation in the study area.

2.2.1 Flora and vegetation surveys

Survey work involved a random meander across the study area with data collected, and observations made about:

- plant species present onsite,
- plant community types (PCTs) present, which were identified with reference to species composition and structure, landscape position and the known geographical distribution of plant communities, and
- habitat and presence of threatened flora species known or likely to occur within the study area.

2.2.1.1 Targeted surveys

An assessment was made of the likelihood of the study area containing each of the threatened flora species known or likely to be present within 10 km. Field assessment involved random meander including a careful search for species with a medium to high likelihood of occurrence (see B2 within Appendix B). Surveys were undertaken during optimal survey periods for the Pale Pomaderris and Button Wrinklewort (Table 1). Site inspection and targeted survey period is indicated by solid box and bold letters.

TABLE 1: OPTIMAL SURVEY PERIODS FOR KEY THREATENED FLORA SPECIES

Species name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Comments
Hoary Sunray (*Leucochrysum albicans var. tricolor*)	U	U	U	U	U	U	U	U	O	O	O	U	Not found on site, during site inspections outside of optimal survey times
Pale Pomaderris (*Pomaderris pallida*)	O	**O**	O	O	O	O	O	O	O	O	O	O	Not found on site, during site inspections at optimal survey times
Buttercup Doubletail (*Diuris aequalis*)	U	U	U	U	U	U	U	U	U	O	O	U	Not found on site, during site inspections outside of optimal survey times
Button Wrinklewort (*Rutidosis leptorrhynchoides*)	O	**O**	O	O	O	O	O	O	O	O	O	O	Not found on site, during site inspections at optimal survey times
Small Purple-pea (*Swainsona recta*)	U	U	U	U	U	U	U	U	O	O	O	U	Not found on site, during site inspections outside of optimal survey times
Silky Swainsona (*Swainsona sericea*)	U	U	U	U	U	U	U	U	O	O	O	U	Not found on site, during site inspections outside of optimal survey times

Legend

O = optimal survey period (species likely to be in flower)

S = sporadic flowering/other identifiable features

U = unsuitable for most survey work (species may be dormant or not identifiable)

2.2.1.2 BAM plots

In the interests of identifying PCTs and highlighting potential significant biodiversity values within the study area, four BAM plots were set up. As part of this process:

- the attributes of each plot were surveyed in accordance with the NSW Government's BAM method; and
- plot data was entered into the NSW Government's Biodiversity Offsets Calculator to enable calculation of vegetation integrity.

BAM plots were set up in the proposed impact areas (Figure 6):

- one in the entry area to the new water supply reservoir (BAM1),
- two in the construction compound area (BAM2 and BAM3), and
- one in the new chlorination building site (BAM4).

FIGURE 6: BAM PLOT LOCATIONS

2.2.2 Fauna and habitat surveys

Survey work involved random meanders and active searches while collecting information on fauna presence and activity, largely recorded through opportunistic sightings (including fauna identifiable by call). Evidence of fauna activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted.

A field assessment was undertaken to determine the presence of habitat within the study area for fauna and threatened fauna species considered likely to occur on the proposal area. This involved traversing the proposal area with surveys focusing on active observation for key habitat types including:

- hollow-bearing trees and associated attributes such as size of hollows (diameter) and distance from the ground for each hollow,
- presence of scattered rocks and rocky outcrops,
- the extent and condition of riparian habitat, including waterways, drainage lines and riparian vegetation,
- presence of stick nests (particularly focussing on presence of large stick nests for threatened raptors),
- presence of mistletoe and potential foraging resources for threatened birds, and
- presence of flowering and fruiting trees providing potential foraging resources.

2.2.3 Survey limitations

The ecological dataset provided for the site was restricted to what was observed by Finbar Shields, Emily Zouch, Gerard Dwyer, and Rowan Webster during site assessments.

The timing of the survey may not have coincided with emergence times of some species of flora and fauna, such as seasonally flowering herbs, seasonal migratory fauna, or nocturnal fauna. Conditions at the time of field inspection were suitable to enable most plant species in the study area to be identified with confidence. However, the results of the field inspection may not be complete because some plants and animals are only detectable at particular times of year, and some plants can only be identified to the species level when in flower.

Field inspections were not intended to provide a comprehensive survey of all the animal species that may utilise the site over time. Rather, habitat surveys were undertaken to determine the likelihood of threatened animal species occurring in the study area, based on the habitat features present.

2.2.4 Weather conditions

Prevailing weather conditions during the surveys (highlighted) and during the lead-up to the survey is presented in Table 2. The data was collated for the nearest Bureau of Meteorology weather station at Canberra Airport AWS (station 070351).

TABLE 2: WEATHER CONDITIONS PRIOR AND DURING FIELD SURVEYS

Date	Specific Survey	Min Temp °C	Max Temp °C	Rainfall (mm)	Max Wind Gust (km/h)
30 March 2023		8.2	20.1	8.8	50
31 March 2023		4.1	21.2	0	46
1 April 2023		4.6	18.5	0	30
2 April 2023		3.1	19.2	0	28
3 April 2023		6.7	21.3	0	24
4 April 2023	**Flora and fauna field inspections.**	**9.9**	**24.3**	**0.6**	**30**

3 Biodiversity Findings

3.1 Landscape context

3.1.1 IBRA Bioregions and Subregions

Under the Interim Biogeographic Regionalisation for Australia (IBRA v7), the study area is located in the Monaro Subregion within the South-Eastern Highlands Region.

3.1.2 NSW Mitchell Landscape Ecosystem

NSW (Mitchell) Landscapes were developed for conservation planning and reserve establishment purposes, to provide consistent state-wide ecological units finer than the existing bioregions and sub-regions[1]. They group ecosystems into larger meso-ecosystems representing natural entities based on topography and geology, and each landscape's name includes both location and descriptive information.

The study area occurs within the Canberra Plains Landscape Ecosystem detailed below.[2]

> *"Open grassy plains with meandering channels and terraces in Quaternary alluvium of loams and sandy clays with small areas of red-brown sands of source bordering dunes, over Silurian rhyolite and rhyodacite. General elevation 650 to 800 with peaks to 1000. Shallow stony uniform loams on steeper slopes, stony harsh red-brown texture-contrast soils on alluvial fans from ranges, yellow-brown to yellow texture-contrast soils on the alluvium, usually with hard setting and bleached A-horizons. Grasslands of; spear grass (Austrostipa sp.), snow grass (Poa sp.) with kangaroo grass (Themeda triandra) on alluvium, open woodlands of; yellow box (Eucalyptus melliodora), Blakely's red gum (Eucalyptus blakelyi), red stringybark (Eucalyptus macrorhyncha), and black cypress pine (Callitris endlicheri), merging into red stringybark, and brittle gum (Eucalyptus mannifera) communities on the hills."*

3.1.3 Topography, geology and soils

The study area lay on the western slopes of Mount Jerrabomberra Reserve, with areas of gentle slopes associated with Mount Jerrabomberra, as seen in Figure 7. Elevation ranges from approx. 655 m at the eastern edge of the area for the proposed chlorination plant to approx. 685 m at the south eastern edge of the entry to the existing Reservoir site.

The study areas fall within two soil landscapes, the larger compound area within the Queanbeyan soil landscape and the two smaller study areas within the Campbell soil landscape.

- **Queanbeyan**: Rolling to undulating low hills and rises on metasediments of the Canberra Lowlands, with local relief of 30 – 90 m, elevation of 560 – 750 m with moderately inclined slopes. Shallow, well—drained Rudosols on crests and upper slopes, well-drained Red Podzolic Soils on midslopes and Yellow Podzolic Soils in drainage lines.
- **Campbell**: Steep to rolling rounded hills and mountains on volcanics and sediments of the Canberra Lowlands, with local relief of 100 – 350 m, elevation of 600 – 110 m and long hillslopes often terracette. Shallow, rapidly drained Lithosols on crests and near rock outcrops. Moderately deep, moderately well-drained Red Podzolic Soils and Yellow Chromosols Yellow Podzolic Soils on midslopes. Imperfectly drained Solodic and Solonized Solonetz Soils with Gleyed Podzolic Soils along drainage lines.

[1] NSW Government Seed dataset, see https://datasets.seed.nsw.gov.au/dataset/nsw-mitchell-landscapes-version-3-1
[2] Information in this section sourced from Descriptions for NSW (Mitchell) Landscapes (2002).

No areas of geological significance (karsts, caves, crevices, or cliffs) are known or observed to be present within the study area. The study area or immediate surrounds (within 1500 m) is not mapped as occurring on acid sulphate soils nor is mapped as having risk/probability of exhibiting occurrence of acid sulphate soils.

3.1.4 Hydrology

The study area contains a few hydrology features, including:

- one mapped hydro line within the north east corner of the compound area,
- an unmapped hydro line through the chlorination building area, and
- a culvert through which drainage flows found within the entry to the Reservoir site.

Drainage from the unmarked hydro line flows south and likely flows into a nearby hydro line that runs off into nearby stormwater drains within the southern residential area. The mapped hydro line and water from the culvert flow northwest, either flowing into urban drains or flowing towards Queanbeyan Nature Reserve and Jerrabomberra Creek. This flows on to Jerrabomberra Wetland Nature Reserve and Lake Burly Griffin in the ACT. Although these wetlands are not Biodiversity Mapped as 'Biodiverse Riparian Land' due to state boundaries, they are important hydrological ecosystems. Provided appropriate erosion and sediment controls, and environmental mitigation measures are adhered to, these waterways are unlikely to be impacted by potential runoff.

FIGURE 7: LANDSCAPE CONTEXT

3.2 Biodiversity Context

The study area is situated within the suburb of Jerrabomberra located on the southern outskirts of Queanbeyan, near the ACT border. It is located within Mount Jerrabomberra Reserve which is encompassed to the south and west by suburban housing.

Mount Jerrabomberra Reserve is comprised of 93.5 ha of largely native vegetation across an elongated hill with three peaks. The reserve is somewhat connected to a larger patch of native vegetation in the south east, with a major roadway separating Mount Jerrabomberra Reserve from even larger patches of native vegetation further east. These patches of vegetation include Cuumbeun Nature Reserve approx. 5 km to the east. To the west of the study area there are multiple protected patches of native vegetation, including Queanbeyan Nature Reserve (approx. 900 m), Jerrabomberra East Grasslands Nature Reserve (approx. 1.5 km), West Jerrabomberra Nature Reserve (approx. 3 km), Jerrabomberra Grassland Nature Reserves (approx. 4 km) and further upstream, the Jerrabomberra Wetlands Nature Reserve (approx. 8 km). These protected areas are separated by residential areas and major roadways.

Under the *Mount Jerrabomberra Site Specific Plan of Management* 2021 the native vegetation within the reserve is considered to be in excellent condition with isolated occurrences of significant weeds. The area is noted to contain locally and regionally significant flora and fauna that contribute to the biodiversity of the region. The report describes important ecological features of the area, including[3]:

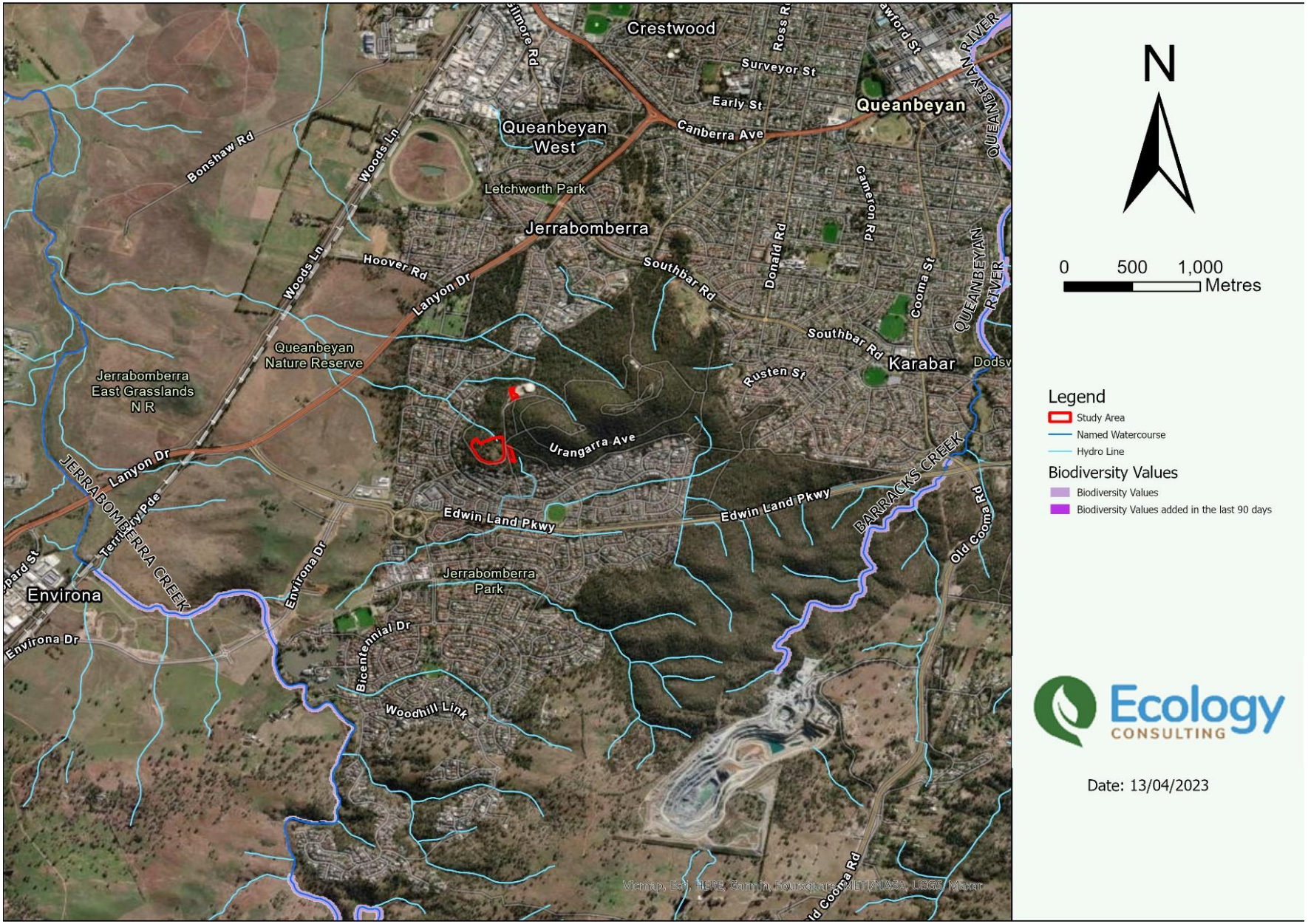
- A high diversity of flora and fauna species;
- Flora species with conservation significance, including Button Wrinklewort (*Rutidosis leptorhynchoides)* listed as Endangered under the EPBC Act, Hoary Sunray (*Leucochrysum albicans* var. *tricolor)* listed as Endangered under the BC Act and EPBC Act, Fan Grevillea (*Grevillea ramosissima*), Twining Fringed Lily (*Thysanotus patersonii*) and Mountain Hickory (*Acacia penninervis*);
- Records of rare and locally significant orchid species;
- Threatened fauna species present include, Gang-gang Cockatoo (*Callocephalon fimbriatum)*, Scarlet Robin (*Petroica boodang)*, Varied Sittella (*Daphoenositta chrysoptera)*, Eastern Bentwing Bat (*Miniopterus (schreibersii) orianae oceanensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis)*, Greater Broad-nosed Bat (*Scoteanax rueppellii)* and Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris)*, and
- Key fauna habitat features including an intact canopy, understory foraging resources, limited hollow-bearing trees and surface rock.

The native vegetation of the area is characterised by a canopy of Inland Scribbly Gum (*Eucalyptus rossii*), Red Stringybark (*Eucalyptus macrorhyncha)* and Red Box (*Eucalyptus polyanthemos)* with a high diversity of shrubs accompanied by a grassy understory. Although the area exhibits distinct areas of disturbance, likely due to recreation and clearing, the study area retains areas of high biodiversity value, including a range of diverse shrubs, forbs and grasses under a largely intact canopy.

The study area is mapped within the NSW ePlanning Spatial Portal as Scenic Protection Land and Terrestrial Biodiversity. The study area does not contain Biodiversity Values (BV) mapped areas, however, as previously mentioned, runoff has potential to flow through the surrounding hydro lines and on into the BV mapped Biodiverse Riparian Land of Jerrabomberra Creek and into other important waterways of the ACT.

[3] Mount Jerrabomberra Site Specific Plan of Management 2021

FIGURE 8: BIODIVERSITY VALUES MAPPING OF THE SURROUNDING AREA



3.2.1 Vegetation

Vegetation within the study area was validated through a series of random meander vegetation surveys and four formal BAM plots. Vegetation within the study area has been assessed as aligning with the BioNet Vegetation Classification Plant Community Types (PCTs):

- ID 3747: Southern Tablelands Western Hills Scribbly Gum Forest.
- ID 3375: Monaro-Queanbeyan Rolling Hills Grassy Forest.
- ID 3534: Central West Stony Hills Stringybark-Box Forest.

There are no Threatened Ecological Communities (TECs) associated with these PCTs.

The vegetation within the study area is predominately composed of native vegetation in good condition, which is of natural vegetation structure and a mostly intact native understorey. This occurs in the form of dry-sclerophyll forest dominated by Inland Scribbly Gum (*Eucalyptus rossii*), Red Stringybark (*E. macrorhyncha*), and Red Box (*E. polyanthemos*). These areas typically displayed a high diversity in prostrate and midstory shrubs, particularly of the family Fabaceae (Mimosoideae) and Ericaceae.

Some areas, such as the proposed chlorination site, contained vegetation of the woodland formation. This was characterised by Red Stringybark (*E. macrorhyncha*) and a grassy understory containing a moderate to high richness in forb diversity.

Some areas within the proposed footprints were observed to have been cleared in past years, and as such displayed obvious signs of disturbance through the present vegetation assemblage. These areas featured a reduced native canopy and mostly degraded understorey containing a moderate to high abundance in exotic species. Disturbance areas occurred along the existing Jerrabomberra Hills Road and most predominately in the proposed site compound area.

3.2.1.1 Canopy

Canopy species are present at both mature and juvenile forms, with continuing seedling recruitment observed across much of the study area. The dominant canopy species are those commonly associated with the dry-sclerophyll forest and woodlands of the South East Highlands Bioregion, namely Scribbly Gum (*Eucalyptus rossii*), Red Stringybark (*E. macrorhyncha*), and Red Box (*E. polyanthemos*). Other species observed in the area include:

- Brittle Gum (*E. mannifera*),
- Silver Wattle (*Acacia dealbata*), and
- Golden Wattle (*A. pycnantha*).

3.2.1.2 Midstory

The study area displayed a high diversity of shrubs species, these mostly occurred in areas containing PCTs 3747: Southern Tablelands Scribbly Gum Forest and 3534: Central West Stony Hills Stringybark-Box Forest. 25 native species were recorded in the study area and five exotic species, which mostly occurred in areas of disturbance. The most abundant native species included:

- Early Wattle (*Acacia genistifolia*),
- Daphne Heath (*Brachyloma daphnoides*),
- Burgan (*Kunzea ericoides*),
- Dolly Bush (*Cassinia* spp.),

- Beard Heath (*Leucopogon* sp.),
- Fan Grevillea (*Grevillea ramosissima* subsp. *ramosissima*),
- Thyme Spurge (*Phyllanthus hirtellus*),
- Hoary Guinea Flower (*Hibbertia obtusifolia*) and
- Peas (*Pultenaea* spp.).

3.2.1.3 Understory

There were 30 grass or grass-like species recorded within the study area, 20 of which are native and 10 exotic. The highest diversity of grasses was observed in the proposed chlorination building footprint which features the PCT including grasses typical of PCT 3375: Monaro-Queanbeyan Rolling Hills Grassy Forest. Species observed include:

- Redanther Wallaby Grass (*Rytidosperma pallidum*),
- Plume Grass (*Dichelachne micrantha*),
- Speargrass (*Austrostipa scabra*),
- Purple Wiregrass (*Aristida ramosa*),
- Weeping Grass (*Microlaena stipoides*),
- Matt-rush (*Lomandra* spp.*),*
- Hairy Panic (*Panic effusum*), and
- Tall Spear-grass (*Austrostipa bigeniculata*).

There were 49 forb species observed within the study area, 26 being native species and 23 exotic. The highest diversity in forb species was recorded in the proposed compound site area which featured areas of disturbance and degraded understorey vegetation. This area also featured the highest richness and abundance of exotic forb species. The most abundance native forbs that were recorded in the study area include:

- Poverty Raspwort (*Gonocarpus tetragynus*),
- Nodding Blue Lily (*Stypandra glauca*),
- Ivy Goodenia (*Goodenia hederacea*),
- Pomax (*Pomax umbellata*),
- Fuzzweed (*Vittadinia* spp.),
- Blueberry Lily (*Dianella revoluta),*
- Golden Everlasting (*Xerochrysum bracteatum*), and
- Native Geranium (*Geranium solanderi*).

3.2.1.4 Exotics

A number of exotic species were observed across the study area. These ranged from mostly benign species such as Wild Aster (*Aster subulatus*) to highly invasive Blackberry (*Rubus fruticosus*). Overall, seven species of HTE were recorded and three species of WONS. Invasive species distribution was contained to areas of disturbance such as roadsides and cleared areas like that of the proposed compound site area. These areas feature a range exotic of species, the most abundant and invasive of these included:

- St John's Wort (*Hypericum perforatum*),

- Serrated Tussock (*Nassella trichotoma*),
- African Boxthorn (*Lycium ferocissimum*),
- Umbrella Sedge (*Cyperus eragrostis*),
- Sheep Sorrel (*Acetosella vulgaris*),
- Sweet Briar (*Rosa rubiginosa*) and
- Cootamundra Wattle (*Acacia baileyana*).

For a complete list of all the plant species found in the study area, see Appendix A.

3.2.1.5 BAM plots

Data collected from the BAM plots reflects field survey findings of high abundance and diversity of native vegetation in areas of little disturbance and an intact canopy (Table 3). All sites exhibit regeneration of canopy species. High scores for composition, structure and function condition can be seen across BAM_1, BAM_2 and BAM_4, as expected due to each area presenting a diverse range of native shrubs, grasses and forbs coupled with a mature canopy. These BAM plots also had very low, to no presence of High Threat Exotics (HTE). Vegetation scores associated with BAM_4 is expectedly much lower than that of the other areas due to the lack of mature trees, a less abundant and diverse shrub layer and a far greater presence of exotic species, including HTEs.

Additionally, the function condition score of BAM_4 indicates that there is more complexity in the features, and therefore more habitat present in this area, likely noted by the greater occurrence of logs within this area. For BAM plot data and photos data, see Appendix A2.

TABLE 3: BAM PLOT CALCULATIONS

Name	Location	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score
BAM_1	Reservoir site	72.2	79.5	74.5	75.3
BAM_2	Compound site (canopy)	88.4	70.3	79.8	79.1
BAM_3	Compound site (no canopy)	42.7	42.2	22.2	34.2
BAM_4	Chlorination site	83.2	88.6	92.4	88

3.2.2 Vegetation types

Key characteristics of the vegetation types found within the study area, including condition, description of native and non-native vegetation and extent are summarised in Table 4. These vegetations types have been mapped and extent can be seen in Figure 10.

TABLE 4: VEGETATION TYPES WITHIN STUDY AREA

Name	Extent (ha)	Condition	Description	Photo
PCT 3747 - Southern Tablelands Western Hills Scribbly Gum Forest	1.23	Good	An intact mid-dense tree canopy of predominantly Inland Scribbly Gum and Red Stringybark, with Brittle Gum and Red Box. A sparse but diverse shrub layer frequently including Daphne Heath, Fan Grevillea, Burgen, Hoary Guinea Flower and various *Acacia* spp.. The understory is sparse to mid-dense, frequently including Redanther Wallaby Grass, Ivy Goodenia, Blueberry Lily and Poverty Raspwort. There is commonly large areas of litter cover and some areas of bare rocky ground. Additionally, near areas of increased disturbance a dominance of species of Dolly Bush and Burgen occur, including at the edges of walking tracks. Few weed species occur within these areas, mostly contained to edge areas and close to areas of disturbance.	
PCT 3747 - Southern Tablelands Western Hills Scribbly Gum Forest	0.61	Degraded	Diversity and abundance of native flora species within this area have been reduced. The canopy has largely been removed, leaving a few mature trees of Inland Scribbly Gum, Red Stringybark and Red Box. Regeneration of mature trees is present near mature trees and throughout the area. A less diverse shrub layer can be found within this area, largely dominated by Dolly Bush and *Acacia* sp.. Historic clearing has given way to a more grassy understory, with Speargrass and Wallaby Grasses frequent, and a greater presence of exotic grasses and forbs. Within this area High Threat Exotic weeds and Weeds of National Significance are found mostly in localised patches. These include, St John's Wort, Serrated Tussock and Sheep Sorrel.	

PCT 3375 - Monaro-Queanbeyan Rolling Hills Grassy Forest	0.24	Good	An intact tree canopy that may vary, but here it includes Red Stringybark, Apple Box and Red Box. A scattered shrub layer frequently including Silver Wattle, Burgen, Dolly Bush and Native Blackthorn (*Bursaria spinosa*). There is a grass understory including Weeping Grass, Speargrass, Common Wheatgrass (*Anthosachne scabra*) and various rush species. Native forbs include Native Geranium, Poverty Raspwort and Golden Everlasting (*Xerochrysum bracteatum*). Weed species occur within these areas, mostly contained to edge areas and close to areas of disturbance. A small amont of High Threat Exotic weeds and Weeds of National Significance are found in localised patches within this area. These include, St John's Wort, Serrated Tussock and Sheep Sorrel.	
PCT 3375 - Monaro-Queanbeyan Rolling Hills Grassy Forest	0.72	Degraded	Diversity and abundance of native flora species within this area have been reduced. The canopy has largely been removed, leaving a few mature trees of Red Stringybark and Red Box. Tree species regeneration is present in areas near mature trees. A less diverse shrub layer can be found within this area, largely dominated by Dolly Bush and Silver Wattle. Historic clearing has reduced complexity of understory, with native grasses such as Speargrass and Wallaby Grasses present, but and a greater presence of exotic grasses and forbs. Within this area High Threat Exotic weeds and Weeds of National Significance are found throughout the area. These include, St John's Wort, BlackBerry, Serrated Tussock and Sheep Sorrel.	

PCT 3534 - Central West Stony Hills Stringybark-Box Forest	0.46	Good	An intact mid-dense tree canopy dominated by Red Stringybark, with some Red Box and Inland Scribbly Gum. A sparse to mid-dense shrub layer commonly including Hoary Guinea Flower, Daphne Heath, Beard Heath, and Dolly Bush. The understory is sparse, often grassy, with native species including, Matt Rushes, Redanther Wallaby Grass, Nodding Blue Lily, Ivy Goodenia and Poverty Raspwort. There is commonly large areas of litter cover and some areas of bare rocky ground. Additionally, near areas of increased disturbance a dominance of species of Dolly Bush and Burgen occur. Few weed species occur within these areas, mostly contained to edge areas and close to areas of disturbance.	

FIGURE 9: NSW STATE VEGETATION TYPE MAPPING OF SURROUNDING AREA

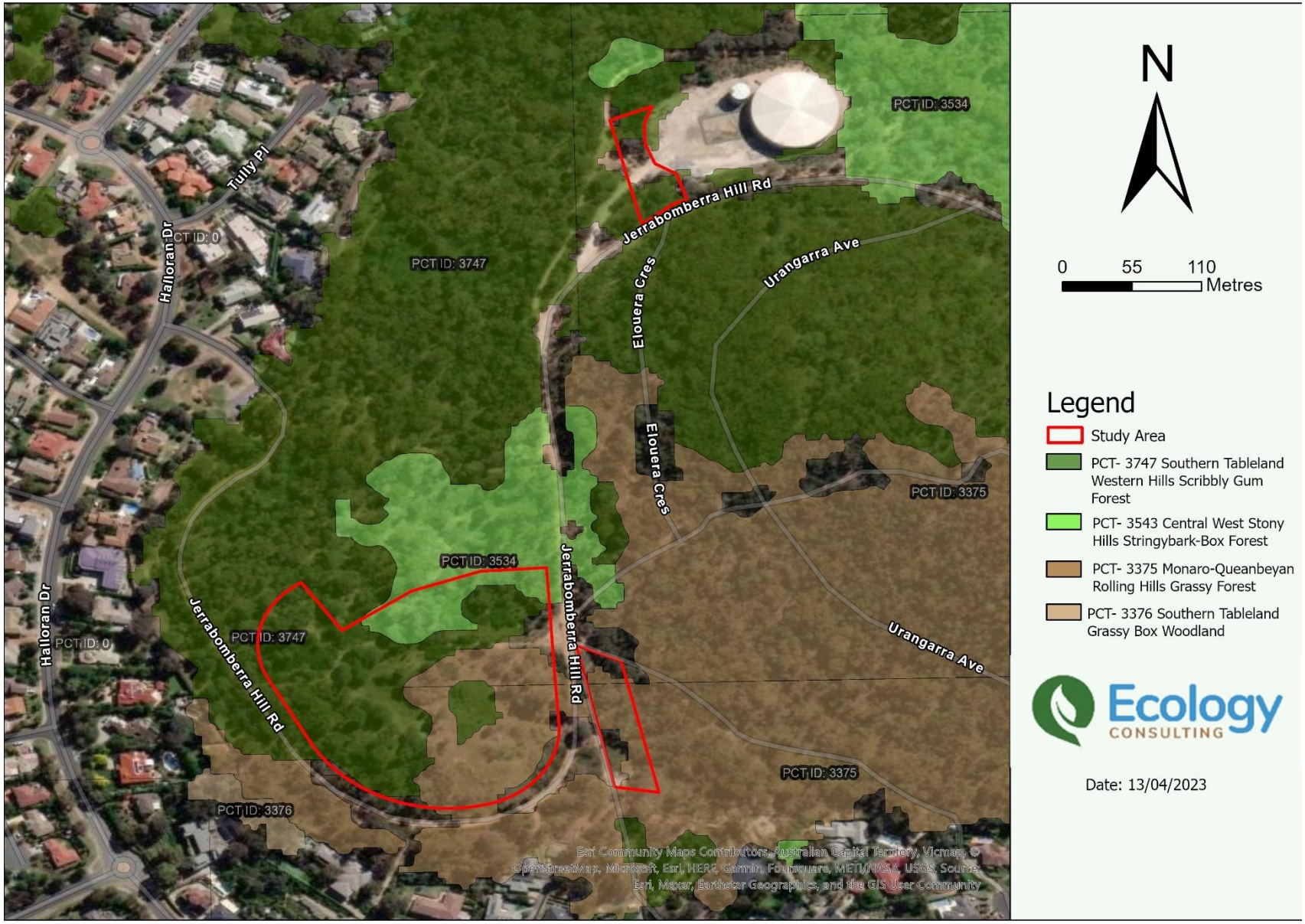
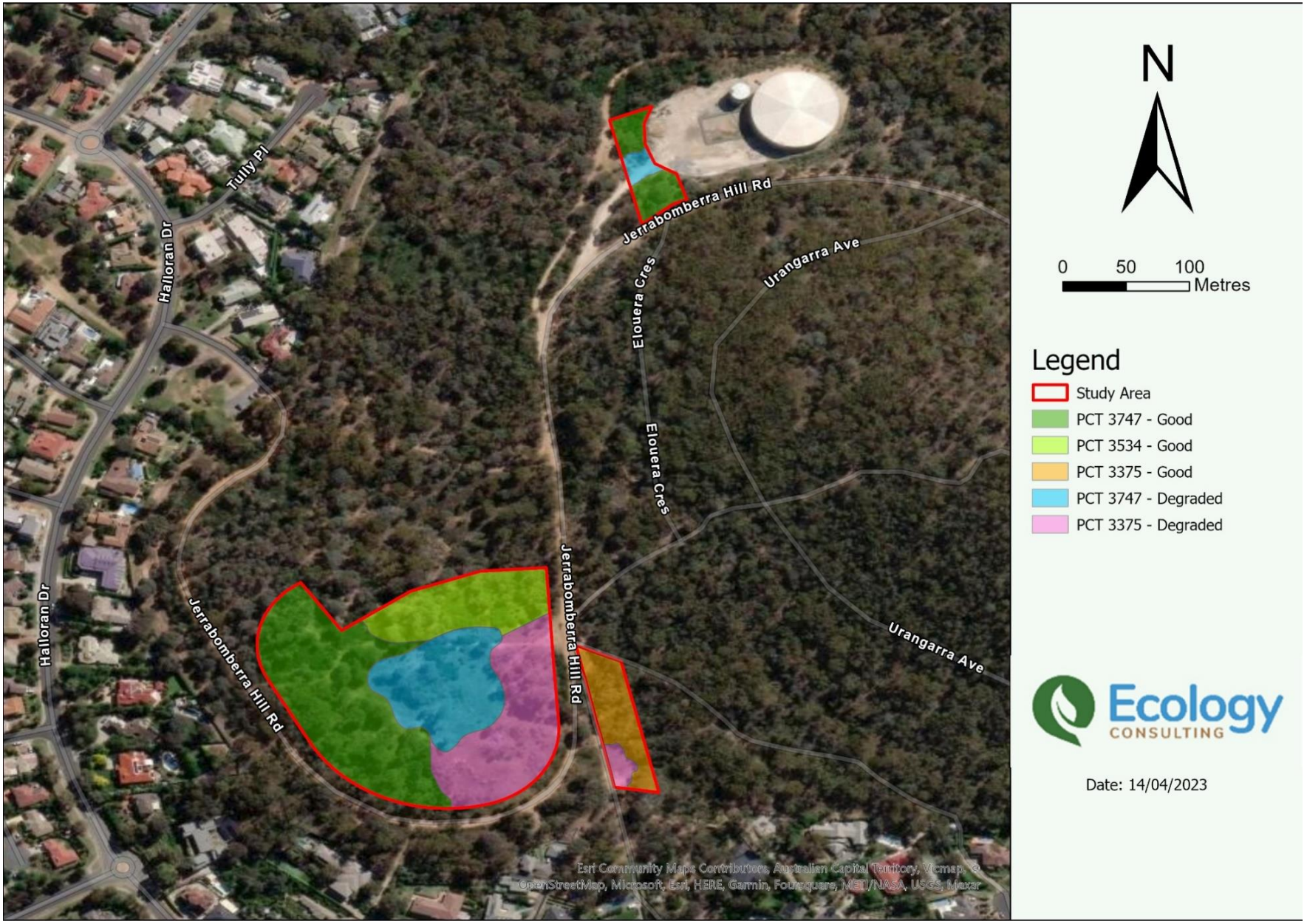


FIGURE 10: FIELD VALIDATED VEGETATION MAPPING OF STUDY AREA



3.2.3 Fauna and habitat

The study area was observed to have a low to moderate diversity of native fauna. Field surveys recorded 20 species of bird (of which 18 were native) utilising the study area for breeding, nesting, foraging and dispersal. An additional six species of mammal (three of which were native), two native frogs and one native reptile were observed. A full list of fauna observed within the study area can be found in Appendix A3.

Habitat for fauna species was observed to vary across the study area reflecting historical disturbances to the site, which likely impacts abundance and diversity of species observed. Key habitat features within, and nearby study area include:

- native woodland providing various habitat services for a range of species including birds, mammals and reptiles,
- habitat-bearing trees containing hollows, nests and fissures providing roosting and nesting habitat for a range of native species, specifically bats, small mammals and birds,
- a culvert running under the road outside the reservoir, which likely provides habitat for reptiles and frogs,
- limited rock outcrops and course woody debris providing limited shelter and foraging opportunities for reptiles and small birds,
- ant/termite mounds providing potential foraging habitat for echidnas and breeding habitat for the threatened Rosenberg's monitor, and
- mistletoe present, providing food sources for honeyeaters and other bird species.

Although no permanent aquatic habitat is present on site there are two distinct gullies that likely are ephemeral drainage lines providing shelter and foraging habitats for small birds, reptiles, and frogs.

The locations of important habitat found within the study area can be seen in Figure 11, including:

- at least six mature hollow-bearing trees (HBT) containing multiple hollows suitable for native and threatened fauna,
- scratches and scat on and nearby HBTs evidencing use by native fauna, and
- a fledgling galah nesting within a hollow.

Habitat available throughout the study area varies, with areas of least disturbance, including an intact canopy and a shrubby understory, likely provide high quality habitat for native and threatened fauna. Areas associated with the previously mapped degraded vegetation area do still retain important habitat features in the form of sparse HBTs, which are an important supplement to the surrounding woodland which also only contains limited mature HBT trees.

FIGURE 11: HABITAT PRESENT WITHIN STUDY AREA

3.2.4 Threatened Ecological Communities (TECs)

Desktop research found that seven Commonwealth and/or NSW-listed TECs are known or may occur within 10 km of the study area (for an assessment into each TEC individually, see B1 within Appendix B). These included:

- Alpine Sphagnum Bogs and Associated Fens,
- Monaro Tableland Cool Temperate Grassy Woodland,
- Montane Peatlands and Swamps,
- Natural Temperate Grassland,
- Tableland Basalt Forest,
- Werriwa Tablelands Cool Temperate Grassy Woodland, and
- Box-Gum Woodland.

Based on their geographic characteristics and the distinct plant communities associated with them, the study area does not support any of the identified TECs. For an assessment into each TEC individually, see Appendix B1.

3.2.5 Threatened plant species

Desktop research found that 20 species of threatened plants are known to or may occur within 10 km of the study area. During the initial field inspection, the study area was observed to contain potential habitat for six of these species:

- Buttercup Doubletail (*Diuris aequalis*),
- Hoary Sunray (*Leucochrysum albicans subsp. tricolor*),
- Pale Pomaderris (*Pomaderris pallida*),
- Button Wrinklewort (*Rutidosis leptorrhynchoides*),
- Small Purple-pea (*Swainsona recta*), and
- Silky Swainson-pea (*Swainsona sericea*).

These species were not observed within the site or study area during field surveys, however, targeted surveys were not able to be conducted during the optimal survey periods for all of these species. Field survey were undertaken during the optimal survey period for Pale Pomaderris and Button Wrinklewort (refer to Table 1) and consequently, it is reasonable to determine that these two species are not present within the study area. However, the remaining species optimal survey periods occur during flowering periods through spring and summer and commonly undergo die back when not in flower. Surveys conducted for these remaining species therefore cannot confidently rule out their presence within the study area.

For a complete list of all threatened flora species considered in preparing this report refer to Appendix B2.

3.2.6 Threatened animal species

Desktop research found that 63 threatened fauna species are known or may occur within 10 km of the study area. During field inspections, no evidence of threatened fauna species were observed in the study area.

The following discussion focuses on those species known to be present or assessed as having a medium to high likelihood of occurrence in the study area and immediate surrounds. For a complete list of all the threatened animal species considered in preparing this report, refer to Appendix B3.

3.2.6.1 Threatened birds

Based on their habitat requirements, there is a medium to high likelihood that larger birds may utilise the study area. These bird species may range over large areas and include owl and parrot species such as:

- Gang-Gang Cockatoo (*Callocephalon fimbriatum*),
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*),
- Spotted Harrier (*Circus assimilis*),
- Black Falcon (*Falco subniger*),
- Little Eagle (*Hieraaetus morphnoides*),
- Powerful Owl (*Ninox strenua*)
- Swift Parrot (*Lathamus discolor*),
- Turquoise Parrot (*Neophema pulchella*), and
- Superb Parrot (*Polytelis swainsonii*).

There is also a medium to high likelihood that the following small birds may utilise the study area:

- Regent Honeyeater (*Anthochaera phrygia*),
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*),
- Speckled Warbler (*Chthonicola sagittata*),
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*),
- Varied Sittella (*Daphoenositta chrysoptera*),
- Little Lorikeet (*Glossopsitta pusilla*),
- Painted Honeyeater (*Grantiella picta*),
- White-throated Needletail (*Hirundapus caudacutus*),
- Scarlet Robin (*Petroica boodang*),
- Flame Robin (*Petroica phoenicea*), and
- Diamond Firetail (*Stagonopleura guttata*).

A considerable amount of foraging and breeding habitat for many of these species was observed in and around the study area. Targeted surveys following appropriate NSW and Commonwealth guidelines at the optimal survey time of year would be required to confidently determine the presence of any of these species within the study area.

3.2.6.2 Threatened fish

No threatened fish species are known or considered likely to be present in the study area given there is no creek, river or other watercourse within it.

3.2.6.3 Threatened frogs

No threatened frog species are known or considered likely to be present in the study area.

3.2.6.4 Threatened invertebrates

One species of threatened invertebrate is considered likely to occur within the study area, this being the Golden Sun Moth (*Synemon plana*). The species has multiple records within 10 km, concentrated in nearby Queanbeyan Nature Reserve and surrounding grassy areas. Although habitat within the study area is suboptimal, targeted surveys following appropriate NSW and Commonwealth guidelines at the optimal survey time of year would be required to confidently determine the presence of any of the species within the study area.

3.2.6.5 Threatened bats

One threatened species of bat is considered likely to occur within the study area, this being the Grey-headed Flying-fox (*Pteropus poliocephalus*). Habitat within the project area was unlikely to be utilised for breeding for this species, as no observations were made of roosting during site inspections. However, there is potential that the species may utilised the area for foraging and dispersal.

3.2.6.6 Threatened mammals

One threatened species of mammal is considered likely to occur within the study area, this being the Koala (*Phascolarctos cinereus*). Suitable habitat trees are present within the study area, with some records nearby. Targeted surveys following appropriate NSW and Commonwealth guidelines would be required to confidently determine the presence of any of the species within the study area.

3.2.6.7 Threatened reptiles

Based on their associated habitats two threatened reptile species are known or considered likely to be present in the study area. These being Rosenberg's Goanna (*Varanus rosenbergi*) and Pink-tailed Worm-lizard (*Aprasia parapulchella*). Potential habitat suited to both species can be found within the study area. Targeted surveys following appropriate NSW and Commonwealth guidelines would be required to confidently determine the presence of these species within the study area.

3.2.7 Threatened populations

No threatened populations as listed under the BC act are known or considered likely to be present in the study area.

3.2.8 Migratory species

The desktop assessment found that 15 migratory bird species are known or may occur within 10 km of the study area. However, based on their habitat preferences, only the White-throated Needletail (*Hirundapus caudacutus*) is considered likely to utilise the study or work areas. For more information see Appendix B5.

3.2.9 Pest animal species

Several pest animal species are associated with KTPs or otherwise listed under Commonwealth and/or State laws. Many of these species are highly mobile and as such, it is rarely possible to categorically rule out their presence in a certain area. Several pest species are likely to be present in the study area and/or immediate surrounds. They include the following birds:

- Common Myna (Acridotheres tristis),
- Rock Pigeon (Columba livia),

- Spotted Turtledove (Streptopelia chinensis),
- House Sparrow (Passer domesticus),
- Skylark (Alauda arvensis), and
- European goldfinch (Carduelis carduel).

As well as the following mammals:

- Cat (Felis catus),
- House mouse (*Mus musculus*),
- Rabbit (*Oryctolagus cuniculus*),
- Hare (*Lepus capens*is),
- Black Rat (*Rattus rattus*),
- Deer (various species), and
- Fox (*Vulpes vulpes*).

The Common Starling (*Sturnus vulgaris*) and Common Blackbird (*Turdus merula*) were observed as occurring within the study area. For a complete list of all the feral animal species considered, their legislative status, and distribution or abundance in the local area, refer to Appendix B6.

3.2.10 Weed species

During the field inspection, it was noted that the areas within the site has experienced historic clearing and disturbance, particularly in the in the more degraded area of the compound site. This had likely contributed to the establishment of 10 weed species in the study area. This includes the following High Threat Exotics (THE):

- Cootamundra Wattle (*Acacia baileyana*),
- Hawthorn (*Crataegus monogyna*),
- Sweet Briar (*Rosa rubiginosa*),
- St. John's Wort (*Hypericum perforatum*),
- Sheep Sorrel (*Acetosella vulgaris*),
- African Lovegrass (*Eragrostis curvula*), and
- Umbrella Sedge (*Cyperus eragrostis*).

As well as the following Weeds of National Significance (WONS):

- African Boxthorn (*Lycium ferocissimum*),
- Blackberry (*Rubus fruticosus* sp. *agg*), and
- Serrated Tussock (*Nassella trichotoma*).

For a complete list of all the weed species considered, their legislative status and discussion of their habitat requirements, refer to Appendix A and Appendix B7.

4 Impact Assessment

This section identifies the potential impacts of the proposal on ecological values of the study area. It includes recommendations to assist the proponent to avoid, minimise and mitigate the potential impacts of the proposal on biodiversity and to enhance the site's ecological values.

4.1 Direct Impacts

4.1.1 Vegetation clearing

This BAR assumes a worst-case scenario where the entirety of the study area will be impacted by the proposal, this includes the potential clearing of all native vegetation within this area. Direct impacts include the clearing or otherwise direct disturbance to up to 3.15 ha of native vegetation and ecological valuable habitats for threatened species outlined throughout this report as a result of construction for a new water supply reservoir, new chlorination building and the establishment of a temporary construction compound.

The native vegetation that has the potential to be cleared varies in composition and condition, with distinct areas of high biodiversity value and areas where historic clearing and disturbances have degraded the biodiversity value of the native vegetation. Despite any potential clearing, the woodland surrounding the proposal site would still retain connectivity to other areas of native vegetation and fall within a large, continuous patch of protected native vegetation within Mount Jerrabomberra Reserve. It is therefore unlikely that the potential clearing attributed to the proposal would cause fragmentation or reduce the overall connectivity of the wider patch.

Potential clearing would cause the removal of many non-threatened individual plant species, particularly within the highly diverse mapped PCTs. Additionally, potential clearing may require the removal of old growth trees, mature trees and areas where canopy regeneration is occurring.

Recommendations have been made in Section 4.6 to avoid and minimise the impacts associated with any potential vegetation clearing works.

4.1.2 Removal of habitat

The proposal has the potential to remove large areas of native vegetation and their associated habitat resources that native fauna utilise, this may include threatened fauna species likely to occur within or nearby the study area. Habitat with potential to be removed or otherwise impacted includes:

- native woodland providing various habitat services including food sources, foraging and breeding habitat as well as strata for the safe movement and dispersal of species,
- habitat-bearing trees containing hollows, nests and fissures providing roosting and nesting habitat,
- limited rock outcrops and coarse woody debris providing limited shelter and foraging opportunities,
- ant/termite mounds providing potential foraging and breeding habitat,
- mistletoe, providing a key food source.

The removal of these food, foraging and breeding resources has the potential to adversely impact local fauna abundance and diversity. Reduction in habitat services can change resource-driven interactions between species, whether it be loss of food resources, loss of breeding habitat, increased competition, or changes to predatory relationships. However, these impacts can be reduced or avoided if the recommendations in Section 4.6 are adhered to.

4.1.3 Fauna injury or mortality

Potential clearing works are likely to result in the injury or mortality of individual fauna, including less mobile species or small hidden fauna. Ground dwelling fauna, such as reptiles and frogs, have been found beneath rocks and debris within the study area, and may be at risk during clearing activities. Many hollows have been observed within the study area, there is a potential risk of injury or mortality to native fauna such as birds, bats, reptiles and arboreal mammals that may be sheltering within.

Recommendations have been made in Section 4.6 to avoid and minimise the risk of vegetation clearing works causing injury or mortality to native fauna.

4.2 Indirect impacts

4.2.1 Erosion and sedimentation

The proposal will require construction activities that may cause erosion, sedimentation, pollution or contaminated runoff within the study area, and through nearby waterways. Potential sources of soil and water pollution may include,

- Increased erosion potential in areas cleared of vegetation,
- Soil disturbances during any potential earthworks or construction,
- Inappropriate management of material stockpiles,
- Spills of leaks from incorrect storage of fuel, oil, and other chemicals, or from any uncovered loads coming to and exiting the project site.

Measures to mitigate the risk for pollution from construction activities are described in Section 4.6.

4.2.2 Weed invasion and edge effect

Disturbance associated with vegetation clearing, vehicle traffic and general day to day operations during construction increases the potential for the introduction, spread, and establishment of weed and pest species. Weed species are effective competitors for food and habitat resources and have the potential to exclude native species and modify the composition and structure of vegetation communities. Three Weeds of National Significance (WONS) were observed in the study area and seven species of High Threat Exotics (HTE) are present throughout the study area. There is a risk of construction activities spreading and transporting these invasive weeds and potentially new weeds into other areas of the study area or surrounding landscape.

The 'edge effect' includes any increased disturbance or pollution as a result of altered environmental conditions within an adjacent area. Changes such as removal of native vegetation, increased traffic, light, noise, erosion or sedimentation can have impacts that bleed into neighbouring areas. The proposal likely will increase the impact from edge effects though native vegetation clearing and various construction activities. It is likely that the proposal will create new edges along areas of native vegetation that currently has minimal disturbance, increasing the potential for weed invasion and spread.

Management strategies to minimise impacts from weed invasion and edge effect can be found in Section 4.6, including recommendation to develop a weed management sub-plan as a part of the proposals Construction Environmental Management Plan (CEMP).

4.2.3 Introduction and spread of pests and pathogens

Construction activities have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into nearby native vegetation through vegetation disturbance and increased site visitation. Phytophthora and Myrtle Rust may result in the dieback or modification of vegetation and damage to fauna habitats.

There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Nevertheless, diseases and pathogens can be introduced or spread to site via dirt or organic material attached to machinery, vehicles, equipment, and employees. The potential for significant or new impacts associated with these pathogens is relatively low, given the creation of exclusion zones to ensure limited access to areas outside areas to be directly impacted. To help mitigate any risk of pathogens being brought onto and/or spread through the site all machinery brought to site and leaving the site should be washed down and inspected to be free of soils, seeds, and other organic material in accordance with Section 4.6.

4.2.4 Noise, vibration and light impacts on fauna

In the short term, construction vehicles and machinery will increase in noise and vibrations in and around the proposal area. The increase in noise and vibrations may disrupt fauna changing foraging behaviour, impacting breeding success and changing species occurrences. Fauna in close proximity to construction activities are more likely to be impacted, particularly species which are nesting, roosting or denning. The study area contains many hollows which may be occupied by native fauna that will potentially be impacted by increased noise and vibrations. These disturbances have the potential to impact breeding activities of surrounding species. Additionally, some species may vacate the area where possible.

Given the temporary nature of the works and the availability of alternate habitat in the surrounding Mount Jerrabomberra Reserve, it is unlikely that the temporary increase of these disturbances produced by construction activities will significantly impact fauna that occur within or near to the study area. However, recommendation to mitigate potential impacts are specified in Section 4.6.

4.3 Cumulative impacts

4.3.1 Fragmentation and isolation of vegetation

The cumulative loss and disturbance of native vegetation has been likened to ‘death by a thousand cuts’, where ecosystems are progressively removed and altered gradually over time. This process is evident within the Jerrabomberra region, where native forest has been progressively removed for residential development. The proposal has the potential to remove or otherwise directly impact up to 3.15 ha of native vegetation within the 93.5 ha Mount Jerrabomberra Reserve. The areas proposed for potential clearing are comprised largely of already disturbed sites at the edge of the reserve, and not disrupting connectivity within the surrounding native vegetation. It is therefore unlikely that the clearing of native vegetation for the proposal would significantly fragment or reduce the overall connectivity of the patch, given the extent of vegetation removal anticipated and its location. Additionally, Mount Jerrabomberra Reserve is a protected patch of native vegetation valued for conservation and recreation, ensuring no further native vegetation removal will occur.

4.3.2 Fragmentation and isolation of habitat

Habitat loss through clearing of native vegetation, removal of particular strata or features within an area can create barriers to the movement of fauna and diminish their access to habitat resources. Although there are areas within the proposal site that have historically been cleared, mature HBTs have been retained in these areas. In the ecological study of the Mount Jerrabomberra Reserve, that informed *Mount Jerrabomberra Plan od Management* 2021, it found:

> *"Limited hollow-bearing trees that provide important shelter and breeding habitat for a range of mammals and birds, and potentially some reptiles and amphibians."*

Although additional removal of habitat within the proposal area might constitute a small area within Mount Jerrabomberra Reserve, the habitat present in the proposal area is likely valuable at a local scale. It is recommended that removal or significant disturbance to HBTs is avoided wherever possible and other recommendation in Section 4.6 are adhered too. If these recommendations are followed it is unlikely that the proposal will create and significant fragmentation or isolation of habitat.

4.4 Impacts on threatened biota and migratory species

The proposal has the potential to result in adverse impacts on threatened species and their habitats within the proposal site. Impacts to native vegetation, and therefore threatened biota, should be minimised as much as practically possible through refinement of proposal design, including location of works footprint, infrastructure location and ensuring prioritisation of utilising existing disturbed sites.

4.4.1 Threatened ecological communities

There are no TECs listed under the BC Act or EPBC Act within the study area and therefore no impacts are likely.

4.4.2 Threatened species

4.4.2.1 Threatened flora

There is broadly suitable habitat for six threatened flora species within the study area. Although no threatened flora species were observed during field assessment, the presence or absence of four of the threatened species cannot be confidently determined as surveys could not be conducted during the optimal survey period. The threatened flora species that may be present include:

- Buttercup Doubletail (*Diuris aequalis*),
- Hoary Sunray (*Leucochrysum albicans subsp. tricolor*),
- Small Purple-pea (*Swainsona recta*), and
- Silky Swainson-pea (*Swainsona sericea*).

As the study area consists of area of high and lower quality habitat (historically cleared and disturbed), of which the degraded habitat found within the study area is considered less likely to contain the above-mentioned species. It has therefore been recommended that works remain within the areas of higher disturbance, however if works are required within areas of high biodiversity targeted surveys at the optimal time of year (September to December, see Table 1) should be conducted. If the proposal adheres to these recommendations it is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction.

Assessment of significance is described further in Appendix C.

4.4.2.2 Threatened fauna

Assessments of significant impacts mandated by the BC act (5-part test) and EPBC act have been prepared for impacts on the threatened fauna species that have a high to moderate likelihood of occurring in the proposal site on occasion and where impact is likely due to habitat removal. There is broadly suitable habitat and close records available for 19 threatened bird species, one threatened insect, two threatened mammals and two threatened reptiles, these include:

- **Small grassland woodland birds**: Regent Honeyeater (*Anthochaera phrygia*), Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), Speckled Warbler (*Chthonicola sagittata*), Varied Sittella (*Daphoenositta chrysoptera*), Little Lorikeet (*Glossopsitta pusilla*), Painted Honeyeater (*Grantiella picta*), White-throated Needletail (*Hirundapus caudacutus*), Scarlet Robin (*Petroica boodang*), Flame Robin (*Petroica phoenicea*), and Diamond Firetail (*Stagonopleura guttata*).
- **Hollow dependant woodland birds**: Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Gang-Gang Cockatoo (*Callocephalon fimbriatum*), Glossy Black-Cockatoo (*Calyptorhynchus lathami*), Powerful Owl (*Ninox strenua*), Swift Parrot (*Lathamus discolor*), Turquoise Parrot (*Neophema pulchella*) and Superb Parrot (*Polytelis swainsonii*).
- **Raptors**: Spotted Harrier (*Circus assimilis*), Black Falcon (*Falco subniger*) and Little Eagle (*Hieraaetus morphnoides*).
- **Invertebrates**: Golden Sun Moth (*Synemon plana*)
- **Mammals**: Grey-headed Fly-fox (*Pteropus poliocephalus*) and Koala (*Phascolarctos cinereus*)
- **Reptiles**: Pink-tailed Worm-lizard (*Aprasia parapulchella*) and Rosenberg's Goanna (*Varanus rosenbergi*)

Generally, it has been determined that the proposal, and any potential clearing, is considered likely to have an adverse effect on the above-mentioned species if they are present locally. A range of measures have been recommended to avoid and minimise the impacts of the proposal on the above species. These include recommendations for works to be confined to degraded areas, avoidance of HBT and pre-clearing surveys. Provided these measures found in Section 4.6 are adhered to and works remain in the recommended areas (lower quality), the proposal is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction.

For more information on the assessment of significance conducted, see Appendix C.

4.4.3 Migratory species

The only migratory species considered likely to be occasionally present is the White-throated Needletail (*Hirundapus caudacutus*). This species spends much of its time foraging for insects high above the canopy. Although there is potential that the species forages in the vicinity of the proposal area, it is unlikely that the proposal would have any impacts on the species.

4.5 Key threatening processes

Key threatening process (KTP) is a process that threatens or threaten the abundance or survival of a native species or ecological community. A process can be listed as a KTP under the BC Act or EPBC Act under slightly different criteria, but generally as a result of:

- causing a native species or ecological community to become eligible for inclusion in a threatened list (other than the conservation dependent category); or
- causing an already listed threatened species or threatened ecological community to become more endangered; or
- adversely affect two or more listed threatened species or threatened ecological communities.

The NSW listed KTP most relevant to the proposal have been summarised in Table **5**, a more in depth discussion of KTPs can be found in Appendix C.

TABLE 5: KEY THREATENING PROCESSES OF RELEVANCE TO THE PROPOSAL

KTP	Potential	Comment
Feral Animals	Species with a medium to high likelihood of occurrence within the study area include: Common Myna (*Acridotheres tristis*), Rock Pigeon (*Columba livia*), Spotted turtledove (*Streptopelia chinensis*), House Sparrow (*Passer domesticus*), Skylark (*Alauda arvensis*), European goldfinch (*Carduelis carduel*), Common Starling (*Sturnus vulgaris*), Common Blackbird (*Turdus merula*), Cat (*Felis catus*), House mouse (*Mus musculus*), Rabbit (*Oryctolagus cuniculus*), Hare (*Lepus capensis*), Black Rat (*Rattus rattus*), Deer (*various species*), and Fox (*Vulpes vulpes*).	The proposal is located very close to residential and urban area which likely means many of these species are already prevalent. The proposal is considered very unlikely to increase the impact of this KTP as the area which the proposal is located is already very close to urban landscape where these pest have already been introduced. For details of all the feral animal species considered as part of the field inspection and this test of significance, see Appendix C6.
Weeds	Invasion and establishment of exotic vines and scramblers such as Blackberry. Invasion of native plant communities by exotic perennial grasses such as Serrated Tussocks. Invasion and establishment of Scotch Broom (Cytisus scoparius). Loss/degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.	There is an absence or low abundance of noted weed species within the proposal area. Construction activities have the potential to introduce and facilitate the establishment of various weed species within the proposal area and immediate surrounds. Impacts will be mitigated by appropriate weed control measures prior to, and rehabilitation efforts post, construction. Overall, it is unlikely that the proposal will significantly contribute to this KTP given appropriate measures are implemented as recommended.
Habitat modification	Clearing of native vegetation. Loss or degradation of specific habitat structures.	The proposal may require the removal of native vegetation or habitat features within the study area, however if recommendations to keep works within the areas already degraded and avoid the removal of hollow-bearing trees the proposal is not likely to result in the loss, or long-term modification, of the structure, composition and ecological function of the area. Additionally, mitigation and rehabilitation measures will minimise any long-term impacts.

4.6 Recommended safeguards and mitigation measures

4.6.1 Avoid and minimise impacts

This BAR has assumed a worst-case scenario where the entirety of the study area will be impacted by the proposal, this includes the potential clearing of all native vegetation within this area. This includes the clearing or otherwise direct disturbance to up to 3.15 ha of native vegetation and ecological valuable habitats, however it has been communicated that the proposal site is likely to be confined to already cleared areas, and not require disturbances to the areas of high biodiversity value within study area.

Through field assessment and vegetation mapping it has been determined that there is 1.33 ha of degraded native vegetation within the proposal area where the works footprint should be contained wherever possible (refer to Figure 10 for mapped area and Table 4 for further information). Additionally, important habitat in the form of HBTs have been mapped within these areas to help further identify habitat to avoid within the areas of degraded vegetation (refer to Figure 11 for mapped HBT). Furthermore, staying within the mapped degraded native vegetation will reduce the likelihood of impacts on threatened flora considered likely to be within the area. If the proposal area is deemed necessary to impact areas of good condition vegetation targeted surveys at the optimal time of year (September to December, see Table 1) should be employed to confidently determine presence, and avoid potential impacts.

It is the recommendations of this BAR that for this proposal, planning and design use the ecological information presented in this report to inform design choice, either confirming current design or initiating a redesign to minimise vegetation and habitat removal. By doing this the proposal is unlikely to cause any significant impacts to native vegetation or threatened biota within the proposal area.

4.6.2 Construction mitigation measures

A range of measures would be required for the proposal in order to mitigate any impacts unavoidable by location and design refinement as outlined above. These include measures to be undertaken before, during and after construction to minimise the direct impact of the proposal. Measures include the development and implementation of detailed plans which may include, although not be limited to:

- Construction Environmental Management Plan (CEMP),
- Erosion and Sediment Control Plan,
- Weed Management and Restoration Plan,
- Nest Box Installation and Monitoring Plan, and
- Landscaping Plan.

At a minimum the proposed measures described below have been identified to manage construction and operational impacts of the proposal to biodiversity.

4.6.2.1 Timing of clearing and construction works

In order to minimise impacts to threatened fauna species that may use habitat trees (e.g., trees containing stick nests, hollows, cavities, and other features likely to contain residing fauna) within the proposal area, an inspection of all trees and other habitat features will be undertaken before removal or direct disturbance. Further details of preclearing inspections are provided in the section below.

In the case that a threatened species is identified utilising a tree or other habitat feature during construction, removal will only be once the ecologist determines the breeding period for that species has ended and all juveniles have moved on. Furthermore, adaptive management of the threatened species is

to be applied as determined by the ecologist, a tree may also be removed after a pre-clearance inspection if a qualified ecologist determines no hollow-dwelling or nesting species are present at that time.

4.6.2.2 Delineation of clearing areas and protection zones

While this BAR has assumed complete removal of vegetation within the proposal area, it has been communicated that proposal plans are to retain areas of native vegetation and habitats where possible. To avoid unnecessary removal or damage to areas of high biodiversity, ecologically valuable habitats and other retained vegetation, the clearing area (construction footprint) should be clearly demarcated with temporary fencing and signage where appropriate.

Areas proposed for retention (particularly the conservation area, remaining vegetation in the development site and key habitat trees) are to be clearly identified, temporarily fenced and sign posted as 'Environmental Protection Zone' prior to the commencement of construction. Restrictions on clearing, access, movement, and construction activity within these areas will be implemented to protect native vegetation and ecologically valuable habitats proposed for retention. Contractors, workers, and visitors to the proposal site are to be made aware of clearing limits and no-go zones as part of their site induction.

4.6.2.3 Clearing provisions

Pre-clearing surveys

A range of fauna species were identified utilising, residing, and breeding within the proposal area during field surveys for this BAR. Removal of native vegetation and habitat for native and threatened fauna species introduces the risk of harm to native (protected) and threatened fauna likely present. Pre-clearing surveys should be undertaken by a suitably qualified ecologist ahead of clearing, aimed at minimising fauna injury and mortality during construction and to identify habitat features to be salvaged/relocated. Pre-clearing surveys would consist of:

- inspection of trees and habitat features for the presence of residing fauna,
- demarcation, mapping and recording of key habitat features (e.g., hollow-bearing trees, fallen logs and bush rock),
- identification and nomination of hollow-bearing trees, bush rock or hollow logs to be salvaged and relocated to adjacent vegetation or landscape areas where appropriate, and
- reporting requirements following the completion of pre-clearing surveys, detailing the location and type of each habitat feature.

Pre-clearing surveys would also be undertaken as a final check for threatened flora and fauna potentially present. A follow-up, rapid survey should be conducted immediately prior to vegetation clearing in order to identify any new habitat features that could not be accounted for during initial pre-clearing surveys.

Clearing supervision and staging of clearing

Upon completion of pre-clearing inspections and rapid surveys outlined above, all clearing should be supervised by an ecologist and conducted utilising a two-stage clearing process as follows:

- Stage 1: This stage consists of clearing trees, and other native vegetation identified by the ecologist as not comprising key habitat features likely to contain residing fauna. Habitat trees (as marked) are not to be removed during this stage and consequently would be isolated for removal during Stage 2. Other habitat features (e.g., bush rock, hollow logs, and man-made structures) may be removed during this stage under the supervision of an ecologist.
- Stage 2: Clearing for Stage 2 is to be undertaken at a minimum of one day following Stage 1 clearing. This is to provide a chance for residing fauna to voluntarily disperse overnight. After

habitat trees have been left overnight, the identified trees may be cleared using the following best practice techniques:

- trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any residing fauna to leave the hollows,
- trees containing stick nests will be inspected and nest carefully removed by a tree climbing arborist or personnel qualified to use an elevated working platform (EWP),
- a bulldozer or excavator is to carefully push the tree over,
- the tree is to be left in its cleared position until completion of an inspection by an ecologist for the presence of fauna (the ecologist may require the tree to be rolled over to undertake a detailed inspection of all hollows),
- the cleared habitat tree may be left overnight to allow any remaining fauna time to leave the hollows and disperse from the construction area, and
- branches containing hollows and sections of trunk will be set aside for salvage including immediate transfer to a dedicated storage area. Following construction tree materials over 10 cm DBH will be relocated to a suitable area in the locality to be utilised for habitat.

Salvage and relocation of fauna and habitat features

A suitably qualified and vaccinated ecologist should be engaged to supervise removal of all native vegetation and habitat features for the proposal in order to minimise the chance of harm to fauna, and to rescue or relocate any fauna displaced during the clearing process. Prior to clearing, appropriate relocation sites should be clearly identified. All workers will be informed about potential fauna present and measures to avoid injuring fauna as part of their site induction. If fauna is injured during the clearing works, appropriate steps will be in place to humanely treat the animal by contacting the nearest wildlife rescue team or taking the animal to the nearest veterinary clinic for treatment. Reporting requirements following the completion of clearing, will include a record of all fauna species encountered, relocated and/or injured.

Similarly, all habitat features removed and identified by an ecologist for salvage and relocation is to be recorded and reported. Key habitat features such as hollows and rocks should be stockpiled on site and relocated within the proposal area.

4.6.2.4 Nest-box installation and monitoring

Relocating fauna and removal of hollows/other habitat features increases competition for resources and has the potential to impact native and threatened species beyond the development footprint. In order to mitigate loss of hollows and other identified habitat features, nest boxes are to be installed and monitored in accordance with a Nest Box Installation and Monitoring Plan. The plan will provide for the replacement of hollows removed and unsalvageable with at a minimum, one similar sized artificial hollow (nest box). Provisions will include:

- the indicative size, type, number, and location of nest boxes required based on the results of the pre-clearing surveys,
- 50 per cent of nest boxes should be installed one month prior to any hollow-bearing tree removal,
- the final size, type, number, and location of nest boxes required based on the results of the clearing supervision reports, and
- all nest boxes to be installed within six months from the date of the commencement of clearing.

4.6.2.5 Erosion, sedimentation and pollution control

The proposal may result in erosion and transport of sediments into the ephemeral drainage line and further offsite as a result of soil disturbance and spills during construction. To reduce sedimentation and pollution during construction, erosion and chemical contaminant control measures will be implemented in accordance with "The Blue Book" (Landcom 2004). This includes the following:

- minimising the amount of exposed soils,
- installation of sediment control fences,
- covering soil stockpiles,
- ensure stockpiles are located well away (at least 40 m) from the ephemeral drainage line or other drainage lines,
- avoiding soil disturbance prior to heavy rainfall,
- precautions for fast and effective containment of pollution, such as:
  - pollution traps,
  - spill kits, and
  - removal of pollution to an off-site location.

To avoid potential indirect impacts during construction, an appropriate Erosion and Sedimentation Control Plan should be in place following best practice (e.g., Landcom, 2004) and are included in a site-specific CEMP, prior to any construction works taking place.

4.6.2.6 Weed, pathogen and disease management

Clearing and construction works can result in the spread of weeds, pathogens and diseases throughout a site or lead to their introduction to an area. In order to minimise the spread of weeds, pathogens and diseases, monitoring, management, and control is to be aligned with relevant legislation and recommendations including the NSW Biosecurity Act 2015 and the South East Regional Strategic Weed Management Plan 2017-2022.

The proposal area currently exhibits evidence of invasive weeds, with zones of higher disturbance and little to no canopy presenting displaying higher rates of invasive species. Importantly, invasive weeds categorised as Weeds of National Significance and High Threat Exotics were identified within proposal area including:

- Weeds of National Significance:
  - African Boxthorn (*Lycium ferocissimum*),
  - Blackberry (*Rubus fruticosus* sp. *agg*), and
  - Serrated Tussock (*Nassella trichotoma*).
- High Threat Exotics:
  - Cootamundra Wattle (*Acacia baileyana*),
  - Hawthorn (*Crataegus monogyna*),
  - Sweet Briar (*Rosa rubiginosa*),
  - St. John's Wort (*Hypericum perforatum*),
  - Sheep Sorrel (*Acetosella vulgaris*),
  - African Lovegrass (*Eragrostis curvula*), and
  - Umbrella Sedge (*Cyperus eragrostis*).

Pathogen spread can cause disease and the weakening of an ecosystem's flora and fauna. Microorganisms causing such diseases can be spread by machinery, vehicles or footwear and preventative measures should be in place to prevent the introduction to the proposal area. Pathogens may include:

- *Phytophthora cinnamomi,* a root-rot fungus that infects native vegetation causing dieback and is listed as a key threatening process under the EPBC Act.
- Chytrid Fungus (*Batrachochytrium dendrobatidis*), a fungal disease that affects amphibians, thought to be causing the decline of some frog species worldwide, including the Alpine Tree Frog and the Booroolong Frog.
- Myrle Rust (*Puccinia psidii*), a fungal disease infecting soft, actively growing parts of plants within the Myrtaceae family (eucalypts, bottlebrush etc.)

Prevention and early intervention are the most effective management strategies to manage weed, pathogen and disease spread. The following strategies will be prompted early in the development of environmental management plans (e.g., CEMP and/or BMP) with robust communication between responsible parties to ensure controls are managed in a strategic and coordinated manner across the proposal area:

- identification, mapping, and treatment of priority weeds before clearing commences,
    - manual weed removal is preferable to the use of herbicides where appropriate,
- advise all workers and visitors of biosecurity measures in place,
- weed infested plant material to be disposed in accordance with waste management legislation,
    - e.g., appropriate disposal of weed material, including seeds, into bags or plastic sheeting to prevent the spread of existing weed species,
- hygiene controls such as cleaning and inspecting for soil or organic material on plant, equipment, and clothing prior to site arrival, including clean vehicles and tyres,
- implement frog hygiene and pest control protocols,
- monitor high-risk and high- traffic areas such as roads and bare ground,
- control the movement of plant, equipment, and workers to minimise the potential for the spread of weeds within and outside the proposal area, and
- continued monitoring and follow-up treatments where necessary within proposal area.

4.6.3 Post construction and operation mitigation measures

4.6.3.1 Landscaping and rehabilitation

The removal of native flora as a consequence of the proposal should be offset by post construction plantings of appropriate flora within a planned landscape area. Field surveys for this BAR have identified localised flora species from which an indicative planting list can been prepared for potential landscaped areas. The list should incorporates species:

- observed in the proposal area, and
- associated with PCT3747, PCT3375 and PCT 3534.

Restricting landscaping to include identified local species (as provided in a indicative planting list) is likely to mitigate the potential for changing species assemblage and introduction of foreign species to the proposal area and surrounding environment.

5 Statutory and planning framework – biodiversity legislation

5.1 Environment Protection Biodiversity Conservation Act 1999

The EPBC Act provides a framework to protect Matters of National Environmental Significance (MNES), including Commonwealth-listed threatened species and threatened ecological communities (TECs). Any actions that will or are likely to have a significant impact on MNES are likely to be considered a Controlled Action under the EPBC and require approval from the Minister for the Environment.

The potential impacts of proposed works were assessed against the MNES, and, for most MNES, no impact was considered likely (Table 6).

TABLE 6: MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

MNES	Potential impacts	More information
World Heritage Properties	None	None, the study area does not contain and is not within 5 km of a World Heritage Property.
National Heritage Places	None	None, the study area does not contain and is not within 5 km of a National Heritage Place.
Wetlands of international importance (RAMSAR wetlands)	None	None, the study area does not contain and is not within 5 km of a wetland of international importance.
Nationally threatened ecological communities and species	Potential	An EPBC Protected Matters search report flags that four TECs and 45 threatened species listed by the Commonwealth are known or may occur within 10 km of the study area. A likelihood of occurrence assessment was undertaken with the following results for commonwealth listed species (see A4 within Appendix A: Biodiversity assessment.). No Commonwealth listed TEC was observed to occur within the study area. While no Commonwealth listed threatened flora species was observed, four species were determined likely to occur within the study area, these include: • Buttercup Doubletail (*Diuris aequalis*), • Hoary Sunray (*Leucochrysum albicans* subsp. *tricolor*), • Pale Pomaderris (*Pomaderris pallida*), • Button Wrinklewort (Ru*tidosis leptorrhynchoides*), and • Small Purple-pea (*Swainsona recta*). Targeted surveys at within the optimal period were not able to be conducted, and therefore their presence could not be determined, these surveys should be conducted if direct impacts are expected within areas of high biodiversity. The proposal is not considered likely to have a significant impact on a Commonwealth listed threatened ecological community or flora species provided measures found in Section 4.6 are adhered to. The following 10 Commonwealth listed threatened fauna species are known or likely to occur, with potential to utilise habitats within the study area: • Regent Honeyeater (*Anthochaera phrygia*), • Gang-Gang Cockatoo (*Callocephalon fimbriatum*), • Painted Honeyeater (*Grantiella picta*), • White-throated Needletail (*Hirundapus caudacutus*), • Swift Parrot (*Lathamus discolor*), • Superb Parrot (*Polytelis swainsonii*), • Grey-headed Flying-fox (*Pteropus poliocephalus*), • Koala (Phascolarctos cinereus), • Pink-tailed Worm-lizard (*Aprasia parapulchella*), and • Golden Sun Moth (*Synemon plana*). Provided measures found in Section 4.6 are adhered to and works remain in the recommended areas (lower quality), the proposal is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction. As these species are also listed under NSW

		law, further detail into a Test of Significance for each species respectively, can be found in Appendix C.
Migratory species	None	15 migratory species listed in the Commonwealth EPBC Protected Matters Report were considered likely to occur within the study area. Few if any species are considered likely to occur in the study area given the quantity and quality of habitat available for these species. The White-throated Needletail may forage above the study are but limited potential habitat is present within it and it is unlikely that the proposal area will have adverse or significant impact on long-term habitat for the survival of this species. For more information, see Appendix B5.
Commonwealth marine areas	None	None, the study area does not contain or adjoin any such area
Great Barrier Reef Marine Park	None	None, the study area does not contain or adjoin any such area
Nuclear actions including uranium mining	None	None, the proposal area does not involve uranium mining or other nuclear actions
A water resource, in relation to coal seam gas development/ large coal mining development	None	None, the proposal area does not involve coal seam gas or coal mining development

5.2 NSW Environmental Planning & Assessment Act 1979

The NSW Government's EP&A Act is the key framework legislation for planning in NSW. It aims to encourage the proper consideration and management of the impacts of proposal area (in this case, unauthorised development) and land-use changes on the natural and built environment, and on the community.

Several planning instruments have been made under the EP&A Act regarding specific aspects of planning at the State or regional level. SEPPs are environmental planning instruments made under the EP&A Act that outline policy objectives relevant to planning at the State or regional level.

5.2.1 Koala Habitat Protection State Environmental Planning Policy

This proposal is not a development under part 4 of the EP&A Act so the Koala SEPP does not apply in any form. However, as koalas are listed as threatened species, the project's impacts on them should be assessed and consideration to this legislation can help minimise any risk.

The Koala SEPP has undergone significant changes in recent years, and different versions of the SEPP currently apply in different areas[4]. These were formerly known as SEPP 44 and are now located within a much larger SEPP on Biodiversity and Conservation as follows:

- Chapter 3 – Koala Habitat Protection 2020
- Chapter 4 – Koala Habitat Protection 2021

As at time of writing, Chapter 4 applies:

- in local government areas in the Sydney Metropolitan Area and Central Coast—in all zones
- in all other identified LGAs—in all zones except RU1, RU2 and RU3 zoned land (where Chapter 3 continues to apply pending development of new land management codes)

[4] https://www.planning.nsw.gov.au/Policy-and-Legislation/Environment-and-Heritage/Koala-Habitat-Protection-SEPP

The study area is in the Queanbeyan-Palerang Regional Council LGA and is zoned C2, so Chapter 4 applies. It specifies that Councils must consider whether a development is consistent with the approved Koala Plan of Management that applies to the land or, if there is no such plan, whether it is likely to impact on Core Koala Habitat. Core Koala Habitat is currently defined as land:

- assessed by a suitably qualified and experienced person as being highly suitable Koala habitat
- where Koalas are present at the time of assessment or have been recorded as being present in the previous 18 years

As Queanbeyan-Palerang Regional Council has not published an approved Koala Plan of Management, works in this LGA would normally require an assessment of potential impacts on Core Koala Habitat.

NSW DPIE modelling has rated native vegetation in the study area as within a koala habitat suitability range of 0.51– 1 (Figure 12). Koala tree use varies considerably by region[5], field inspection of the study area noted the presence of the following koala use tree species listed in Schedule 3 of the Biodiversity and Conservation SEPP:

- Red Stringybark (*Eucalyptus macrorhyncha*),
- Inland Scribbly Gum (*E. rossii*), and
- Red Box (*E. polyanthemos*).

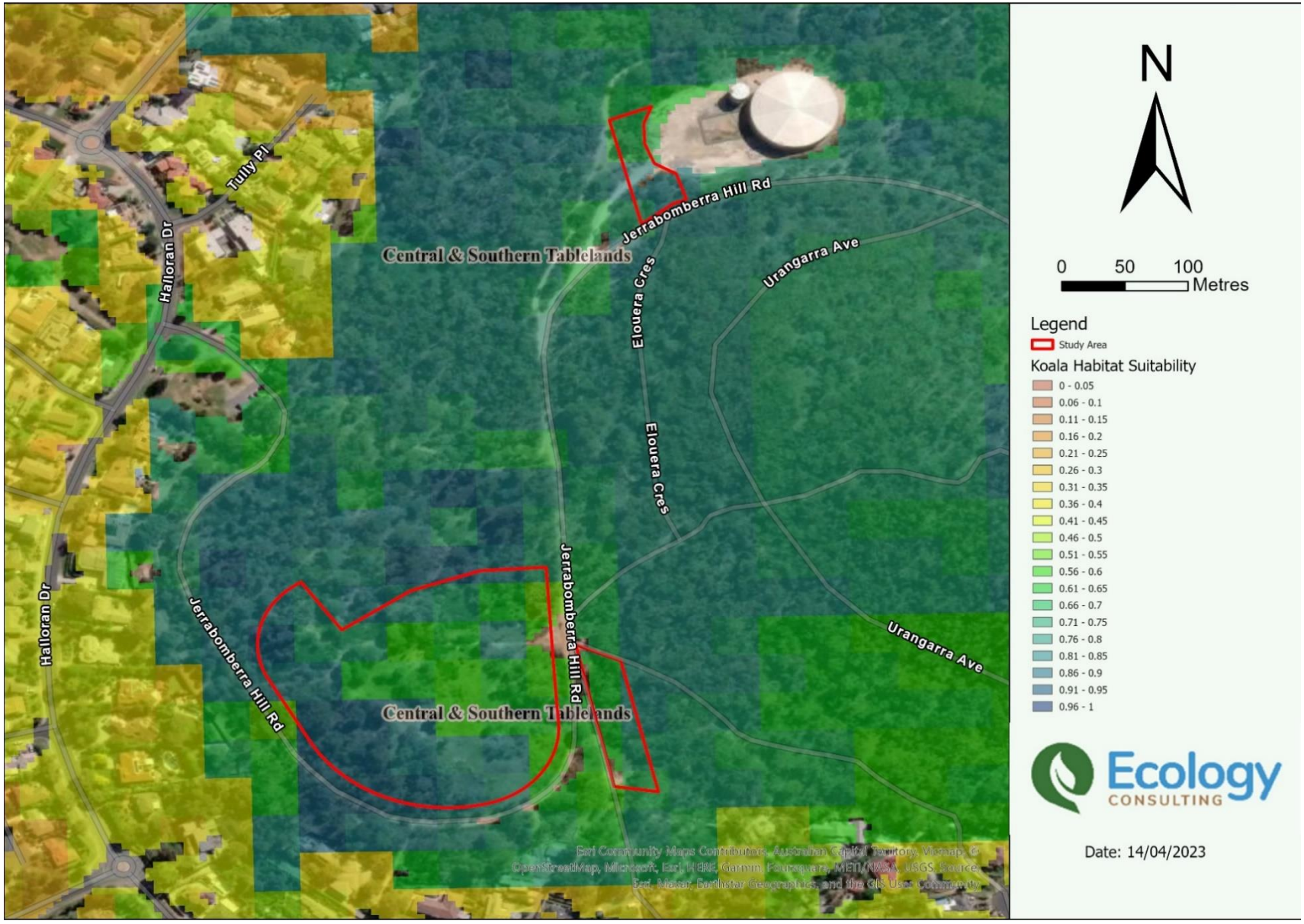
Field inspection reveals the project area does not constitute core or critical Koala habitat. Whilst the study area may contain incidental Koala habitat based on details mentioned above, it is not considered highly suitable koala habitat based on the following:

- Koalas were not recorded as being present at the time of assessment.
- No historical records or sightings within the study area itself.
- No attributes such as breeding females (females with young) and historical records of a population.

Although habitat within the study area is potentially suited to the species, it has not historical evidence of Koalas utilising this area. Furthermore, with the urbanisation of the area surrounding Mount Jerrabomberra Reserve likely act as a barrier to any potential use of the area by the species. The likelihood of Koala occurrence on site and potential impact of proposed works is discussed further in Appendix B.

[5] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Native-animals/review-of-koala-tree-use-across-nsw-180385.pdf

FIGURE 12: DPIE MAPPING OF POTENTIAL KOALA HABITAT IN AND NEAR THE STUDY AREA



5.3 NSW Biodiversity Conservation Act 2016

The BC Act aims to maintain a healthy, productive, and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. Among other things, it identifies all the terrestrial species and ecological communities that are listed as threatened or otherwise protected under NSW law.

Under the BC Act, proponents of Part 5 activities must apply the 5-part Test of Significance under s 7.3 to assess whether the proposed activity is likely to significantly affect threatened species, or ecological communities, or their habitats, a declared Area of Outstanding Biodiversity Value (AOBV) or key threatening process (KTP). If the activity is likely to have a significant impact, or will be carried out in an AOBV, the proponent must either,

- apply the NSW Biodiversity Offsets Scheme and meet their biodiversity offset credit obligations (if any), or
- prepare a Species Impact Statement (SIS) that meets the requirements of clause 7.6 of the BC Regulation 2017 and submit it to the Environment Agency Head for approval.

An assessment was undertaken of the likelihood of threatened species and communities occurring within the study area, and the potential impacts of the proposal on these species and communities. As detailed in Appendix B, the study area contains or is likely to contain the following:

- no threatened ecological communities,
- six threatened flora species, and
- 24 threatened fauna species.

To determine if the proposal is likely to significantly affect threatened species or ecological communities, an assessment was carried out against the Test of Significance mandated by the BC Act. That assessment concluded that provided measures found in Section 4.6 are adhered to and works remain in the recommended areas (lower quality), the proposal is unlikely to significantly affect threatened species listed under the BC Act. For more information on the Test of Significance and related matters, see Appendix C.

5.4 NSW Fisheries Management Act 1994

The FM Act aims to conserve, develop, and share the fisheries resources of the State. It identifies the aquatic species and ecological communities that are listed as threatened or otherwise protected in NSW, and related Key Threatening Processes including:

- degradation of native riparian vegetation, and
- installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.

The proposal area does not involve contribution to any Key Threatening Processes listed under the FM act. Furthermore, no threatened species listed under the FM occur or are likely to occur within the study area.

One of the objectives of the Fisheries Management Act 1994 is to 'conserve key fish habitats'. There are no Key Fish Habitats relevant to the study area.

5.5 NSW Biosecurity Act 2015

The Biosecurity Act 2015 requires landholders to manage weed and pest species. Whilst pests and weeds on site do not appear to present an immediate threat to biodiversity on site, safeguards and sustained action is required to prevent weed spread to areas of high biodiversity value within the study area and immediate surrounds.

6 Conclusion

This report presents its findings for the proposed works for a new water supply reservoir, chlorination building and associated temporary construction compound within Mount Jerrabomberra Reserve, Jerrabomberra, NSW, 2619. It has been conducted on behalf of The Department of Regional NSW – NSW Public Works to prepare a Biodiversity Assessment Report (BAR) in support of the REF for the proposed works.

The vegetation within the study area is comprised of areas of varying composition and condition, including areas of good condition native vegetation with high biodiversity. Historical clearing and recreational activities have resulted in areas of largely removed canopy, reduced diversity of mid story and disturbed understory. These areas have an increased occurrence of exotic species including important weed species in low abundance.

The proposal area contains three Plant Community Types (PCT): PCT 3747 (Southern Tablelands Western Hills Scribbly Gum Forest), PCT3375 (Monaro-Queanbeyan Rolling Hills Grassy Forest) and PCT353 (Central West Stony Hills Stringybark-Box Forest). Theses PCTs are not associated with any Threatened Ecological Community (TEC) and no TEC listed under the NSW BC Act or the Commonwealth EPBC Act occurs or is likely to occur within the study area.

The proposal has been assessed with the potential to impact the entire 3.15 ha of the study area, however, communication with NSW Public Works indicates that clearing or otherwise direct impacts would likely be concentrated within already degraded areas of vegetation. Through field assessment and vegetation mapping it has been determined that there is 1.33 ha of degraded native vegetation within the study area and works should be contained within these areas where possible. Additionally, important habitat in the form of hollow-bearing-trees have been mapped within these areas to help further identify habitat to avoid within the areas of degraded vegetation.

Threatened fauna and flora species with potential to be present on the site have been identified and assessed Although no threatened flora or fauna species were observed within the study area during field surveys, a number have been assessed to have potential to utilise habitats within the proposal area. A Threatened Species Test of Significance (TOS) for impacts of the proposal on threatened species known or likely to occur within the proposal area or immediate surrounds has determined that if recommendations from this report are followed, there is not likely to be a significant impact on the extent and viability of threatened species in the local area.

A number of safeguards and mitigation measures are recommended, including but not limited to measures undertaken before during and after the proposed works. An example includes the preparation and implementation of a CEMP, which would incorporate appropriate measures identified in this report. These measures are recommended to minimise the impacts of the proposal on native flora and fauna, including threatened species known, and likely to occur in the proposal site.

It is the recommendations of this BAR that for the proposal, planning and design use the ecological information presented in this report to inform design choice, either confirming current design or initiating a redesign to minimise vegetation and habitat removal. Furthermore, all additional components of the proposal should be planned and completed while adhering to the recommendations presented within this report to avoid and minimise unnecessary impacts to biodiversity.

Appendix A: Species observed within study area

A1 Flora species observed within the study area during field inspection

This list focuses on native and wild species observed in the study area. It may not include species obviously planted as part of gardens. Plant species information is presented in order of growth form then scientific name. It does not take into account the relative abundance or significance of particular species.

The following codes denote the status of a species:

H	High Threat Exotic (NSW)
K	Species that is associated with a Key Threatening Process
N	Native
P	Protected species (not listed as a threatened species but subject to special protections)
T	Threatened species (may be Vulnerable, Endangered or Critically Endangered)
W	Weed of National Significance
X	Other exotic species

Common Name	Scientific Name	Bam 1 Cover	Bam 2 Cover	Bam 3 Cover	Bam 4 Cover	Status
Trees						
Silver Wattle	*Acacia dealbata*	0.2			4.2	**N**
Golden Wattle	*Acacia pycnantha*	1	0.4	1.6	0.8	**N**
Apple Box	*Eucalyptus bridgesiana*					**N**
Red Stringybark	*Eucalyptus macrorhyncha*				38	**N**
Brittle Gum	*Eucalyptus mannifera*					**N**
Red Box	*Eucalyptus polyanthemos*	24	22	0.4	3.5	**N**
Inland Scribbly Gum	*Eucalyptus rossii*		15			**N**
Desert Ash	*Fraxinus angustifolia* subsp. *angustifolia*	0.1	0.1		0.2	**X**
Shrubs						
Cootamundra Wattle	*Acacia baileyana*					**H**
Poverty Wattle	*Acacia dawsonii*					**N**
Early Wattle	*Acacia genistifolia*		0.3	0.4		**N**
Native Cranberry	*Astroloma humifusum*					**N**
Daphne Heath	*Brachyloma daphnoides*		1.3		0.4	**N**
Native Blackthorn	*Bursaria spinosa*					**N**
Shiny Cassinia	*Cassinia longifolia*	0.7	0.4		0.4	**N**
Rosemary Cassina	*Cassinia quinquefaria*	0.2	0.3	4.2	0.4	**N**
Hawthorn	*Crataegus monogyna*				0.2	**H**
Narrow-leaf Bitter-pea	*Daviesia leptophylla*		0.3			**N**

Common Name	Scientific Name	Bam 1 Cover	Bam 2 Cover	Bam 3 Cover	Bam 4 Cover	Status
Egg and Bacon Peas, Parrot Peas	*Dillwynia sericea*					N
Cherry Ballart	*Exocarpos cupressiformis*	4			0.3	N
Fan Grevillea	*Grevillea ramosissima* subsp. *ramosissima*	1				N
Tree Hakea	*Hakea eriantha*					N
Needlebush	*Hakea sericea*					N
Hoary Guinea Flower	*Hibbertia obtusifolia*		1.2			N
Australian Indigo	*Indigofera australis*					N
Burgan	*Kunzea ericoides*	5.5	5		5.2	N
Beard Heath	*Leucopogon* sp.		1.4		0.3	N
Holly Lomatia	*Lomatia ilicifolia*					N
African Boxthorn	*Lycium ferocissimum*					W
Urn Heath	*Melichrus urceolatus*					N
Mountain Mirbelia	*Mirbelia oxylobioides*					N
Chinese Photinia	*Photinia serratifolia*				0.2	X
Thyme Spurge	*Phyllanthus hirtellus*	0.4				N
Slender Rice Flower	*Pimelea linifolia*		1.2		0.3	N
Cox River Bush-pea	*Pultenaea procumbens*		0.5			N
Eggs and Bacon	*Pultenaea* sp.		3.5			N
Whitetil Nightshade	*Solanum chenopodium*					X
A Red Five-corners	*Styphelia* sp.					N
Grasses and Grasslike						
A Hairgrass	*Aira* sp.		0.2			X
Common Wheatgrass	*Anthosachne scabra*			0.4	0.3	N
Purple Wiregrass	*Aristida ramosa*	0.5			0.6	N
Yanganbil	*Austrostipa bigeniculata*					N
Speargrass	*Austrostipa scabra*		0.3	8.5	4.5	N
Bearded Oats	*Avena barbata*					X
Red Grass	*Bothriochloa macra*				0.4	N
Quaking Grass	*Briza maxima*				0.5	X
Shivery Grass	*Briza minor*				0.4	X
Knob Sedge	*Carex inversa*				0.2	N
Umbrella Sedge	*Cyperus eragrostis*					H
Cocksfoot	*Dactylis glomerata*	0.1			0.4	X
Shorthair Plumegrass	*Dichelachne micrantha*	0.3	0.3		0.4	N
African Lovegrass	*Eragrostis curvula*					H
Yorkshire Fog	*Holcus lanatus*		0.1			X
A Rush	*Juncus* sp.	0.2	0.2	0.4	0.3	N
Pacific Bent Grass	*Lachnagrostis filiformis*					N
A Sword Grass	*Lepidosperma latens*	0.2	0.6			N
Wattle Mat-rush	*Lomandra filiformis* subsp. *filiformis*	0.1	0.5			N
Green Mat-rush	*Lomandra hystrix*				0.6	N

Common Name	Scientific Name	Bam 1 Cover	Bam 2 Cover	Bam 3 Cover	Bam 4 Cover	Status
Spiny-headed Mat-rush	*Lomandra longifolia*					N
Many-flowered Mat-rush	*Lomandra multiflora* subsp. *multiflora*				0.3	N
Woodrush	*Luzula densiflora*					N
Weeping Grass	*Microlaena stipoides*				9	N
Serrated Tussock	*Nassella trichotoma*			0.2	0.3	W
Hairy Panic	*Panicum effusum*				0.6	N
Snowgrass	*Poa sieberiana*		0.2			N
Redanther Wallaby Grass	*Rytidosperma pallidum*	24				N
Wallaby Grass	*Rytidosperma* sp.	1.5	0.2	6.5	7.5	N
A Pidgeon Grass	*Setaria* sp.			0.5		X
Slender Rat's Tail Grass	*Sporobolus creber*					N
Forbs						
Sheep Sorrel	*Acetosella vulgaris*			3.5	0.4	H
Wild Aster	*Aster subulatus*					X
Lemon Beauty-heads	*Calocephalus citreus*					N
Yellow Burr-daisy	*Calotis lappulacea*			0.3		N
Common Centaury	*Centaurium erythraea*			0.3	0.3	X
Common Everlasting	*Chrysocephalum apiculatum*					N
Clustered Everlasting	*Chrysocephalum semipapposum*					N
Spear Thistle	*Cirsium vulgare*			0.4	0.2	X
Flaxleaf Fleabane	*Conyza bonariensis*	0.1	0.2	0.9	0.3	X
Blueberry Lily	*Dianella revoluta*	0.2	0.4			N
Stinkwort	*Dittrichia graveolens*					X
Patterson's Curse	*Echium plantagineum*					X
Climbing Saltbush	*Einadia nutans*					N
Creeping Cudweed	*Euchiton japonicus*					N
Star Cudweed	*Euchiton sphaericus*	0.1				N
Goosegrass	*Galium aparine*					X
Everlasting	*Gamochaeta* sp.			0.2	0.2	X
Native Geranium	*Geranium solanderi*					N
Poverty Raspwort	*Gonocarpus tetragynus*	0.5	0.4		0.6	N
Ivy Goodenia	*Goodenia hederacea*	0.4	0.3			N
Erect Hovea	*Hovea linearis*					N
Stinking Pennywort	*Hydrocotyle laxiflora*				0.3	N
St. John's Wort	*Hypericum perforatum*			14	0.4	H
Catsear	*Hypochaeris radicata*	0.1	0.2	0.3	0.4	X
A Peppercress	*Lepidium* sp.					X
Scarlet Pimpernel	*Lysimachia arvensis*					X
White Horehound	*Marrubium vulgare*					X
Yam Daisy	*Microseris lanceolata*				0.2	N
A Thistle	*Onopordum* sp.					X
Yellow Wood-sorrel	*Oxalis perennans*			0.3	0.3	N

Common Name	Scientific Name	Bam 1 Cover	Bam 2 Cover	Bam 3 Cover	Bam 4 Cover	Status
Chilean Whitlow Wort, Brazilian Whitlow	*Paronychia brasiliana*			0.7		X
Proliferous Pink	*Petrorhagia nanteuilii*					X
Lamb's Tongues	*Plantago lanceolata*			0.4	0.3	X
Pomax	*Pomax umbellata*	0.5				N
Swamp Dock	*Rumex brownii*					N
Vervain	*Salvia verbenaca*					X
Cotton Fireweed	*Senecio quadridentatus*			0.3		N
Nodding Blue Lily	*Stypandra glauca*	0.2	5			N
Yellow Hawkweed	*Tolpis barbata*					X
Hop Clover	*Trifolium campestre*					X
Subterranean Clover	*Trifolium subterraneum*				0.2	X
Great Mullein	*Verbascum thapsus* subsp. *thapsus*				0.2	X
Purpletop	*Verbena bonariensis*			0.3		X
Woolly New Holland Daisy	*Vittadinia gracilis*			0.4	0.5	N
A Fuzzweed	*Vittadinia muelleri*			9	0.4	N
Tufted Bluebell	*Wahlenbergia communis*		0.2		0.2	N
Annual Bluebell	*Wahlenbergia gracilenta*		0.2	0.3		N
Golden Everlasting	*Xerochrysum bracteatum*		0.4		1.5	N
Ferns						
Rock Fern	*Cheilanthes sieberi*	0.3	0.3	0.5	0.4	N
Other						
Box Mistletoe	*Amyema miquelii*					N
Downy Dodder-laurel	*Cassytha pubescens*		0.4		0.3	N
Twining glycine	*Glycine clandestina*				0.2	N
False Sarsaparilla	*Hardenbergia violacea*	0.3	0.4			N
Sweet Briar	*Rosa rubiginosa*	0.1		0.2	0.2	H
Blackberry	*Rubus fruticosus* sp. *agg*	0.1				W

A2 Systematic flora survey data

This appendix section summarises the results of systematic flora survey work across the study area

A2.1 BAM plots

	BAM_1	BAM_2	BAM_3	BAM_4
Date of survey	04/04/2023	04/04/2023	04/04/2023	04/04/2023
Location				
Easting (UTM 55H)	700424	700231	700304	700415
Northing (UTM 55H)	60832191	6082803	6082795	6082785
BAM ATTRIBUTE - 20x20m plot **Species richness (count)**				
Native tree	3	3	2	4
Native shrub	6	11	2	7
Native forb	6	7	7	8
Native grass and grasslike species	7	7	4	13
Native fern	1	1	1	1
Other native vascular plant	1	2	0	2
Total native vascular plants	24	31	16	35
Cover abundance %				
Native tree	25.2	37.4	2	46.5
Native shrub	11.8	15.4	4.6	7.3
Native forb	1.9	6.9	23.1	4
Native grass and grass-like species	26.8	2.3	15.8	24.9
Native fern	0.2	0.3	0.5	0.4
Other native vascular plant	0.3	0.8	0	0.5
Total native vascular plants	66.2	63.1	46	83.6
High Threat Exotics	0.1	0	17.7	1.2
BAM ATTRIBUTES - 1x1m quadrats **Litter cover %**				
5m	50	98	25	65
15m	63	30	35	52
25m	75	55	12	30
35m	93	45	8	22
45m	78	92	2	8
Average	71.8	64	16.4	35.4
Bare ground cover (%)				
5m	1	0	0	1
15m	1	8	0	0
25m	3	2	0	0
35m	0	3	1	1

45m	1	0	52	0
Average	1.2	2.6	10.6	0.4
Cryptogam cover %				
5m	3	0	0	0
15m	0	0	0	0
25m	10	3	0	0
35m	0	1	11	1
45m	1	0	40	0
Average	2.8	0.8	10.2	0.2
Rock cover %				
5m	12	0	0	0
15m	5	2	0	0
25m	3	12	0	0
35m	0	2	4	1
45m	1	0	3	0
Average	6.4	3.2	1.4	0.2

FIGURE A 1: BAM_1 PHOTOS

50m transect line

Plot BAM1-1 (05m)

Plot BAM1-2 (15m)

Plot BAM1-3 (25m)

Plot BAM1-4 (35m)

Plot BAM1-5 (45m)

FIGURE A 2: BAM_2 PHOTOS

50m transect line

Plot BAM1-1 (05m)

Plot BAM1-2 (15m)

Plot BAM1-3 (25m)

Plot BAM1-4 (35m)

Plot BAM1-5 (45m)

FIGURE A 3: BAM_3 PHOTOS

50m transect line

Plot BAM1-1 (05m)

Plot BAM1-2 (15m)

Plot BAM1-3 (25m)

Plot BAM1-4 (35m)

Plot BAM1-5 (45m)

FIGURE A 4: BAM_4 PHOTOS

50m transect line

Plot BAM1-1 (05m)

Plot BAM1-2 (15m)

Plot BAM1-3 (25m)

Plot BAM1-4 (35m)

Plot BAM1-5 (45m)

A3 Fauna species observed within study areas during site inspection

This list includes species recorded during field surveys and provides an indication on the types of species to utilize the project area. Additional fauna species may utilise the site over time subject to variations in factors such as behaviour, season, and weather conditions.

K	Species that is associated with a Key Threatening Process
P	Protected species (not listed as a threatened species but subject to special protections)
T	Threatened species (may be Vulnerable, Endangered or Critically Endangered)
X	Other exotic species

TABLE A 1: FAUNA SPECIES OBSERVED WITHIN STUDY AREA ONE DURING SITE INSPECTIONS

Common Name	Scientific Name	Family	Status	Observation Type
Birds				
Brown Thornbill	*Acanthiza pusilla*	Acanthizidae	P	Call
Pied Currawong	*Strepera graculina*	Artamidae	P	Visual
Pink Galah	*Eolophus roseicapilla*	Cacatuidae	P	Call
Sulphur-crested Cockatoo	*Cacatua galerita*	Cacatuidae	P	Call
White-throated Treecreeper	*Cormobates leucophaea*	Climacteridae	P	Call
Crested Pigeon	*Spilopelia chinensis*	Columbidae	P	Visual
Common Bronzewing	*Phaps chalcoptera*	Columbidae	P	Visual
Australian Raven	*Corvus coronoides*	Corvidae	P	Call
Pied Magpie	*Gymnorhina tibicen*	Corvidae	P	Visual
Superb Fairywren	*Malurus cyaneus*	Maluridae	P	Visual
Noisy Miner	*Manorina melanocephala*	Meliphagidae	P	Call
Red Wattlebird	*Anthochaera carunculata*	Meliphagidae	P	Call
Magpie -lark	*Grallina cyanoleuca*	Monarchidae	P	Visual
Wood Duck	*Chenonetta jubata*	Anatidae	P	Visual
Rainbow Lorikeet	*Trichoglossus moluccanus*	Psittaculidae	P	Visual
Crimson Rosella	*Platycercus elegans*	Psittaculidae	P	Visual
Willie Wagtail	*Rhipidura leucophrys*	Rhipiduridae	P	Visual
Grey Fantail	*Rhipidura albiscapa*	Rhipiduridae	P	Visual
Common Starling	*Sturnus vulgaris*	Sturnidae	K	Visual
Blackbird	*Turdus merula*	Turdidae	K	Visual
Mammals				
European Rabbit	*Oryctolagus cuniculus*	Leporidae	K	Scat
Eastern Grey kangaroo	*Macropus giganteus*	Macropodidae	P	Scat
Domestic Dog	*Canis familiaris*	Canidae	K	Scat
Domestic Cat	*Felis catus*	Felidae	K	Track
Brushtail Possum	*Trichosurus vulpecula*	Phalangeridae	P	Scat
Bare Nosed Wombat	*Vombatus ursinus*	Vombatidae	P	Scat
Reptiles				
Delicate Skink	*Lampropholis delicata*	Scincidae	P	Visual
Amphibians				

Common Name	Scientific Name	Family	Status	Observation Type
Spotted Grass Frog	*Limnodynastes tasmaniensis*	Limnodynastidae	**P**	Visual
Common Eastern Froglet	*Crinia signifera*	Myobatrachidae	**P**	Visual
Arthropod				
European Honeybees	*Apis mellifera*	Apidae	**X**	Visual

Appendix B: Likelihood of occurrence assessment

The proposed works are sited in areas containing varying conditions of native vegetation. Some areas are sited in a previously cleared and highly exotic areas, others contain intact native vegetation. The development's impacts will vary from species to species because different species utilise different habitats and are vulnerable to different things. Consequently, the following analysis works through each one of the species listed as under the Commonwealth EPBC Act and/or the NSW BC Act. For ease of reference, the following acronyms are used to indicate the status of a community or species according to each jurisdiction:

CE	Critically Endangered
E	Endangered
V	Vulnerable
P	Species where only certain geographically defined populations are protected
M	Migratory species that is protected but not listed as threatened under the EPBC Act
–	Not listed

The following analysis also incorporates data accessed (16 March 2023) from a variety of sources including:

- EPBC Protected Matters Search Tool
- threatened community/species profiles published by the NSW Department of Planning and Environment https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species
- Atlas of Living Australia (ALA) for the area within a 10 km radius of the study area
- BioNet Atlas of NSW Wildlife for the area within a 10 km radius of the study area
- eBird Hotspots West Hume Woodland and Wetlands, and Jerrabomberra Grasslands Nature Reserve (https://ebird.org/hotspot/L13157982 and https://ebird.org/hotspot/L2541592)

B1 Threatened Ecological Communities

Scientific Name	Common name	Cwlth EPBC Act	NSW BC Act	Likely presence	Where discussed
Alpine Sphagnum Bogs and Associated Fens	Alpine Sphagnum Bogs and Associated Fens	E	-	Not Present	B1.1
Monaro Tableland Cool Temperate Grassy Woodland in the South-Eastern Highlands Bioregion	Monaro Tableland Cool Temperate Grassy Woodland	-	CE	Not Present	B1.2
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands, and Australian Alps Bioregions	Montane Peatlands and Swamps	E	E	Not Present	B1.3
Natural Temperate Grassland of the South-Eastern Highlands	Natural Temperate Grassland	CE	-	Not Present	B1.4
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregion	Tableland Basalt Forest	-	E	Not Present	B1.5
Werriwa Tablelands Cool Temperate Grassy Woodland in the South-Eastern Highlands and South-East Corner Bioregions	Werriwa Tablelands Cool Temperate Grassy Woodland	-	CE	Not Present	B1.6
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	Box-Gum Woodland	CE	CE	Not Present	B1.7
EEC count		4	6	7 TECs across all jurisdictions	

B1.1 ALPINE SPHAGNUM BOGS AND ASSOCIATED FENS

This commonwealth listed TEC occurs in small pockets in Tasmania, Victoria, NSW, and the ACT. Consists of highly fragmented, isolated remnants, and its present geographic extent is restricted. Most examples are situated within national parks and other conservation reserves. Requires a good supply of groundwater and an impeded drainage system that keeps the water table at or near the surface. Under these conditions, the decomposition of organic materials is incomplete, eventually forming the peat that underlies the community.

The ecological community is known to exist at 1200 m above sea level in Victoria and as low as 1000 m in parts of the Australian Capital Territory (ACT) and New South Wales (NSW), despite these locations being geographically montane rather than alpine or subalpine. In order to meet the definition of the TEC sites must satisfy condition criteria stipulated in the Listing Advice and/or Conservation Advice.

The study area does not contain this TEC: it is present at an elevation well below 1200 m above sea level and does not contain either alpine sphagnum bogs or associated fens.

For more information about this TEC, see:
https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20382

B1.2 MONARO TABLELAND COOL TEMPERATE GRASSY WOODLAND

This NSW-listed TEC occurs between Captains Flat in the north and Bombala in the south, as far east as the crest of the Great Dividing Rage and is characterised by a sparse to very sparse tree layer dominated by Snow Gum (*Eucalyptus pauciflora*), either as a single species or in a mix with any of these species as co-dominants:

- Blackwood (*Acacia melanoxylon*),
- Candlebark (*Eucalyptus rubida*),
- Black Sallee (*E. stellulata*), and
- Ribbon Gum (*E. viminalis*).

The TEC is also characterised by certain grass and forb species that tend to persist on sites even if the tree canopy is removed. Such derived native grassland may still be protected under relevant laws and can regenerate to woodland under the right conditions.

The study area does not contain this TEC: Snow Gum and other TEC associated canopy species were not observed to be present in the study area. Furthermore, vegetation in the study area is primarily characterised by dry-sclerophyll forest and not that of sparse canopy woodland associated with this TEC.

For more information about this TEC, see:
https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20346

B1.3 MONTANE PEATLANDS AND SWAMPS

This NSW-listed TEC grows on the peaty or organic-mineral sediments that accumulate on poorly drained flats in the headwaters of streams and is extremely distinctive. It occurs on undulating tablelands and plateaux, above 400-500 m elevation.

It comprises a dense, open, or sparse layer of shrubs (1-5 m tall). It is the only type of wetland that may contain more than trace amounts of Sphagnum moss (*Sphagnum* spp.). In some peatlands and swamps, particularly those with a history of disturbance to vegetation, soils or hydrology, the shrub layer comprises dense thickets of Leptospermum species. In others with a history of grazing by domestic livestock, the shrub layer may be very sparse or absent. Common shrubs include:

- Alpine Baeckea (*Baeckea gunniana*),
- Mountain Baeckea (*Baeckea utilis*),
- Alpine Bottlebrush (*Callistemon pityoides*),
- Prickly Tea Tree (*Leptospermum juniperinum*),
- Small-fruited Hakea (*Hakea microcarpa*), and
- Epacris (e.g., *E. breviflora, E. microphylla, E. paludosa*).

Soft-leaved species typically make up most of the groundcover biomass which include:

- Carex spp. (e.g., C. *appressa, C. fascicularis, C. gaudichaudiana*), and
- Poa spp. (e.g., *P. costiniana, P. labillardieri*).

The study area does not contain this TEC: it does not contain a peatland or swamp.

For more information about this TEC, see:
https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10936

A comprehensive list of species that characterize the TEC can be found in the final determination: https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2004-2007/montane-peatlands-swamps-endangered-ecological-community-listing

B1.4 NATURAL TEMPERATE GRASSLAND

This Commonwealth-listed TEC is confined to the Southern Tablelands, a region bounded by the ACT, Yass, Boorowa, the Abercrombie River, Goulburn, the Great Eastern Escarpment, the Victorian border, and the eastern boundary of Kosciusko National Park. The altitudinal range of the TEC is between 500 m and 1200 m asl.

The TEC is found on broad sweeping plains with poor drainage and cold air inversions that promote frosts which inhibit tree growth. It is characterised by grassland dominated by native grasses and a large range of herbaceous species in many plant families (collectively known as forbs). It is a naturally treeless area, though trees of a range of species may occur in low densities, either as isolated individuals or in clumps. It usually occurs on flat or gently undulating areas.

It supports a range of fauna species, some of which are unique to grassland communities, or if not unique, are restricted to sites with grassy ecosystems (i.e., grassy woodland communities). Examples of threatened fauna species support by this TEC include Pink-tailed Worm-lizard (*Aprasia parapulchella),* Striped Legless Lizard (*Delma impar*) and Golden Sun Moth (*Synemon plana*).

There are eight distinct associations within the community which can be found in the link below.

The study area does not contain this TEC: the study area is characterised by dry-sclerophyll forest and is not a naturally treeless area.

For more information about this TEC, see:
https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20260

B1.5 TABLELAND BASALT FOREST

This NSW-listed TEC occurs on loam or clay soils associated with basalt, but sometimes on other substrates that produce relatively fertile soils. It occurs at elevations of 600 – 900 m above sea level and is characterised by an open forest dominated by pure stands or varying combinations of the following eucalypt species:

- Ribbon Gum (*E. viminalis*),
- Narrow-leaved Peppermint (*E. radiata*),
- Mountain Gum or Broad-leaved Ribbon Gum (*E. dalrympleana* subsp. *dalrympleana*), and/or
- Snow Gum (*E. pauciflora*).

The study area does not contain this TEC: none of the above tree species were observed in or near the study area.

For more information on this TEC, see
www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20074

B1.6 WERRIWA TABLELANDS COOL TEMPERATE GRASSY WOODLAND

This NSW-listed TEC occurs on the eastern slopes of the Great Dividing Range, between Golspie in the north and Majors Creek in the south and between Carwoola in the west and Marulan in the east. It is

characterised by a sparse to very sparse tree layer dominated by Snow Gum (*E. pauciflora*), sometimes with Candlebark (*E. rubida*) as a co-dominant.

The TEC is also characterised by a certain grass and forb species that tend to persist on sites even if the tree canopy is removed. Such derived native grassland may still be protected under relevant legislation and can regenerate to woodland under the right conditions.

The study area does not contain this TEC: neither Snow Gum or Candlebark were observed to be present in the study area. Furthermore, vegetation in the study area is primarily characterised by dry-sclerophyll forest and not that of grassy woodland associated with this TEC.

For more information on this TEC, see:
www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20347

B1.7 BOX GUM WOODLAND

As its name suggests, this Commonwealth and NSW-listed TEC is characterised by woodland dominated by one or more of the following tree species:

- White Box (*Eucalyptus albens*),
- Yellow Box (*E. melliodora*), and/or
- Blakely's Red Gum (*E. blakelyi*).

The TEC is also characterised by a certain grass and forb species that tend to persist on sites even if the tree canopy is removed. Such derived native grassland may still be protected under relevant legislation and can regenerate to woodland under the right conditions.

Legal definitions of this TEC vary slightly by jurisdiction. The Commonwealth listing for this TEC is slightly different to the NSW listing, in that either the tree layer or the ground layer must be intact to quality for Commonwealth protection. Both definitions have been considered for the purposes of this report.

The study area does not contain this TEC: the study area was not characterised by woodland dominated by either White Box, Yellow Box, or Blakely's Red Gum. None of these associated canopy species were observed to be present within the study area. Furthermore, the study area contains vegetation characterised as primarily dry-sclerophyll forest.

For more information on this TEC as defined by NSW, see
www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10837

For more information about this TEC as defined by the Commonwealth, see
www.awe.gov.au/sites/default/files/documents/box-gum.pdf

B2 Threatened plant species

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Comment about species preferences and habitat in the study area	Likely presence
Caladenia actensis	Canberra Spider Orchid	CE	—	**Yes**	No	Currently only known from two populations (Mount Ainslie and Mount Majura) Grows on shallow gravelly brown clay loam soils of volcanic origin and in transitional vegetation zones between open grassy woodland and dry sclerophyll forest. The species is currently only found in two locations >10km away from study area.	Low
Caladenia tessellata	Thick-lipped Spider-orchid	V	E	**Yes**	**Yes**	Orchid known from the Sydney area (old records), Wyong, Ulladulla, and Braidwood in NSW. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Species recorded within 10 km of study area over 80 years ago. Known populations not close to study area.	Low
Calotis glandulosa	Mauve Burr-daisy	V	V	No	No	Small forb that prefers grassland in semi-alpine to alpine areas. Study area does not fall within preferred habitat of semi-alpine to alpine areas and no records found within 10 km of study area.	Low
Diuris aequalis	Buttercup Doubletail	E	E	**Yes**	**Yes**	Orchid recorded in forest, low open woodland with grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands. Leaves die back each year and resprout just before flowering. Populations tend to contain few, scattered individuals; despite extensive surveys, only about 200 plants in total, from 20 populations are known. Two records of species exist, each found within 2020. Potentially suitable habitat including low open woodland is found within the study area.	Moderate
Dodonaea procumbens	Trailing Hop-bush	V	V	**Yes**	No	Grows in low-lying areas, most commonly occurring in Natural Temperate Grasslands or Snow Gum (*E. pauciflora*). Additionally, this species often grows in winter-wet areas in woodland, low open forests, on sands and clays. Grows in open spaces where there is little competition from other plants and generally does not exist in areas where the vegetation is heavily grazed. Often occurs in disturbed or exposed locations such as roadsides or outcrops of rocks. One record within 10 km of the study area. Associated PCTs and habitats not present within the study area.	Low
Eucalyptus aggregata	Black Gum	V	V	**Yes**	**Yes**	Canopy species that grows in the lowest parts of the landscape, on alluvial soils in poorly drained flats and hollows near creeks and small rivers. Unlike to be found within study area, as study area consists of high, hilly topography and does not contain suitable habitat.	Low
Eucalyptus macarthurii	Paddy's River Box	E	E	**Yes**	**Yes**	Tall tree occurs on grassy woodland on relatively fertile soils on broad cold flats. It has a moderately restricted distribution. It is currently recorded from the Moss Vale District to Kanangra-Boyd National Park. Study area was not found to contain suitable habitat.	Low

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Comment about species preferences and habitat in the study area	Likely presence
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	**Yes**	No	Medium-sized tree 10-20 m tall. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Tends to grow on lower slopes in the landscape. Two records of species greater than 20 years old, however, the species is only known to inhabit areas within the New England Tablelands. Therefore, nearby records are likely misidentified.	Low
Grevillea iaspicula	Wee Jasper Grevillea	CE	E	**Yes**	No	An erect shrub that can reach 2.5 m in height. Has been found only in the Wee Jasper area and on the shores of Lake Burrinjuck near Burrinjuck village on the border of the Southern Tablelands and South Western Slopes. Occurs on rocky limestone outcrops and surrounding sink holes and cave entrances. Associated vegetation includes open woodland dominated by White Box (*Eucalyptus albens*) and Apple Box (*E. bridgesiana*). Study area is outside of known distribution off species, few records nearby are likely misidentified. Associated species not found within study area.	Low
Lepidium aschersonii	Spiny Peppercress	V	V	No	No	Erect perennial herb to 30 cm high. Not widespread, occurring in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains). Found on ridges of gilgai clays dominated by Brigalow, Belah, Buloke and Grey Box. In the south has been recorded growing in Bull Mallee. Often the understorey is dominated by introduced plants. Vegetation structure varies from open to dense, with sparse grassy understorey and occasional heavy litter. No records within 10 km of the study area and no associated species present	Low
Lepidium ginninderrense	Ginninderra Peppercress	V	—	**Yes**	**Yes**	Small perennial herb growing to 20 cm in height. This species is known from two natural sites and two planted sites in the northern ACT. Associated with the TEC Natural Temperate Grasslands. Records within 10 km of the study area, however, suitable habitat not found within study area.	Low
Lepidium hyssopifolium	Aromatic Peppercress	E	E	**Yes**	No	Small forb that prefers grassland and grassy woodlands. In NSW, there is a small population near Bathurst, one population at Bungendore, and one near Crookwell. Two records within 10 km of study area, however, outside of known population areas. Limited suitable habitat for species.	Low
Leucochrysum albicans subsp. tricolor	Hoary Sunray	E	—	No	**Yes**	Small clump-forming forb that grows well in disturbed roadside verges. Occurs in a wide variety of grassland, woodland, and forest habitats, generally on relatively heavy soils. Can occur in modified habitats such as semi-urban areas and roadsides. It does not tolerate heavy competition. Many records withing 10 km of study area and suitable habitat found within study area.	High
Pomaderris pallida	Pale Pomaderris	V	V	**Yes**	**Yes**	Compact, rounded shrub usually growing in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or Callitris spp. woodland. Recent records of species within 10 km of the study area exist, additionally associated *E. macrorhyncha* present throughout study area.	Moderate

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	Comment about species preferences and habitat in the study area	Likely presence
Prasophyllum petilum	Tarengo Leek Orchid	E	E	No	No	Orchid that grows in grassy woodland, highly susceptible to grazing and only known on little grazed sites. Not visible outside flowering period (October—December). Grows in grassy woodland, highly susceptible to grazing and only known on little grazed sites. Grows in grassy woodland in association with River Tussock, Black Gum, and tea-trees near Queanbeyan. No records of species within 10 km of the study area, additionally, limited associated species present.	Low
Rutidosis leptorrhynchoides	Button Wrinklewort	E	E	**Yes**	**Yes**	Perennial, multi-stemmed herb. Grows on soils that are usually shallow, stony red-brown clay loams; tends to occupy areas where there is relatively less competition from herbaceous species. Many sightings of species within 10 km of study area, including recent sightings and a sighting >40 years old within approx. 100 m of study area. Potentially suitable habitat present within the study area.	High
Senecio macrocarpus	Large-fruit Fireweed	V	—	No	No	In NSW, it occurs in partly cleared dry forests and box-gum woodlands which transition to Brittle Gum Forest with a relatively undisturbed understorey of native grasses, forbs and subshrubs. No known records of species, with limited suitable habitat within the area.	Low
Swainsona recta	Small Purple-pea	E	E	**Yes**	**Yes**	Erect perennial herb growing in association with understorey dominants that include Kangaroo Grass (*Themeda triandra*), Poa Tussocks (*Poa* spp.) and spear-grasses (*Austrostipa* spp.). Few recent records of species exists within 10 km of study area, majority close records >60 years old. Potentially suitable habitat present.	Moderate
Swainsona sericea	Silky Swainson-pea	—	V	**Yes**	**Yes**	Found in Natural Temperate Grassland and Snow Gum (*Eucalyptus pauciflora)* Woodland on the Monaro. Also found in Box-Gum Woodland in the Southern Tablelands and South-West Slopes. Many records within 10 km of the study area, however, associated vegetation communities is not present within study area.	Moderate
Thesium australe	Austral Toadflax	V	V	No	No	Small, straggling herb occurring in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda triandra*). No known records of species within 10 km of the study area and associated species not found within study area.	Low
	Species count	19	16			20 species across all jurisdictions	

B3 Threatened animal species

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Birds								
Anthochaera phrygia	Regent Honeyeater	CE	CE	**Yes**	**Yes**	No	Very distinctive woodlands specialist that inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. The species displays preference for old growth sites with abundant mistletoe. Recent records within 10 km of study area exist. Although associated vegetation communities are not present, abundant mistletoe found within study area.	Moderate
Artamus cyanopterus	Dusky Woodswallow	—	V	**Yes**	**Yes**	**Yes**	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. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland. Records of species within 10 km of study area exist, with suitable habitat present within the study area.	High
Botaurus poiciloptilus	Australasian Bittern	E	E	**Yes**	**Yes**	No	Wetland specialist that favours permanent freshwater wetlands with tall, dense vegetation especially bullrushes. Records of species within 10 km of study area exist, however no suitable wetland or permanent freshwater features present within study area.	Low
Burhinus grallarius	Bush Stone-curlew	—	E	**Yes**	No	No	Found throughout Australia (except Tasmania and a few other locations), this species is considered rare-extinct in its home range on south-eastern NSW. Only in northern Australia is this species not threatened. Inhabits forests and woodlands that present a sparse grassy understorey and high amounts of fallen timber. Generally nocturnal, feeding on insects and small invertebrates, such as, snakes, lizards, and frogs. One recent record of species exists within 10 km of study area. Study area has limited suitable habitat with limited fallen timber.	Low
Calidris ferruginea	Curlew Sandpiper	CE	E	**Yes**	No	No	Migratory shorebird most often found in littoral and estuarine habitats. Sometimes found in inland swamps and lakes during annual migration to and from Siberia. Suitable habitat for species not found within the study area.	Low

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Callocephalon fimbriatum	Gang-Gang Cockatoo	E	V	**Yes**	**Yes**	**Yes**	Distinctive parrot found from southern Victoria through south- and central-eastern New South Wales. In Spring and summer, generally found in tall mountain forests and woodlands especially wet sclerophyll forests. In autumn and winter often moves to lower altitudes in drier and more open forests and woodlands. Prefers to roost in old growth forests and to nest in hollows with a 10+ cm diameter at least 9 m above ground level. Recent records of species within 10 km of study area exist, with suitable habitat present within the study area.	High
Calyptorhynchus lathami	Glossy Black-Cockatoo	—	V	**Yes**	**Yes**	No	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. The study area does not contain these feed trees. Limited species records with 10 km, however potential nesting habitat is present in the study area.	Moderate
Chthonicola sagittata	Speckled Warbler	—	V	**Yes**	**Yes**	**Yes**	Ground-dwelling bird living in a wide range of Eucalyptus dominated communities with a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth, and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Recent records of species within 10 km of study area exist, with suitable habitat present within the study area.	High
Circus assimilis	Spotted Harrier	—	V	**Yes**	**Yes**	No	Medium-sized bird of prey occurring in grassy open woodland. Found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree. Preys on terrestrial mammals (e.g., bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. Few recent records of species within 10 km of study area. Potential suitable habitat found within study area.	Moderate
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	—	V	No	**Yes**	No	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest. Mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, Hollows in standing dead or live trees and tree stumps are essential for nesting. Few recent records within 10 km of study area, with potential suitable habitat present within study area.	Moderate

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Daphoenositta chrysoptera	Varied Sittella	—	V	**Yes**	**Yes**	**Yes**	Acrobatic woodland specialist that lives in eucalypt forests and woodland, mallee, and Acacia woodland. Feeds on slaters and other arthropods extracted from crevices in bark and dead wood. Found across most of mainland Australia including vast majority of NSW. Many recent records of species exist, including records within approx. 100 m of study area. Suitable habitat present within study area.	High
Ephippiorhynchus asiaticus	Black-necked Stork	—	E	No	**Yes**	No	Australia's only stork. Floodplain wetlands (swamps, billabongs, watercourses, and dams) of the major coastal rivers are the key habitat in NSW. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. Record of species within 10 km of study area >40 years old. No suitable habitat within the study area.	Low
Epthianura albifrons	White-fronted Chat	—	V	**Yes**	No	No	Primarily located across the southern extent of Australia. Species is commonly found foraging in bare or grassy grounds in wetlands, in pairs or individually. Breeding period extends from late July to early March. Preference for temperate and arid climates often in foothills or lowlands up to 1000 m in altitude, very rarely does it occupy sub-tropical areas. In western NSW the species is most commonly found around waterways, similarly in coastal areas the species is known to inhabit damp open habitats near a water source. Suitable habitat not found within study area.	Low
Falco hypoleucos	Grey Falcon	—	E	**Yes**	No	No	Medium-sized raptor usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions. Sometimes found in open woodlands near the coast and near wetlands where surface water attracts prey. Suitable habitat not present, study area is not within the extent of semi-arid and arid regions, nor are there coastal or wetland habitats present.	Low
Falco subniger	Black Falcon	—	V	**Yes**	**Yes**	No	The black falcon's habitat is usually in the arid and semi-arid zones. It is usually found near watercourses or utilizing patches of isolated trees. It hunts over open wooded grasslands, saltbush plains, bluebush plains and other low vegetation. Records of species within 10 km of study area exist. Potential suitable habitat present within study area.	Moderate

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Glossopsitta pusilla	Little Lorikeet	—	V	**Yes**	**Yes**	No	Distributed widely across the coastal and Great Divide regions of eastern Australia. Nomadic movements are common, influenced by season and food availability. Forages primarily in the canopy of open Eucalyptus forest and woodland, and also Angophora, Melaleuca, and tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Few recent records of species exist within 10 km of study area. Riparian habitat not present, however, study area is dominated by potentially suitable Eucalypt forest habitat.	Moderate
Grantiella picta	Painted Honeyeater	V	V	**Yes**	**Yes**	No	Distinctive nomadic species that is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias especially Amyema species. Two records of species within 10 km of study area. Potentially suitable habitat within study area including numerous Amyema present.	Moderate
Haliaeetus leucogaster	White-bellied Sea-Eagle	—	V	**Yes**	**Yes**	No	Large eagle with habitats characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Records within 10 km of study area exist. Study area occurs >7km away from large bodies of waters (Googong Dam and Lake Burley Griffin).	Low
Hamirostra melanosternon	Black-breasted Buzzard	—	V	**Yes**	No	No	Large bird of prey that can have a wingspan of 1.5 m. The species is found sparsely in areas of less than 500 mm rainfall, from north-western NSW and north-eastern South Australia to the east coast. Lives in a variety of inland habitats, particularly along well timbered watercourses. One records of the species found within 10 km of study area. Unlikely habitat within study area is suitable for species.	Low
Hieraaetus morphnoides	Little Eagle	—	V	**Yes**	**Yes**	**Yes**	Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Many records of species present within 10 km of the study area. Potential suitable habitat present, particularly within old tall growth.	High
Hirundapus caudacutus	White-throated Needletail	V	—	**Yes**	**Yes**	**Yes**	Almost exclusively aerial species that forages for insects up to 1 km above ground, usually in large flocks. Only occurs in Australia between late spring and early autumn, breeds in north Asia. Records of species within 10 km of study area exist, it is unlikely habitat within study area is utilised by species.	Moderate

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Ixobrychus flavicollis	Yellow-necked Bittern	—	V	**Yes**	No	No	Medium-sized heron that produces a distinctive booming call during breeding season. Easily distinguished from other bitterns through its very dark colouring. The species has an extremely wide distribution in Australia, however is rarely recorded south of Sydney. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. The study area contains habitat that is unlikely to be utilised by this species. Limited records within 10 km	Low
Lathamus discolor	Swift Parrot	CE	E	**Yes**	**Yes**	No	Distinctive parrot that breeds in Tasmania during spring and summer and migrates to the mainland for autumn and winter, where they are found in areas with eucalypts that flower profusely in winter or that have abundant lerp (sap-sucking bugs) infestations. Some favourite flowering trees include but not limited to Swamp Mahogany (*Eucalyptus robusta*,), and Spotted Gum (*Corymbia maculata)*, Red Bloodwood (*C. gummifera*). Records of species within 10 km of study area exist, it is unlikely habitat within study area is utilised by species.	Moderate
Lophochroa leadbeateri	Major Mitchell's Cockatoo	—	V	**Yes**	No	No	Medium-sized cockatoo that is distinctive in its salmon-pink and white colouring. Inhabits arid and semi-arid inland areas, utilising a wide range of treed and treeless habitats, always within the proximity of a water source. In NSW it is occurs as far east as about Bourke and Griffith, with records continuing sporadically further east than that. Mostly a ground feeder consuming primarily seeds of native and exotic melon species, saltbushes, cypress pines and wattles. Single record exists from South Canberra. It is unlikely habitat within study area is utilised by this species.	Low
Lophoictinia isura	Square-tailed Kite	—	V	**Yes**	No	No	Medium-sized kite that inhabits a range of timbered habitats including open forests and dry woodlands. Scattered records exist of the species in NSW, primarily present in the north-west of the state and along major western flowing river systems. Breeding occurs during summer with some individuals migrating to the south coast during this period, departing by March. Single record exists from South Canberra. It is unlikely habitat within study area is utilised by this species.	Low
Melanodryas cucullata	Hooded Robin (south-eastern form)	—	V	No	**Yes**	No	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Limited records within 10 km of the study area and present habitat unlikely to support this species.	Low

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	—	V	No	**Yes**	No	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts. Nests are placed high in the crown of a tree, in the uppermost lateral branches, hidden by foliage. Sub-optimal habitat in study area and only one local record over 8 km away dated 1985. Limited records within 10 km of the study area and present habitat unlikely to support this species.	Low
Neophema pulchella	Turquoise Parrot	—	V	**Yes**	**Yes**	No	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust. Some mature hollow-bearing trees are present within the study area. Species records within 10 km of the study area and potential species habitat is present.	Moderate
Ninox connivens	Barking Owl	—	V	**Yes**	No	No	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Preferentially hunts small arboreal mammals. Requires very large permanent territories in most habitats due to sparse prey densities. The study area contains habitat that is unlikely to be utilised by this species. Limited records within 10 km.	Low
Ninox strenua	Powerful Owl	—	V	**Yes**	No	No	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Roosts by day in dense vegetation and nests in large tree hollows, in large eucalypts. The study area contains some large hollow bearing trees, and records within 10 km. However habitat is considered sub-optimal.	Medium
Numenius madagascariensis	Eastern Curlew	CE	—	**Yes**	No	No	Freshwater specialist that prefers the fringes of swamps, dams, and nearby marshy areas where there is a cover of grasses, lignum, low scrub, or open timber. The study area contains habitat that is unlikely to be utilised by this species. Limited records within 10 km	Low
Oxyura australis	Blue-billed Duck	—	V	**Yes**	No	No	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. The study area contains habitat that is unlikely to be utilised by this species. Limited records within 10 km	Low
Pachycephala olivacea	Olive Whistler	—	V	**Yes**	**Yes**	No	Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. Forage in trees and shrubs and on the ground, feeding on berries and insects. Makes nests of twigs and grass in low forks of shrubs. Limited records within 10 km and the study area does not contain wet forests.	Low

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Petroica boodang	Scarlet Robin	—	V	**Yes**	**Yes**	**Yes**	Distinctive woodland specialist found in grassy eucalypt forests and woodlands. Prefers sites with abundant logs and fallen timber, but sometimes found in grazed paddocks with scattered trees. Many species records within 10 km of the study area and potential species habitat is present.	High
Petroica phoenicea	Flame Robin	—	V	**Yes**	**Yes**	**Yes**	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps, or banks. Many species records within 10 km of the study area and potential species habitat is present.	High
Polytelis swainsonii	Superb Parrot	V	V	**Yes**	**Yes**	No	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. They nest in the hollows of large trees (dead or alive). May forage up to 10 km from nesting sites, primarily in grassy box woodland. Some mature hollow-bearing trees are present within the study area. Many species records within 10 km of the study area and potential species habitat is present.	Moderate
Pycnoptilus floccosus	Pilotbird	V	—	**Yes**	No	No	Widely distributed throughout the south-eastern region of Australia. Ground foraging species that occupies a variety of different habitats. Single record from within 10 km and it is unlikely habitat within study area is utilised by this species.	Low
Rostratula australis	Australian Painted Snipe	E	E	**Yes**	**Yes**	No	A small freshwater wader. Prefers fringes of swamps, dams, and nearby marshy areas where there is a cover of grasses, lignum, low scrub, or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks, or reeds. The study area contains habitat that is unlikely to be utilised by this species.	Low
Stagonopleura guttata	Diamond Firetail	—	V	**Yes**	**Yes**	**Yes**	Distinctive ground-feeding bird found in grasslands and grassy eucalyptus woodlands, riparian areas, and sometimes lightly wooded farmland. Has been recorded in some towns and near farmhouses. Many species records within 10 km of the study area and potential species habitat is present.	High
Stictonetta naevosa	Freckled Duck	—	V	**Yes**	No	No	Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move to lakes, reservoirs, farm dams and sewage ponds. Generally, rest in dense cover during the day, usually in deep water. Nests are usually located in dense vegetation at or near water level. Multiple records within 10km but the study area contains habitat that is unlikely to be utilised by this species.	Low
Fish								

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Maccullochella macquariensis	Trout Cod	E	E	No	No	n/a	Freshwater fish known from a single natural population, two stable translocated populations and many stocked populations. Often found in faster flowing water with rocky and gravel bottoms. The study area does not contain aquatic habitat suitable to support this species.	Low
Maccullochella peelii	Murray Cod	V	—	No	No	n/a	Occurs naturally in the waterways of the Murray Darling Basin in a wide range of warm water habitats, from clear, rocky streams to slow-flowing turbid rivers and billabongs. The study area does not contain aquatic habitat suitable to support this species.	Low
Macquaria australasica	Macquarie Perch	E	E (FM act)	**Yes**	No	n/a	Occurs in waters with lots of cover such as aquatic vegetation, snags, boulders, and overhanging banks. The study area does not contain aquatic habitat suitable to support this species.	Low
Frogs								
Litoria aurea	Green and Golden Bell Frog	V	E	**Yes**	**Yes**	n/a	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes waterbodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Limited species records within 10 km and very limited potential habitat is present in the study area.	Low
Litoria booroolongensis	Booroolong Frog	E	E	No	No	n/a	Species is restricted to NSW and north-eastern Victoria, primarily along western-flowing streams of the Great Dividing Range. The species has been observed to bask in the sun on exposed rocks near flowing water in the summer. Breeding for the species occurs during spring- early summer, with tadpole metamorphosis taking place in late summer – early autumn. Not recorded within 10 km and very limited potential habitat is present in the study area.	Low
Litoria castanea	Yellow-Spotted Tree Frog	CE	CE	No	No	n/a	Long-lived and mostly aquatic tree frogs. Require large permanent ponds or slow flowing 'chain-of-ponds' streams with abundant emergent vegetation such as bulrushes and aquatic vegetation. Not recorded within 10 km and very limited potential habitat is present in the study area.	Low
Litoria raniformis	Southern Bell Frog	V	E	**Yes**	**Yes**	n/a	Usually found in or around permanent or ephemeral swamps and billabongs along floodplains and river valleys. May also be found in irrigated rice crops, particularly where there is no available natural habitat. Limited species records within 10 km and very limited potential habitat is present in the study area.	Low
Mammals—bats								

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	No	No	n/a	Small-medium bat mainly found in well-timbered areas with extensive cliffs and caves. Breeds in breeds in sandstone caves/overhangs and will return to same nursery sites over many years. Not recorded within 10 km and the study area does not contain any cliffs.	Low
Falsistrellus tasmaniensis	Eastern False Pipistrelle	—	V	**Yes**	**Yes**	n/a	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils, and other flying insects above or just below the tree canopy. Study area contains mostly dry-sclerophyll forests with trees less than 20 m. Scattered records within 10 km and limited potential habitat is present within the study area.	Low
Miniopterus orianae oceanensis	Large Bent-winged Bat	—	V	No	**Yes**	n/a	Prefers to roost in caves but may also use derelict mines, storm-water tunnels, and similar man-made structures. Breeding or roosting colonies can number from 100 to 150,000 individuals. Limited records within 10 km and study area habitat is unlikely to support this species.	Low
Myotis macropus	Southern Myotis	—	V	**Yes**	**Yes**	n/a	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. 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. Limited records within 10 km and the study area contains habitat that is unlikely to support this species.	Low
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	**Yes**	**Yes**	n/a	Largest bat in Australia, generally found within 200 km of the east coast. Roosts communally in large camps often located in a gully close to water under dense canopy cover. May travel 20–50 km when foraging for foods, with a home range is ~785,000 ha. Favourite food plants include flowering native trees (*Eucalyptus*, *Melaleuca* and *Banksia*), fruiting rainforest trees and vines, urban gardens, and cultivated fruit crops. Many records within 10 km and due to the urban connectivity of the site there is potential this species may utilise the study area for foraging and roosting.	Moderate
Mammals—other								
Dasyurus maculatus	Spotted-tail Quoll	E	V	**Yes**	**Yes**	n/a	Mostly nocturnal predator that forages across a range of habitat types, including rainforest, open forest, woodland, coastal heath, and inland riparian forest, from the sub-alpine zone to the coastline. Dens in hollow-bearing trees, fallen logs, other animal burrows, caves, and rocky outcrops. Often hunts densely vegetated creek lines but may also consume carrion. Limited records within 10 km and study area habitat is unlikely to support this species.	Low

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Petaurus australis	Yellow-bellied Glider	—	V	**Yes**	No	n/a	Species occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Limited records within 10 km and study area habitat is unlikely to support this species.	Low
Petaurus norfolcensis	Squirrel Glider	—	V	**Yes**	No	n/a	Inhabits 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. Prefers mixed species stands with a shrub or Acacia midstory. Requires abundant tree hollows for refuge and nest sites. Limited records within 10 km and study area habitat is unlikely to support this species.	Low
Phascolarctos cinereus	Koala	E	V	**Yes**	**Yes**	n/a	Iconic tree-dweller that inhabits eucalypt woodlands and forests, feeding on the foliage of 70+ Eucalyptus species and 30+ other species. Details vary, see DPIE's Review of koala tree use across New South Wales (2018) and note that koala habitat protection is the focus of State Environmental Planning Policy (SEPP 44). Recorded within 10 km and Koala use tree species recorded within the study area.	Moderate
Pseudomys fumeus	Smoky Mouse	E	CE	**Yes**	No	n/a	Small-medium rodent that is known from a limited number of sites in south-east NSW and the ACT. 3 records exist from Kosciuszko National Park and 2 in the adjacent Ingbyra and Bondo State Forests, the remained of sightings are from South East Forests National Park and surrounding areas. Limited records within 10 km and study area habitat is unlikely to support this species.	Low
Reptiles								
Aprasia parapulchella	Pink-tailed Worm-lizard	V	V	**Yes**	**Yes**	n/a	Species inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda triandra*). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. The study area contains sparse coverage of native grass, with few areas comprised of a native grass dominant understory. It also contains some areas of scattered surface rock, however these were not a dominant habitat feature. Records within 10 km and some potential species habitat is present in the study area.	Moderate

Scientific Name	Common Name	Cwlth EPBC Act	NSW Law	ALA records within 10 km	BioNet records within 10km	eBird hotspot	Comment about species preferences and habitat in the study area	Likely presence
Delma impar	Striped Legless Lizard	V	V	**Yes**	No	n/a	Mainly found in and around Natural Temperate Grassland but has also been captured in grasslands with a high exotic component and in open Box-Gum Woodland. The study area lacks grasslands that are typically associated with the presence of this species. Limited records within 10 km and minimal potential species habitat is present in the study area.	Low
Tympanocryptis pinguicolla	Grassland Earless Dragon	E	E	**Yes**	No		Restricted to a small number of Natural Temperate Grassland sites. Within its habitat, apparently prefers areas with a more open structure, characterised by small patches of bare ground between the grasses and herbs. The only populations now known are in the ACT and adjacent NSW at Queanbeyan, and on the Monaro Basalt Plains between Cooma and south-west of Nimmitabel. The study area lacks grasslands that are typically associated with the presence of this species. Limited records within 10 km and minimal potential species habitat is present in the study area.	Low
Varanus rosenbergi	Rosenberg's Goanna	—	V	**Yes**	**Yes**	n/a	Ground-dwelling monitor that is highly vulnerable to predators including domestic dogs and cats. Found in heath, open forest, and woodland where it forages among fallen timber, lays its eggs in termite mounds, and shelters in hollow logs, rock crevices and burrows created by other animals. Has been recorded in eastern Queanbeyan, potential species habitat is present in the study area.	Moderate
Invertebrates								
Synemon plana	Golden Sun Moth	V	V	**Yes**	**Yes**	n/a	Medium-sized day-flying moth that requires native grassland dominated by Kangaroo Grass, Wallaby Grass and (exotic) Chilean Needle Grass. Spends much of its lifecycle underground and adult females are flightless. The study area lacks grasslands that are typically associated with the presence of this species. The habitat within the study area would be considered suboptimal for the species, however many records within 10 km within nearby Queanbeyan Nature Reserve	Moderate
Keyacris scurra	Key's Matchstick Grasshopper	—	E	**Yes**	No	n/a	Usually found in native grasslands but it has also been recorded in other vegetation associations containing a native grass understory. Associated with Kangaroo grass and known to feed on Asteraceae species. Limited records within 10 km and minimal potential species habitat is present in the study area.	Low
	Species count	27	59				63 species across all jurisdictions	

[#] Local bird sighting data from eBird hotspots: West Hume Woodland and Wetlands, and Jerrabomberra Grasslands Nature Reserve (https://ebird.org/hotspot/L13157982 and https://ebird.org/hotspot/L2541592)

B4 Threatened populations

Threatened populations are geographically defined groups of native plants and animals likely to become extinct in NSW in the near future. A population is a group of organisms of the same species occupying a particular area. Coastal Emu on the New South Wales north coast, Glossy Black Cockatoo in the Riverina and Black Cypress Pine on the Woronora Plateau are examples of the 50 or so threatened populations in New South Wales.

A search of the BioNet Atlas of NSW Wildlife found no threatened populations exist or may exist within 10 km of the study area.

B5 Migratory species

Scientific Name	Common Name	Cwlth EPBC Act	NSW BC Act	ALA records within 10 km	BioNet records within 10km	eBird hotspots#	Comment about species preferences and habitat in the study area	Likely presence
Marine birds								
Apus pacificus	Fork-tailed Swift	(M)	—	No	**Yes**	No	Species is almost exclusively aerial and feeds on insects in mid-air, only landing occasionally where it nests on mountain cliffs and cliff faces. Limited records within 10 km and unlikely to utilise the study area for nesting.	Low
Terrestrial birds								
*Hirundapus caudacutus**	White-throated Needletail	V	—	**Yes**	**Yes**	**Yes**	Species is almost exclusively aerial and forages for insects up to 1 km above ground, usually in large flocks. Only occurs in Australia between late spring and early autumn, breeds in north Asia. Records of species within 10 km of study area exist, it is unlikely habitat within study area is utilised by species.	Moderate
Monarcha melanopsis	Black-faced Monarch	(M)	—	**Yes**	No	No	Widespread in eastern Australia, mainly occurring in rainforest ecosystems. Also sometimes found in nearby open eucalypt forests (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understory as well as in dry sclerophyll forests and woodlands, often with a patchy understory. The study area is unlikely to support this species due to its dry-sclerophyll formation and lack of records within 10 km.	Low
Motacilla flava	Yellow Wagtail	(M)	—	No	No	No	Found in open country near water, such as wet meadows where it feeds on insects and nests in tussocks. Not recorded within 10 km and limited potential habitat is present in the study area.	Low
Myiagra cyanoleuca	Satin Flycatcher	(M)	—	**Yes**	No	No	Species inhabits heavily vegetated gullies in eucalypt forests near water and may forage through a diverse range of ecosystems nearby. Few records within 10 km and limited potential habitat is present in the study area.	Low
Rhipidura rufifrons	Rufous Fantail	(M)	—	**Yes**	No	No	Species predominately occurs in coastal areas. Few records within 10 km and limited potential habitat is present in the study area.	Low
Wetlands birds								
Actitis hypoleucos	Common Sandpiper	(M)	—	No	No	No	Wetlands specialist. No records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
Calidris acuminata	Sharp-tailed Sandpiper	(M)	—	**Yes**	No	No	Wetlands specialist. Few records within 10 km and species unlikely to utilise the habitat present in the study area.	Low

Scientific Name	Common Name	Cwlth EPBC Act	NSW BC Act	ALA records within 10 km	BioNet records within 10km	eBird hotspots#	Comment about species preferences and habitat in the study area	Likely presence
*Calidris ferruginea**	Curlew Sandpiper	CE	E	**Yes**	No	No	Migratory shorebird most often found in littoral and estuarine habitats. Sometimes found in inland swamps and lakes during annual migration to and from Siberia. Few records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
Calidris melanotos	Pectoral Sandpiper	(M)	—	**Yes**	No	No	Wetlands specialist. Few records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
Gallinago hardwickii	Latham's Snipe	(M)	—	**Yes**	**Yes**	No	Wetlands specialist. Few records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
Limosa lapponica baueri	Bar-tailed Godwit	V	—	**Yes**	No	No	Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms. Few records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
*Numenius madagascariensis**	Eastern Curlew	CE	—	**Yes**	No	No	Freshwater specialist that prefers the fringes of swamps, dams, and nearby marshy areas where there is a cover of grasses, lignum, low scrub, or open timber. Few records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
Pandion haliaetus	Osprey	(M)	V	No	No	No	Coastal habitat and freshwater wetland specialist. No records within 10 km and species unlikely to utilise the habitat present in the study area.	Low
*Rostratula australis**	Australian Painted Snipe	E	E	**Yes**	**Yes**	No	A small freshwater wader. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The study area contains habitat that is unlikely to be utilised by this species.	Low
	Species count	**15**	**3**				***These species are also listed and considered under D3**	

Local bird sighting data from eBird hotspots: West Hume Woodland and Wetlands, and Jerrabomberra Grasslands Nature Reserve (https://ebird.org/hotspot/L13157982 and https://ebird.org/hotspot/L2541592)

B6 Pest species associated with Key Threatening Processes (KTPs)

Scientific Name	Common Name	Cwlth EPBC Act	NSW BC Act	ALA records within 10 km	BioNet records within 10km	eBird hotspots#	Comment about species preferences and habitat in the study area	Likely presence
Mammals								
Canis lupus	Wild dog	—	Yes	**Yes**	**Yes**	n/a	Found across NSW, however, the eastern ranges, the coastal hinterland and tablelands have the highest populations. Prefer areas where human disturbance is limited and where shelter, food and water are abundant.	Low
Capra hircus	Feral goat	Yes	Yes	**Yes**	**Yes**	n/a	Found in many areas of NSW. They have benefited from sheep grazing practices and the provision of artificial water points throughout the drier regions of NSW.	Low
Felis catus	Cat	Yes	Yes	**Yes**	**Yes**	n/a	Found all over Australia in all habitats, including forests, woodlands, grasslands, wetlands, and arid areas.	High
Lepus capensis	Hare	Yes	—	**Yes**	**Yes**	n/a	Preferred habitat is open country with the presence of tussock or rocks to hide amongst.	Moderate
Mus musculus	House mouse	Yes	—	**Yes**	**Yes**	n/a	Associated with human habituation, nest behind rafters, in woodpiles, storage areas, or any hidden spot near a source of food.	High
Oryctolagus cuniculus	Rabbit	Yes	Yes	**Yes**	**Yes**	n/a	Densities are greatest around non-arable rough country. This includes creeks, riverbanks, erosion gullies and rocky outcrops.	High
Rattus rattus	Black Rat	Yes	—	**Yes**	**Yes**	n/a	Black Rats are very closely associated with humans, common in urban areas.	High
Sus scrofa	Feral pig	Yes	Yes	**Yes**	**Yes**	n/a	Need moist areas providing adequate food and water and enough shelter to protect against extremes of temperature. In NSW feral pigs are found in a variety of habitats that can provide these requirements.	Low
various species	Deer	—	—	**Yes**	**Yes**	n/a	Live predominantly in grassy forests, rainforests, eucalypt forests and farmlands. Preferred food is grass, but they also eat the leaves of shrubs, trees and herbs, bark, and some fruit.	Moderate
Vulpes vulpes	Fox	Yes	Yes	**Yes**	**Yes**	n/a	Common in fragmented landscapes and areas providing shelter, food, and den sites. Highest densities include temperate grazing lands and peri-urban/urban areas where food is abundant.	Moderate
Birds								
Acridotheres tristis	Common Myna	Yes	—	**Yes**	**Yes**	**Yes**	Typically found in open woodland, cultivation, and around human habitation. Records for surrounding area.	High

Scientific Name	Common Name	Cwlth EPBC Act	NSW BC Act	ALA records within 10 km	BioNet records within 10km	eBird hotspots[#]	Comment about species preferences and habitat in the study area	Likely presence
Alauda arvensis	Skylark	Yes	—	**Yes**	**Yes**	**Yes**	Found in cultivated grasslands and crops, wastelands, and coastal dunes. Records for surrounding area.	High
Anas platyrhynchos	Mallard	Yes	—	**Yes**	**Yes**	No	Prefers still, shallow water with abundant plant life and is most often found on artificial lakes, ponds, and wetlands in urban and farm areas. No waterbodies present in study area.	Low
Carduelis carduelis	European Goldfinch	Yes	—	**Yes**	**Yes**	**Yes**	Fairly common to common in open woodland, parks, gardens, and farmland and open country with hedges and weedy patches; often feeds on seeding thistles. Records within the surrounding area.	High
Columbia livia	Rock Pigeon	Yes	—	**Yes**	**Yes**	**Yes**	Common in most built-up areas. Likely within surrounding unban environment.	High
Passer domesticus	House Sparrow	Yes	—	**Yes**	**Yes**	**Yes**	Occurs in and around human habitation, as well as cultivated areas and some wooded country. Records within surrounding area.	High
Passer montanus	Eurasian Tree Sparrow	Yes	—	No	No	No	Relative to the House Sparrow, although typically found in small flocks, often in more natural areas than House Sparrow. No records within surrounding area.	Low
Pycnonotus jocosus	Red-whiskered Bulbul	Yes	—	No	No	No	Occurs mainly in built-up areas, inhabiting parks, gardens, and streetscapes, though they are occasionally recorded in orchards. They especially favour areas infested with weeds, especially lantana, privet, and blackberry. No records found within surrounding area.	Low
Streptopelia chinensis	Spotted Turtledove	Yes	—	**Yes**	**Yes**	**Yes**	Common around human habitation and can easily be seen in parks, gardens, and agricultural areas. Suitable habitat and records within surrounding area.	High
Sturnus vulgaris	Common Starling	Yes	—	**Yes**	**Yes**	**Yes**	Short-grassed habitats are favoured foraging habitats, and they may feed in association with livestock. Species observed during site inspection.	**Present**
Turdus merula	Common Blackbird	Yes	—	**Yes**	**Yes**	**Yes**	Most often found in urban areas and surrounding localities but has successfully moved into bushland habitats. Species observed during site inspection.	**Present**
	Species count	**19**	**16**				**21 species total**	

[#] Local bird sighting data from eBird hotspots: West Hume Woodland and Wetlands, and Jerrabomberra Grasslands Nature Reserve (https://ebird.org/hotspot/L13157982 and https://ebird.org/hotspot/L2541592)

B7 Weed species

The following information relates to Weeds of National Significance identified in the EPBC PMST report as relevant to this site.

Scientific Name	Common Name	Cwlth EPBC Act	NSW BC Act	ALA records within 10 km	BioNet records within 10km	Comment about species preferences and habitat in the study area	Likely presence
Asparagus asparagoides	Bridal Creeper	WONS	Yes	**Yes**	No	As well as a wide range of natural habitats, bridal creeper grows well in citrus orchards and pine plantations. It can grow in most soils but is most common close to the coast where it invades woodlands and other open coastal vegetation. Not observed in study area during site inspection.	Low
Chrysanthemoides monilifera	Bitou Bush	WONS	Yes	No	No	Found mostly in coastal areas. Not observed in study area during site inspection.	Low
Cytisus scoparius, and various Genista spp.	Broom spp.	WONS	Yes	**Yes**	**Yes**	Evergreen shrub 1–4 m tall with bright yellow pea-like flowers, tends to form dense thickets. All species prefer cool temperate areas especially the tablelands. Not recorded in study area, however suitable habitat, and records within 10 km.	Moderate
Lycium ferocissimum	African Boxthorn	WONS	Yes	**Yes**	**Yes**	Drought tolerant species growing in temperate, subtropical, and semi-arid regions. It can grow on all soil types, though it grows best on well-drained, sandier soils along dry creek beds. The species is present within the study area. Care must be taken that creation and use of the site compound does not contribute to the spread of this invasive weed.	**Present**
Nassella neesiana	Chilean Needle Grass	WONS	Yes	**Yes**	**Yes**	Resembles native spear grasses (*Austrostipa* spp.) but has a distinctive corona of 'little teeth' where the awn joins the seed. Has a major impact on grassland productivity and animal health. Not recorded in study area, however suitable habitat, and records within 10 km.	Moderate
Nassella trichotoma	Serrated Tussock	WONS	Yes	**Yes**	**Yes**	Drought tolerant grass with exceptionally low feed value that can completely take over a new area within 4 years. Prefers cool temperate conditions and does not grow well in wet areas, heavy shade, or heavily vegetated areas. The species is present within the study area. Care must be taken that creation and use of the site compound does not contribute to the spread of this invasive weed.	**Present**
Opuntia spp.	Prickly Pears	WONS	Yes	**Yes**	**Yes**	Present in all regions of NSW from the coast to the far west. See DPI Weeds for details of individual Opuntia species. Not recorded in study area, however suitable habitat, and records within 10 km.	Moderate
Rubus fruticosus agg.	Blackberry	WONS	Yes	**Yes**	**Yes**	Prickly scrambler with edible purplish berries. Grows 7 m long canes that touch the ground and take root, forming dense thickets. Prefers cool temperate climate but will grow in drier areas if has access to water e.g., along riverbank. Not recorded in study area, however suitable habitat, and records within 10 km.	Moderate

Scientific Name	Common Name	Cwlth EPBC Act	NSW BC Act	ALA records within 10 km	BioNet records within 10km	Comment about species preferences and habitat in the study area	Likely presence
Sagittaria platyphylla	Delta Arrowhead	WONS	Yes	**Yes**	No	An aquatic weed capable of aggressive growth and rapid spread. Establishment is favoured by slow moving or static shallow water. The smaller channels provide ideal conditions for infestation, as the water is generally warmer, shallower, and slower moving. Not recorded in study area and limited suitable habitat, records within 10 km.	Low
Salix spp. *except S. babylonica, S. x calodendron & S. x reichardtii*	Willows except Weeping Willow, Pussy Willow, and Sterile Pussy Willow	WONS	Yes	**Yes**	**Yes**	Deciduous trees or shrubs that form large, dense root mats on the surface of the soil or in shallow. Historically planted for erosion control, but has had a major impact on the amount, speed and quality of water flows especially when they drop leaves in autumn. Not recorded in study area and limited suitable habitat, records within 10 km.	Low
Senecio madagascariensis	Fireweed	WONS	Yes	**Yes**	**Yes**	A widely naturalised forb of pastures, open woodlands, grasslands, suburban bushland, roadsides, disturbed sites, waste areas, parks, and coastal environments in sub-tropical and warmer temperate regions. Not recorded in study area, however suitable habitat, and records within 10 km.	Moderate
Ulex europaeus	Gorse	WONS	Yes	No	**Yes**	Evergreen shrub 1–2.5 m tall with spiny leaves and bright yellow peak-like flowers with coconut scent. Forms dense thickets. Prefers cool temperate areas. Limited records within 10 km and limited potential species habitat is present in the study area.	Low
	Species count	12+				12+ species total	

Appendix C: NSW Test of Significance

The NSW *Biodiversity Conservation Act 2016* sets out a five-part Test of Significance "for the purposes of determining whether a proposal or activity is likely to significantly affect threatened species or ecological communities, or their habitats" (s7.3). The five-part test also applies to aquatic species and ecological communities listed as threatened or otherwise protected in NSW under the *Fisheries Management Act 1994*.

The following assessment considers the potential impacts of the proposal on species and communities that are listed as threatened under the NSW law and that are known or considered to have a medium to high likelihood of occurring in the study area. Depending on what is proposed, these impacts may include:

- direct impacts, such as loss of hollow-bearing trees
- indirect impacts, such as loss of native seed bank due to soil erosion / deposition
- cumulative impacts, such as fragmentation of wildlife corridors
- key threatening processes, such as removal of dead wood and dead trees

Please note, the NSW five-part Test of Significance focuses on matters listed under NSW law. Impacts on species that are only listed under the Commonwealth EPBC Act not NSW law are assessed in the MNES table in Volume 1 (Table 11).

C1 Threatened species

In the case of a threatened species, whether the action proposed 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.

C1.1 Threatened plants

Buttercup Doubletail (*Diuris aequalis*)

Buttercup Doubletail is an orchid recorded in forest, low open woodland with grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands. Leaves die back each year and resprout just before flowering. Populations tend to contain few, scattered individuals; despite extensive surveys, only about 200 plants in total, from 20 populations are known. Two records of species exist, each found within 2020. Potentially suitable habitat including low open woodland is found within the study area.

Habitat in study area is suitable and has the potential to support this species. Additionally, there are two recent records within 10 km of the study area. Initial surveys were undertaken outside this species flowering times and it was not possible to determine its presence or absence from the study area, particularly due the cryptic nature of orchid species.

Hoary Sunray (*Leucochrysum albicans* subsp. *tricolor*)

Hoary Sunray is a perennial daisy that is endemic to south-eastern Australia. It occurs in a wide variety of grassland, woodland, and forest habitats, generally on relatively heavy soils. Also known to occur in modified habitats such as semi-urban areas and roadsides. Highly dependent on the presence of bare ground for germination.

Habitat in study area is suitable and has the potential to support this species, particularly is disturbed areas along roadsides and on exposed soils. Additionally, records of the species can be found within 10 km of the study area. Initial surveys were undertaken outside this species flowering times and it was not possible to rule out its presence or absence from the study area.

Pale Pomaderris (*Pomaderris pallida*)

Pale Pomaderris is a compact, rounded shrub usually growing in shrub communities surrounded by Brittle Gum (*Eucalyptus mannifera*) and Red Stringybark (*E. macrorhyncha*) or Callitris spp. woodland. Recent records of species within 10 km of the study area exist, additionally associated *E. macrorhyncha* present throughout study area.

Habitat in study area is suitable and has the potential to support this species with associated canopy species present within the study area. Records of the species can be found within 10 km of the study area, however, are associated with a known population along the Queanbeyan River. Meandering surveys were conducted during optimal survey period, and although its presence is unlikely within the study area, it cannot be ruled out without targeted surveys.

Button Wrinklewort (*Rutidosis leptorrhynchoides*)

Button Wrinklewort is a perennial, multi-stemmed herb. Grows on soils that are usually shallow, stony red-brown clay loams; tends to occupy areas where there is relatively less competition from herbaceous species. Many sightings of species within 10 km of study area, including recent sightings and a sighting >40 years old within approx. 100 m of study area. Potentially suitable habitat is present within the study area.

Habitat in study area is suitable and has the potential to support this species. Additionally, records of the species can be found as close as 100 m from the study area. Meandering surveys were conducted during optimal survey period, and although its presence is unlikely within the study area, it cannot be ruled out without targeted surveys.

Small Purple-pea (*Swainsona recta*) and Silky Swainson-pea (*Swainsona sericea*)

Small Purple-pea is an erect perennial herb growing in association with understorey dominants that include Kangaroo Grass (*Themeda triandra*), Poa tussocks (*Poa* spp.) and spear-grasses (*Austrostipa* spp.). Few recent records of species exists within 10 km of study area, majority close records >60 years old. Potentially suitable habitat present.

Silky Swainson-pea is found in Natural Temperate Grassland and Snow Gum (*Eucalyptus pauciflora)* Woodland on the Monaro. Also found in Box-Gum Woodland in the Southern Tablelands and South-West Slopes. Many records within 10 km of the study area, however, associated vegetation communities is not present within study area.

Habitat in study area has the potential to support these species, particularly in areas of least disturbances. Records of both species can be found within 10 km of the study area. Initial surveys were undertaken outside this species flowering times and it was not possible to rule out its presence or absence from the study area.

Conclusion

The study area consists of area of high and lower quality habitat (historically cleared and disturbed), of which the degraded habitat found within the study area is considered less likely to contain the above-mentioned species. It has therefore been recommended that works remain within the areas of higher disturbance, if the works are deemed necessary to impact areas of high biodiversity it is recommended

that targeted surveys at the optimal time of year are conducted to confidently determine presence of these species. If recommendations from this report are adhered to the proposal is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction. In the case that works extend into higher quality areas, targeted surveys are recommended for the above species to confidently determine likely presence and consequently assess the potential for significant impacts.

No other threatened plant species listed as threatened under NSW law are considered likely to be present in the study area for reasons discussed in Appendix B.

C1.2 Threatened birds

Small grassland/woodland birds:

- Regent Honeyeater (*Anthochaera phrygia*),
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*),
- Speckled Warbler (*Chthonicola sagittata*),
- Varied Sittella (*Daphoenositta chrysoptera*),
- Little Lorikeet (*Glossopsitta pusilla*),
- Painted Honeyeater (*Grantiella picta*),
- White-throated Needletail (*Hirundapus caudacutus*),
- Scarlet Robin (*Petroica boodang*),
- Flame Robin (*Petroica phoenicea*), and
- Diamond Firetail (*Stagonopleura guttata*).

Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. The species 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. It has been recorded within 10 km of the study area, with some mistletoes suitable for foraging throughout study area.

Dusky Woodswallow is a medium-sized woodland specialist found in grassy eucalypt forests and woodlands. It prefers sites with abundant logs and fallen timber but is also known to utilise farmland on the edges of forest or woodland where it may nest in the top of decaying wooden fence posts. In warmer parts of NSW, it is a year-round resident but in colder regions such as Carwoola may migrate to northern NSW/southern QLD for the winter. It has been recorded within 10 km of the study area and there is potential habitat present.

Speckled Warbler is a small well-camouflaged ground-dwelling bird found in a wide range of *Eucalyptus* dominated communities that have a grassy understory, often on rocky ridges or in gullies. Typical habitat includes scattered native tussock grasses, a sparse shrub later, some eucalypt regrowth and an open canopy. Their diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Habitat within the study area is potentially suited to the species. Additionally, it has many records within 10 km of the study area.

Varied Sittella is an acrobatic woodland specialist that lives in lives in eucalypt forests and woodland, mallee, and Acacia woodland. The species feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.

The species builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Foraging and potential nesting habitat exists within the study area and the many recent records of the species within 10 km, including one within 100 m of study area.

Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia. Nomadic movements are common, influenced by season and food availability. Forages primarily in the canopy of open Eucalyptus forest and woodland, and also Angophora, Melaleuca, and tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. It has been recorded within 10 km of the study area, while optimal riparian habitat is not present within the study area, the eucalypt woodland would provide foraging and breeding opportunities.

Painted Honeyeater inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. The species nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark, or mistletoe branches. It has been recorded within 10 km of the study area. The species may utilise mistletoes and multiple *Acacia* sp. within the study area for foraging.

White-throated Needletail is an almost exclusively aerial species that forages for insects up to 1 km above ground, usually in large flocks. Only occurs in Australia between late spring and early autumn, breeds in north Asia. It has been recorded within 10 km of the study area, however due to the species being almost exclusively aerial, it is unlikely that the species relies on the reasonably small study area for foraging opportunities.

Scarlet Robin is an iconic robin that breeds in grassy eucalypt forests and woodlands, where it nests in tree forks > 2 m above ground level. It prefers sites with abundant logs and fallen timber but is also known utilise more open woodland, grasslands, pasture with scattered trees and even gardens. In colder regions it is an altitude migrant: it will migrate to and spend the winter in lowland areas before returning to the highlands to breed. Potential foraging and nesting habitat occur within the study area and the species has been recorded within 10 km.

Flame Robin is a small robin that is found in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. It prefers clearings or areas with open understories, with groundlayer of the breeding habitat dominated by native grasses and a sparse or dense shrub layer. It forages from low perches from which they sally or pounce onto small invertebrates which they take from the ground, coarse woody debris or in the air. It has been recorded within 10 km of the study area and some suitable fallen timber habitat is present within the study area.

Diamond Firetail is a large finch that is found in grassy eucalypt woodlands, open forest, mallee, Natural Temperate Grassland and in secondary grassland derived from other communities. It feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds, green leaves and insects. It has been recorded within 10 km of the study area. Potential foraging and nesting habitat occur within the study area and the species has been recorded within 10 km.

Conclusion

A considerable amount of habitat for these species was observed in and around the study area. Without the use of targeted surveys at the optimal survey time of year we cannot rule out the presence of any of these species within the study area. The proposal, and any potential clearing, is considered likely to have an adverse effect on above-mentioned species if they are present locally. A range of measures have been recommended to avoid and minimise impacts of the proposal on the above species. These include

recommendations for works to be mostly concentrated within degraded areas, avoidance of HBT and implantation of construction mitigation measures. Provided these measures are adhered to and works remain in the recommended areas (lower quality), the proposal is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction.

Hollow-dependant woodland birds:

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*),
- Gang-Gang Cockatoo (*Callocephalon fimbriatum*),
- Glossy Black-Cockatoo (*Calyptorhynchus lathami*),
- Powerful Owl (*Ninox strenua*),
- Swift Parrot (*Lathamus discolor*),
- Turquoise Parrot (*Neophema pulchella*), and
- Superb Parrot (*Polytelis swainsonii*).

Brown Treecreeper (eastern subspecies) is endemic to eastern Australia and occurs in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range. Fallen timber is an important habitat component for foraging. When foraging in trees and on the ground, they peck and probe for insects, mostly ants, amongst the litter, tussocks and fallen timber, and along trunks and lateral branches. Nectar from Mugga Ironbark (*Eucalyptus sideroxylon*) and paperbarks, and sap from an unidentified eucalypt are also eaten. Hollows in standing dead or live trees and tree stumps are essential for nesting. The species has been recorded within 10 km of the study area.

Gang-Gang Cockatoo are one of the more distinctive and charismatic members of Australia's avifauna. The species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas. The species is also often found in urban areas. They typically favour old growth forest and woodland attributes for nesting and roosting. Nesting hollows are typically over 7 cm in diameter in eucalypts and 3 metres or more above the ground. Multiple hollow-bearing trees within the study area are suitable breeding habitat for the species. The species has been recorded within 10 km of the study area.

Glossy Black-Cockatoo is known to inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. The species is dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May. The study area does not contain feed trees, however there is multiple hollow-bearing trees that would be suitable breeding habitat for the species. Additionally, it has been recorded within 10 km of the study area.

Powerful Owl is the largest owl in Australasia widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. The species inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. It roosts by day in dense vegetation comprising species such as, Black She-oak (*Allocasuarina littoralis*),

Blackwood (*Acacia melanoxylon*), and a number of eucalypt species. Potential habitat for foraging in nearby fragmented landscapes and roosting habitat available in the form of large hollows.

Swift Parrot is a distinctive parrot that breeds in Tasmania during spring and summer and migrates to the mainland for autumn and winter, where they are found in areas with eucalypts that flower profusely in winter or that have abundant lerp (sap-sucking bugs) infestations. Some favourite flowering trees include but not limited to Swamp Mahogany (*Eucalyptus robusta*,), and Spotted Gum (*Corymbia maculata)*, Red Bloodwood (*C. gummifera*). The study area does not contain associated foraging trees, however the species has been recorded within 10 km of the study area.

Turquoise Parrot is a highly distinctive bird (male) which range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. The species lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants or browsing on vegetable matter. The species nests in tree hollows, logs or posts, from August to December. Potential foraging and nesting habitat occur within the study area and records exist within 10 km.

Superb Parrot inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. They nest in the hollows of large trees (dead or alive) and may forage up to 10 km from nesting sites, primarily in grassy box woodland. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. May forage up to 10 km from nesting sites, primarily in grassy box woodland. Potential foraging and nesting habitat occur within the study area, however the area is outside of expected breeding sites. Records exist within 10 km.

Conclusion

A considerable amount of habitat, particularly important breeding habitat, for these species was observed in the study area. Hollows observed ranges from small through to multiple large and extra-large hollows, suited to the nesting requirements of all mentioned threatened species. Without targeted surveys at the optimal survey time of year the presence and use of these hollows by any of these species is difficult to determine.

The proposal, and any potential clearing, is considered likely to have an adverse effect on the above-mentioned species if they are utilizing these HBTs. A range of measures have been recommended to avoid and minimise impacts of the proposal on the above species. These include recommendations for works to be confined to degraded areas, avoidance of HBT, reusing and reinstalling hollows and the use of pre-clearing surveys. Provided these measures are adhered to and works remain in the recommended areas (lower quality), the proposal is not considered likely to have a significant impact on the above species such that a viable local population is likely to be placed at risk of extinction.

Raptors:

- Spotted Harrier (*Circus assimilis*),
- Black Falcon (*Falco subniger*), and
- Little Eagle (*Hieraaetus morphnoides*).

Spotted Harrier is a medium-sized, slender bird of prey occurring throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment, and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. The species is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats

including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. They prey on terrestrial mammals (e.g., bandicoots, bettongs, and rodents), birds and reptiles, occasionally insects and rarely carrion. Potential nesting habitat occurs within the study area and foraging habitat is available in nearby grassland nature reserves. There are also records of this species within 10 km of the study area.

Black Falcon is a large very dark falcon that is widely, but sparsely, distributed in inland NSW. Its habitat is usually in the arid and semi-arid zones. It is usually found near watercourses or utilizing patches of isolated trees. It hunts over open wooded grasslands, saltbush plains, bluebush plains and other low vegetation. The species is highly mobile, commonly travelling hundreds of kilometres. Requires large old trees for nesting and hunting. Potential nesting habitat occurs within the study area and foraging habitat is available in nearby grassland nature reserves, nearby waterbodies, including wetlands and Queanbeyan River. There are also records of this species within 10 km of the study area.

Little Eagle is a medium-sized raptor that occupies open eucalypt forest, woodland, or open woodland, and in inland NSW, also Sheoak or Acacia woodlands and riparian woodlands. It has an extremely large home range, of up to 20,000 km^2. It nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter and preys on birds, reptiles, and mammals, occasionally adding large insects and carrion. Potential nesting and habitat occur within the study area. There are also records of this species within 10 km of the study area.

Conclusion

Potential habitat for these species was observed in the study area, however no large stick nests were observed at the time of field assessment.

The proposal, and any potential clearing, is considered likely to have an adverse effect on the above-mentioned species if they are utilizing the study area through the removal of foraging and potential future breeding habitat. A range of measures have been recommended to avoid and minimise impacts of the proposal on the above species. These include recommendations for works to be confined to degraded areas, staging works around breeding seasons where appropriate, pre-clearing surveys and closer inspection of any large stick nests observed to confirm absence and if present. Provided these measures are adhered to adverse effects on these species may be minimised or avoided.

Due to the small scale of available habitat in the work area in comparison to this species' large home range, the proposal is not considered 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.

C1.3 Threatened fish

No threatened fish species are known or considered likely to be present in the study area given their known distribution and habitat requirements.

C1.4 Threatened frogs

No threatened frog species listed as threatened under NSW law are considered likely to be present in the study area for reasons discussed in Appendix C.

C1.5 Threatened invertebrates

Golden Sun Moth (*Synemon plana*)

Golden Sun Moth is a medium-sized day-flying moth occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses *Rytidosperma* spp., spear-

grasses *Austrostipa* spp. and Kangaroo Grass *Themeda australis*. Adults are short-lived (one to four days) and do not feed - having no functional mouthparts; the larvae are thought to feed exclusively on the roots of wallaby grasses. Spends much of its lifecycle underground and adult females are flightless. The species has multiple records within 10 km, concentrated in nearby Queanbeyan Nature Reserve and grassy areas.

Habitat within the study area is sub-optimal and likely not utilized like nearby native grasslands, therefore the proposal is not considered 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.

C1.6 Threatened mammals

Grey-headed Fly-fox (*Pteropus poliocephalus*)

Grey-headed Flying-fox is the largest bat in Australia, generally found within 200 km of the east coast. Roosts communally in large camps often located in a gully close to water under dense canopy cover. May travel 20–50 km when foraging for foods, with a home range is ~785,000 ha. Favourite food plants include flowering native trees (*Eucalyptus*, *Melaleuca* and *Banksia*), fruiting rainforest trees and vines, urban gardens, and cultivated fruit crops.

Habitat within the project area was unlikely to be utilised for breeding for this species, as no observations were made of roosting during site inspections. However, there is potential that the species may utilised the area for foraging and dispersal. Clearing and disturbances from proposal may result in minor impacts on the species. However, the works are unlikely to have any negative effect on the species due to the area of habitat present is small and likely only represents a relatively small area to access food sources when compared to the surrounding foraging habitats. Therefore, the proposal is not considered 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.

Koala (*Phascolarctos cinereus*)

Koala is an iconic tree-dweller that inhabits eucalypt woodlands and forests, feeding on the foliage of 70+ Eucalyptus species and 30+ other species. Details vary, see DPIE's Review of koala tree use across New South Wales (2018) and note that koala habitat protection is the focus of State Environmental Planning Policy (SEPP 44). The study area contains the following trees belonging to the Koala use tree species listed in Schedule 2 of the Koala SEPP 2021:

- Red Stringybark (*Eucalyptus macrorhyncha*),
- Inland Scribbly Gum (*E. rossii*), and
- Red Box (*E. polyanthemos*).

Records of Koalas exist within 10 km of the study area, with records as recent as 2019 concentrated near Cuumbeun Nature Reserve, which is found >5 km to the northeast of the study area.

Field inspection reveals the project area does not constitute core or critical Koala habitat. Whilst the study area may contain incidental Koala habitat based on details mentioned above, it is not considered highly suitable koala habitat based on the following:

- Koalas were not recorded as being present at the time of assessment,
- No historical records or sightings within the study area itself, and
- No attributes such as breeding females (females with young) and historical records of a population.

Although habitat within the study area is potentially suited to the species, it has not historical evidence of Koalas utilising this area. Furthermore, with the urbanisation of the area surrounding Mount Jerrabomberra Reserve likely act as a barrier to any potential use of the area by the species. Therefore, the proposal is not considered 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.

C1.8 Threatened reptiles

Pink-tailed Worm-lizard (*Aprasia parapulchella*)

Pink-tailed Worm-lizard is a species inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda triandra*). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. The study area contains sparse coverage of native grass, with few areas comprised of a native grass dominant understory. It has been recorded within 10 km of the study area.

Limited potential habitat for the species is available within the study area, what habitat that is present is sub-optimal with minimal suitable loose surface rock present. With limited habitat present and what habitat present making up a relatively small area in comparison to the surrounding landscape, the proposal is not considered 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.

Rosenberg's Goanna (*Varanus rosenbergi*)

Rosenberg's Goanna is a Ground-dwelling monitor that is highly vulnerable to predators including domestic dogs and cats. Found in heath, open forest, and woodland where it forages among fallen timber, lays its eggs in termite mounds, and shelters in hollow logs, rock crevices and burrows created by other animals. It has been recorded within 10 km of the study area.

Potential habitat for this species was observed in the study area, however no evidence of the species utilising termite mounds was observed at the time of field assessment. Additionally, the species requires a large area of habitat for foraging and breeding, and is very susceptible to impacts associated with being close to urbanised areas (vehicle strikes and predation from domestic and feral animals). However, without the use of targeted surveys at the optimal survey time of year we cannot rule out the presence and use of the study area by the species.

Due to the small scale of available habitat in the work area in comparison to this species' large home range, the proposal is not considered 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.

C2 Threatened ecological communities

In the case of a critically endangered or endangered ecological community, whether the action proposed:

1. 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
2. Is likely to modify the composition substantially and adversely such that its local occurrence is likely to be placed at risk of extinction.

No threatened ecological communities are known or considered likely to be present in the study area given its dominant tree species and other characteristics as discussed Appendix B.

C3 Habitat for a threatened species, population, or ecological community

In relation to the habitat of a threatened species, population, or ecological community:

1. The extent to which habitat is likely to be removed or modified due to the action proposed, and
2. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat because of the proposed action, and
3. The importance of the habitat to be removed, modified, fragmented, or isolated to the long-term currently interconnecting or proximate areas of habitat for a threatened species, population, or ecological community.

The proposal may require the removal of native vegetation and associated habitats for the threatened species as discussed in C1 and C2 above. This includes the removal of/reduction in:

- native woodland providing habitat for a range of species including birds, mammals and reptiles,
- habitat-bearing trees containing hollows, nests and fissures providing roosting and nesting habitat for a range of native species, specifically bats, small mammals and birds,
- a culvert running under the road outside the reservoir, which likely provides habitat for reptiles and frogs,
- limited rock outcrops and course woody debris providing limited shelter and foraging opportunities for reptiles and small birds,
- ant/termite mounds providing potential breeding habitat for the Rosenberg's monitor, and
- mistletoe.

The proposal area occurs within the 93.5 ha patch of woodland of Mount Jerrabomberra Reserve within the residential area of Jerrabomberra. Clearing associated with the proposal is not likely to fragment or isolated other areas of habitat as any potential clearing will occur within a larger area of native vegetation, and largely close to areas of disturbance (reservoir and roads) and adjacent to areas of residential housing.

The habitat recommended to be removed is considered to be of lower quality and covers a relatively small area, in comparison to that of the surrounding landscape. This is mostly due historical clearing and disturbances from recreation.

C4 Declared Areas of Outstanding Biodiversity Value

Whether the proposal or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

The proposal is extremely unlikely to impact on any declared Area of Outstanding Biodiversity Value in NSW due its very small scale and distance from any such area. There are currently four declared AOBVs in all of NSW. The closest to the study area is the Wollemi Pine habitat over three hundred kilometres away in the Blue Mountains; the rest all involve marine habitats even further away. For more information about such areas, see the NSW Government's Area of Outstanding Biodiversity Value register.

C5 Key Threatening Processes

Whether the proposal or activity is or is part of a Key Threatening Process or is likely to increase the impact of a Key Threatening Process.

Key threatening processes (KTPs) are listed under both Commonwealth and State legislation. There are more than 20 Commonwealth-listed KTPs, almost 40 NSW-listed KTPs and eight under the FM act. The lists overlap and include broad threats such as climate change as well as specific threats relating to Lord Howe Island, shark control programs on beaches and longwall mining. The NSW-listed KTPs most relevant to the development are as follows.

C5.1 Feral animals

A number of KTPs are associated with feral animals, which may have impacts including predation, habitat degradation, competition, and disease transmission. Species with a medium to high likelihood of occurrence within the study area include:

- Common Myna (*Acridotheres tristis*),
- Rock Pigeon (*Columba livia*),
- Spotted turtledove (*Streptopelia chinensis*),
- House Sparrow (*Passer domesticus*),
- Skylark (*Alauda arvensis*),
- European goldfinch (*Carduelis carduel),*
- Common Starling (*Sturnus vulgaris*),
- Common Blackbird (*Turdus merula*),
- Cat (*Felis catus*),
- House mouse (*Mus musculus*),
- Rabbit (*Oryctolagus cuniculus*),
- Hare (*Lepus capensis),*
- Black Rat (*Rattus rattus*),
- Deer (*various species*), and
- Fox (*Vulpes vulpes*)

Most of the pest animals listed above occupy vast areas of NSW and are extremely difficult to control without a concerted effort at the landscape level. The proposal is located very close to residential and urban areas which likely means many of these species are already prevalent. The proposal is considered very unlikely to increase the impact of this KTP as the area which the proposal is located is already very close to urban landscape where these pest likely have already been introduced.

Pest control as stated in the *Mount Jerrabomberra Reserve Plan of Management* 2021 notes that monitoring for impacts should be regularly identified, control actions must be ecologically and socially responsible and should balance feasibility, sustainability, humaneness and public safety. Furthermore, that the occurrence and impacts of priority pest species identified in the Regional Strategic Pest Animal Management Plan should be assessed and management action taken as considered appropriate.

For details of all the feral animal species considered as part of the field inspection and this test of significance, see Appendix C6.

C5.2 Weeds

Invasion and establishment of exotic vines and scramblers such as Blackberry

Blackberry (*Rubus fruticosus* sp. agg) was observed during field inspection in low abundance. There is a high chance for Blackberry to invade any disturbed areas. Control of Blackberry on site is recommended as it a Weed of National Significance. Impacts will be mitigated by appropriate weed control measures prior to works, and ongoing rehabilitation efforts.

Overall, it is unlikely that the proposal will significantly contribute to this KTP given appropriate measures that are described in Section 4.6.2.6 are implemented as recommended.

Invasion of native plant communities by exotic perennial grasses such as Serrated Tussocks

Several perennial exotic grasses invade and may dominate native plant communities by competing with, and displacing, many native species. Many of the perennial exotic grasses establish following disturbances such as overgrazing, road works and management of roadside areas. Spread of these grasses is often exacerbated by slashing, weed control, forestry and mining operations, movement or addition of fertilisers and nutrients, changes to drainage and fire regimes.

Construction activities have the potential to introduce and facilitate the establishment of perennial exotic grasses in the proposal site, and perennial exotic grasses as listed in the NSW Scientific Committee's final determination for this KTP where observed within the project area and immediate surrounds. There is a chance for these species to invade areas disturbed by proposed works and spread into the surrounding locality. Impacts will be mitigated by appropriate weed control measures prior to, and rehabilitation efforts post, construction.

Overall, it is unlikely that the proposal will significantly contribute to this KTP given appropriate measures that are described in Section 4.6.2.6 are implemented as recommended.

Invasion and establishment of Scotch Broom (*Cytisus scoparius*)

No evidence of Scotch Broom was observed during the field inspection. As such, the proposal is not likely to result in an increase in the impact of this KTP within the locality.

Loss/degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Given the study area's ecological values and the close proximity to surrounding residential area, the proposal has some potential to increase the impact of the KTP related to escaped garden plants. Though an increase in this KTP is not likely if appropriate measures are implemented as recommended.

C5.3 Habitat modification

Clearing of native vegetation

Clearing is defined in Section 3 of the BC Act as:

> "*the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long-term modification, of the structure, composition and ecological function of stand or stands*".

The proposal may require the removal of various strata of native vegetation within the study area, however if recommendations to keep works within the areas of lower biodiversity value the proposal is not likely to result in the loss, or long-term modification, of the structure, composition and ecological function of stand or stands. Furthermore, rehabilitation and landscaping will minimise any long-term impacts of clearing in the long term.

Loss or degradation of specific habitat structures (various KTPs)

The proposal may involve the removal of any of the following habitat structures,

- hollow-bearing trees, or
- dead wood and dead trees.

It has been recommended that the removal of these habitat structures be avoided wherever possible. If this recommendation is adhered too, combined with implementation of mitigation and rehabilitation measures proposed, any loss or degradation of specific habitat structures will likely be offset. This may include (but not limited to) salvage of key habitat features and installation of artificial habitat structures (e.g., nest boxes).

<end of report>

Appendix B – Consideration of section 171

Section 171(2) of the EP&A Regulation 2021 indicates, for purposes of Part 5 of the Act, the factors that must be taken into account when consideration is being given to the likely impact of an activity on the environment.

A determining authority is only required to consider the following matters where an EIS has been prepared for a Part 5 activity under the EP&A Act. However, the following information is provided to assist determining authorities in making determinations consistent with those made for an activity requiring preparation of an EIS.

The various factors and findings following environmental assessment are presented below.

(a) the environmental impact on the community,

There is the potential for some minor and temporary noise, dust, waste management and traffic impacts during construction works. However, given these impacts are intermittent, temporary and will be reduced by implementing the recommended mitigation measures, they are not considered to be significant.

(b) the transformation of the locality,

The new reservoir will be constructed adjacent to the existing reservoir and will be similar in size and scale as the existing reservoir. The reservoir site is visible from the publicly accessible access road and users of the Reserve, however the site is screened from view elsewhere by the existing bushland that is protected by the Reserve. The proposed electrical building will be constructed adjacent to the proposed new reservoir within a topographic depression therefore is not likely to be visually prominent.

The proposal involves the construction of additional water supply infrastructure on land which currently accommodates water supply infrastructure. Therefore, a transformation of the locality is not anticipated.

A significant transformation of the locality not anticipated.

(c) the environmental impact on the ecosystems of the locality,

The vegetation within the study area is comprised of areas of varying composition and condition, including areas of good condition native vegetation with high biodiversity. Clearing will be required for the proposal, however a biodiversity assessment determined that if clearing or otherwise direct impacts are concentrated within already degraded areas of vegetation, there is not likely to be a significant impact on the extent and viability of threatened species in the local area. As such, no adverse impact on the ecosystems in the locality is predicted. Mitigation measures have been provided to reduce risks.

(d) the reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality,

The area is currently used as a water reservoir and the new reservoir will result in minimal changes to the environmental quality of the locality. Minor visual impacts within the immediate area are anticipated during the construction works typically associated with the vegetation clearing and material stockpiling. Appropriate mitigation measures would be implemented to avoid a reduction in any environmental quality or value of the locality. The new reservoir would be of a similar scale to the existing reservoir therefore no significant visual impacts are anticipated post-works.

(e) the effect on a locality, place or building that has -

(i) aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance, or

(ii) other special value for present or future generations.

No effects identified.

(f) the impact on the habitat of protected animals, within the meaning of the Biodiversity Conservation Act 2016.

A biodiversity assessment found that impacts of the Proposal on threatened species are not likely to be significant provided the recommended mitigation measures are implemented.

(g) the endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air,

No impact to threatened species is anticipated with the implementation of the recommended mitigation measures during construction works.

(h) long-term effects on the environment,

No effects identified

(i) degradation of the quality of the environment,

There would be temporary and minor degradation of the quality of the environment during the works which would involve clearing of vegetation and excavation. The works would result in some short-term impacts including noise and dust during the construction period. Control measures to minimise these impacts would be implemented during construction as part of the contractor's Construction Environmental Management Plan (CEMP).

(j) risk to the safety of the environment,

Disinfection of the proposed reservoir would be carried out using chlorine under strict adherence to prescribed work practices and as documented in Council’s Operational Environmental Management Plan.

(k) reduction in the range of beneficial uses of the environment,

None identified.

(l) pollution of the environment,

There is the potential for some minor and temporary noise and air pollution during the Proposal works. With the implementation of appropriate mitigation measures during construction works there would be no long term or significant pollution of the environment as no discharges to the environment are anticipated during operation of the reservoir.

(m) environmental problems associated with the disposal of waste,

All construction waste would be taken off site for disposal at a licensed recycling facility or waste facility in line with EPA requirements. The Contractor would prepare a Waste Management Plan to ensure waste is managed appropriately during works, so as not to cause off-site impacts.

(n) increased demands on natural or other resources that are, or are likely to become, in short supply,

None identified.

(o) the cumulative environmental effect with other existing or likely future activities,

None identified.

(p) the impact on coastal processes and coastal hazards, including those under projected climate change conditions.

Not relevant to this Proposal.

(q) applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1.

The Proposal is compatible with the Queanbeyan-Palerang Local Strategic Planning Statement 2040, Goal 2, Direction 18: Secure water resources.

(r) other relevant environmental factors.

None identified.

Appendix C – Aboriginal Due Diligence Assessment

NSW Public Works

Aboriginal Heritage Due Diligence Assessment

Jerrabomberra Water Supply Reservoir and Electrical Building

Report Number: P-FY20231658-PWO-ENV-RP-001-A2

November 2024

Prepared for:

QPRC

Report Number: P-FY20231658-PWO-ENV-RP-001-A2

P-FY20231658-PWO-ENV-RP-001-A2_JerrabomberraResADDA.docx

Template Rev 6 Feb 2023

Document control

Version	Author(s)	Reviewer	Approved for issue	
			Name	Date
A0 (draft)	A. Cameron	Liz Mathieson	Liz Mathieson	08/05/2023
A1 (final)	A. Cameron	Liz Mathieson	Liz Mathieson	21/11/2023
A2 (final)	A. Cameron	Liz Mathieson	Liz Mathieson	27/11/2024

Dr Alyce Cameron

Archaeologist

NSW Public Works, 359 Harbour Drive, Coffs Harbour NSW 2450

M 0488 316 037

E alyce.cameron@pwa.nsw.gov.au | **W** www.publicworks.nsw.gov.au

Cover photo: Jerrabomberra Reservoir existing water infrastructure.

Source: NSW Public Works 2023, Department of Primary Industries and Regional Development NSW.

Acknowledgements

The Department of Primary Industries and Regional Development NSW (NSW Public Works) stands on Country that always was and always will be Aboriginal land.

From creation, all generations have been caring for Country and sharing with each other, surviving, and living in harmony as one. Today, we show our respect by acknowledging the ancient protocols and traditions of the First Nations peoples. We recognise the elders for continuing dreamtime lore, protecting the knowledge of all things sacred and spiritual, sustaining all living species that called this place home, and preserving the oldest living culture in the world.

We acknowledge the Traditional Custodians of the land and waters, and we pay respect to Elders past, present, and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally, and economically through thoughtful and collaborative approaches to our work.

Executive Summary

NSW Public Works (NSW PW) have been engaged by Queanbeyan-Palerang Regional Council (the proponent) to complete an Aboriginal heritage due diligence assessment to support a Review of Environmental Factors (REF) for a new water reservoir, chlorination building, electricity transmission line and site compound laydown area.

A visual inspection was conducted on Thursday 13 April 2023 by Dr Alyce Cameron (archaeologist, NSW PW). Pedestrian inspection focused on the two study areas and any areas clear of grass inside them.

No Aboriginal sites or objects have been recorded inside the study area. The study area has a low potential for archaeological deposits to be present. Based on the results of this assessment, no further archaeological assessments are necessary.

The undertaking of the Aboriginal due diligence process has resulted in the conclusion that the proposed works will have an impact on the ground surface, but no Aboriginal objects or intact archaeological deposits will be harmed. The following recommendations are provided as a precautionary measure to ensure the greatest possible protection to the area’s Aboriginal cultural heritage values:

1. The Proposal may proceed at the study area with no further archaeological investigation. The Proposal and all land and ground disturbance activities must be confined to inside the study area. Should the Proposal extend outside the study area then further archaeological assessment may be required.
2. All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols.
3. This assessment has concluded that Aboriginal objects are unlikely to be harmed by the proposed works. However, if during works, Aboriginal objects, artefacts, or skeletal material are noted the Unanticipated Finds Protocol (Appendix C) should be followed.

Contents

Tables

Figures

Photos

Glossary

Term	Definition
A Horizon	Surface mineral horizon(s) with some organic accumulation; either darker in colour than underlying horizons, or lighter in colour but with a lower silicate clay/sesquioxide content.
Aboriginal object/s	Aboriginal object/s are any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains. Defined by the *National Parks and Wildlife Act 1974* (NPW Act).
Aboriginal Place	An Aboriginal Place is a location declared to be an Aboriginal Place under Section 84 of the *National Parks and Wildlife Act* by the Minister administering the NPW Act and by order published in the Gazette. The Aboriginal Place is of special significance with respect to Aboriginal culture and may or may not contain Aboriginal objects.
Aboriginal site	The location of one or more Aboriginal objects and material traces of past Aboriginal land use.
Alluvial landscape	Alluvial soil landscapes are formed by deposition along rivers and streams. Soil parent material is alluvium. Alluvial soil landscapes include floodplains and alluvial deposits. Typical landform elements include those found on meander plains; including bars, back plains, scrolls, scroll plains, flood-outs, oxbows, levees, terraces, prior and current stream channels.
Alluvium	Alluvium is a loose clay, silt, sand or gravel that has been deposited by running water. Alluvium is typically geologically young and not consolidated into solid rock.
Artefact scatter	An artefact scatter consists of two or more stone artefacts located within 50 metres of each other. Artefact scatters can be located on the ground surface or as subsurface deposits. Sometimes recorded in association with other archaeological features such as hearths, modified trees or PADs.
B Horizon	A Subsoil horizon(s) characterised by one or more of the following: concentration of silicate clay, iron, aluminium, and/or organic material; different structure and/or consistency to adjacent horizons; and/or stronger colours than adjacent horizons.

Term	Definition
Colluvial landscape	Colluvial soil landscapes are affected by mass movement. Soil parent material mostly consists of colluvial mass movement debris including scree and talus along with other landslide, mudflow and creep deposits. Colluvial soil landscapes usually include alcoves, cliffs, cliff-foot slopes, scarps, landslides, talus, some moderately inclined to precipitous hillslopes and areas of commonplace evidence of mass movement.
Colluvium	Colluvium is a general term for loose unconsolidated sediments that have been deposited at the base of hill slopes by rain wash, sheetwash, downslope creep or a combination of these processes.
Devonian	A geological period between 419.2 to 358.8 million years ago between the end of Silurian and the beginning of the Carboniferous. Part of the Palaeozoic Era.
Erosional landscape	Erosional soil landscapes have been primarily sculpted by erosive action of running water. Streams are well defined and competent to transport their sediment load. Soil depth is usually shallow (with occasional deep patches), and mode of origin is variable and complex. Soils may be either absent, derived from water washed parent materials or derived from in situ weathered bedrock. Erosional soil landscapes usually consist of steep to undulating hillslopes and may include tors, benches, and areas of rock outcrop. Evidence of mass movement is rare.
Isolated find	A stone artefact located by itself, usually at least 50 metres from any other Aboriginal archaeological feature (i.e., an artefact scatter, modified tree, quarry location, etc.).
Metasediments	Rocks of sedimentary origin that have been subjected to metamorphism.
Modified tree	A modified tree has been culturally modified through scarring, carving or the deliberate removal by traditional methods of the bark or wood from a tree, or the deliberate modification by traditional methods of the wood of the tree.
National Parks and Wildlife Act (NPW Act):	The NSW legislation which covers the conservation of the natural and cultural heritage of the state of New South Wales; fostering public appreciation, understanding and enjoyment of its natural and cultural heritage; and managing any lands reserved for the purposes of conserving and fostering public appreciation and enjoyment of its natural and/or cultural heritage.
Ordovician	A geological period between 485.4 to 443.8 million years ago between the Cambrian Period and the Silurian Period. Part of the Palaeozoic Era.

Term	Definition
Palaeozoic	The Palaeozoic Era is the earliest of three geologic eras of the Phanerozoic Eon. It is subdivided into six geologic periods of the Cambrian, Ordovician, Silurian, Devonian, Carboniferous and Permian.
Potential archaeological deposit (PAD)	An area where subsurface stone artefacts and/or other cultural features are likely to occur.
Quaternary	The current and most recent geologic era which began 2.58 million years ago. It is one of three periods of the Cenozoic Era and follows on from the Neogene Period.
Silurian	A geological period between 443.7 to 416.0 million years ago, between the end of the Ordovician Period and the beginning of the Devonian Period. Part of the Palaeozoic Era.

Abbreviations and Notations

Item	Description
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
BCD	Biodiversity Conservation Division.
DECCW	Department of Environment, Climate Change and Water
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
HNSW	Heritage NSW. Formerly OEH and BCD.
LEP	Local Environmental Plan
LGA	Local Government Area
NPW Act	National Parks and Wildlife Act 1974
NPWS	NSW National Parks and Wildlife Services
NSW	New South Wales
OEH	Office of Environment and Heritage
REF	Review of Environmental Factors

1. Introduction

This section provides a brief description of the proposal, the background to the proposal and its objectives.

1.1 Purpose of the Proposal

NSW Public Works (NSW PW) have been engaged by Queanbeyan-Palerang Regional Council (the proponent) to complete an Aboriginal heritage due diligence assessment to support a Review of Environmental Factors (REF) for a new water reservoir, electrical building, and site compound laydown area.

Queanbeyan-Palerang Regional Council (QPRC) is the local water supply authority for the local government area. The existing 24ML steel water reservoir at Jerrabomberra has been identified as in a very poor condition and urgent work is required to upgrade the facility to meet water supply demands prior to summer 2023/24.

1.2 The study area

For the purposes of this due diligence assessment the study area consists of two main locations:

- Northern part of the study area incorporating Lot 1 DP 40407 and including the reservoir site and widened access entry (approximately 2800 m^2). This area also includes the proposed electricity transmission line along an existing track between Carolyn Jackson Drive and the reservoir location.
- Southern part of the study area incorporating Lot 126 DP 17204 and part of Lot 872 DP 1060706 and including the temporary construction compound and the future chlorination building (approximately. 38350 m^2). Also includes the existing gravel access tracks.

The locations of the study areas are shown in Figure 1-1 and an aerial map is shown in Figure 1-2. The study area is in the Queanbeyan-Palerang Regional Local Government Area (LGA). Note that the study area includes proposed works which have since been removed from the scope as of November 2024.

1.3 The proposed works

The proposed works inside the study area consist of:

- A widened access point at the entry of the existing reservoir site
- Realignment of fences and the entry of the existing reservoir site
- Demolition of existing 1.8ML site steel reservoir
- A new 53m diameter, 10m high, water reservoir adjacent to the existing Jerrabomberra Reservoir
- A temporary construction compound area to be established on part Lot 126 DP 17204

- A new electrical control building (approximately 11 m x 4 m) within the footprint of the reservoir site.

The plans for the proposed works are provided in Appendix A.

1.4 Assessment methodology

This Aboriginal Due Diligence assessment has been undertaken in compliance with the following:

- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010).

1.5 Report authorship

This report was authored by Dr Alyce Cameron (archaeologist, NSW PW) who has over 15 years' experience of heritage consulting in Australia (BA Hons (Combined archaeology and biological anthropology, Australian National University) and PhD (Archaeology & Palaeoanthropology, Australian National University). The report was reviewed internally by Liz Mathieson (Principal Scientist, NSW PW).

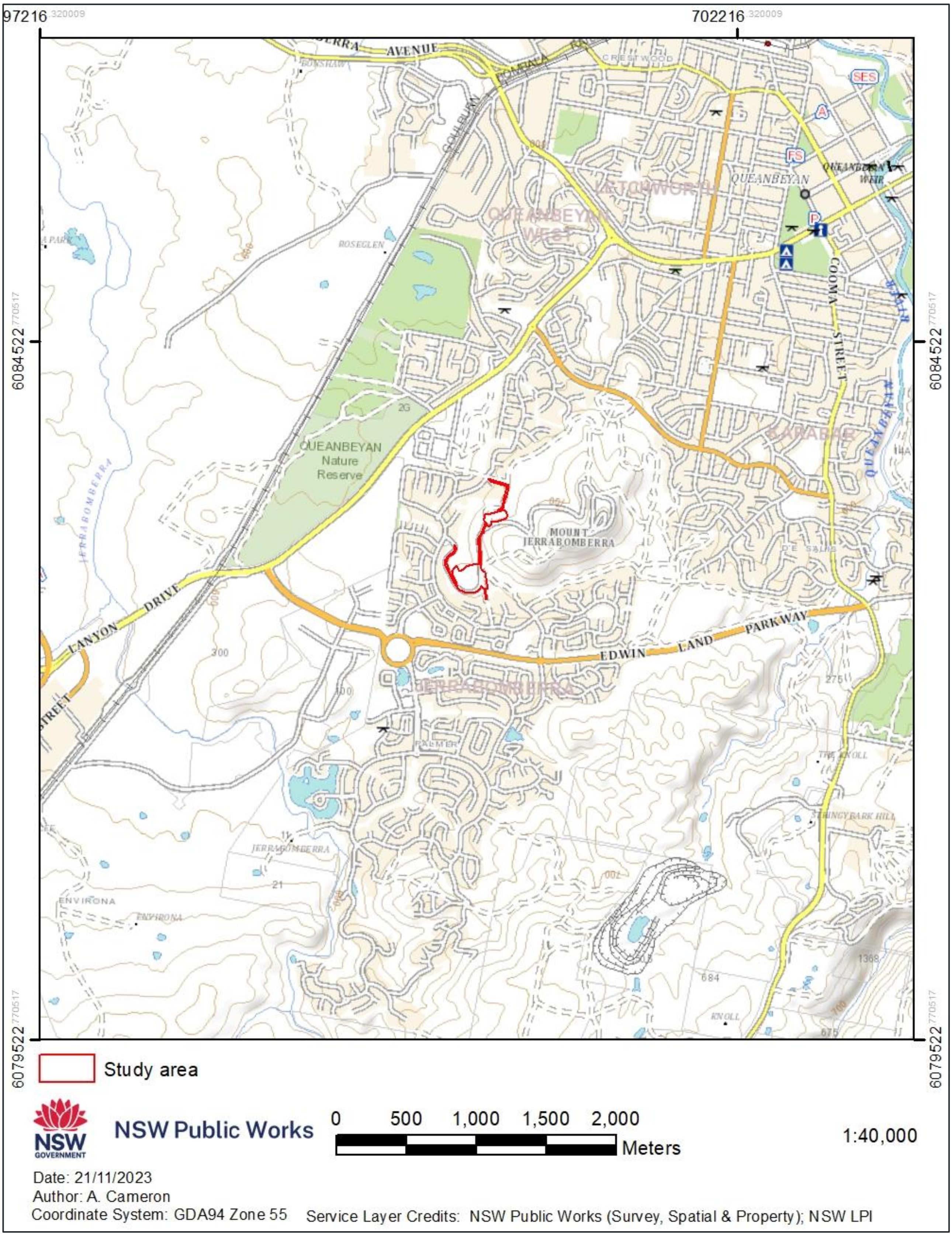


Figure 1-1: Location of study area (NSW PW 2023)

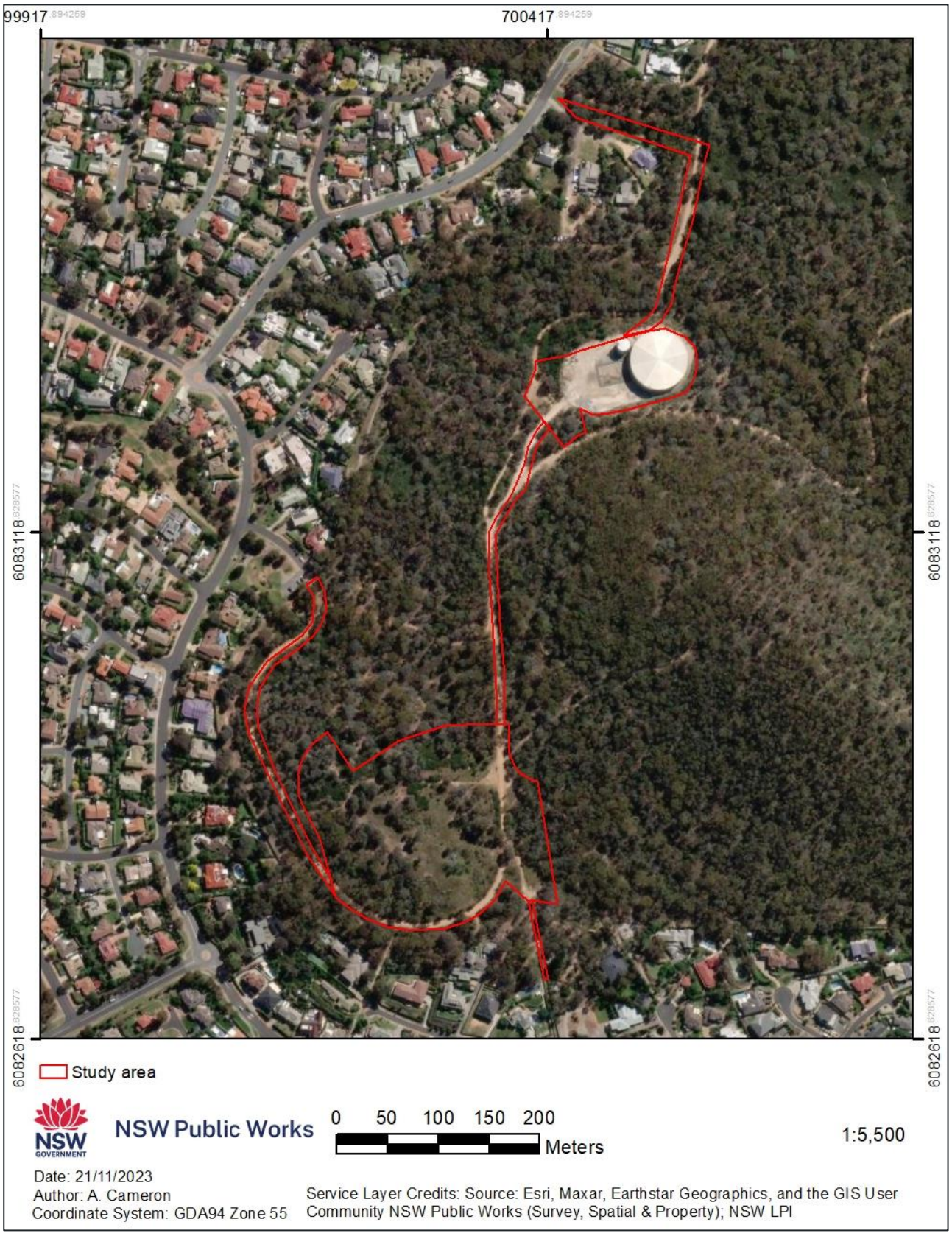


Figure 1-2: Aerial of study area (NSW PW 2023)

2. Statutory Considerations

2.1 Heritage Act 1977

The *Heritage Act 1977* protects and aims to conserve the environmental heritage of New South Wales. Environmental heritage is broadly defined under Section 4 of the *Heritage Act 1977* as consisting of “those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance” (Heritage Branch, DoP 2009:4). Aboriginal places or objects that are recognised as having high cultural value (potentially of local and State significance) can also be listed on the State Heritage Register and protected under the provisions of the *Heritage Act 1977*.

2.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. One of the objects of the NPW Act is the conservation of places, objects and features of significance to Aboriginal people (Section 2A). The NPW Act provides for the management of both Aboriginal Objects and Aboriginal Places and is administrated by Heritage NSW within the Department of Planning and Environment.

Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86). Harm to an Aboriginal Place or Object includes any act or omission that destroys, defaces or damages the object or place, or, in relation to an Aboriginal object, moves the object from the land on which it had been situated. However, harm to an Aboriginal Object that is ‘trivial or negligible’ does not constitute an offence. Also, it is a defence against prosecution for unintentionally harming Aboriginal Objects if due diligence had been exercised to determine that no Aboriginal object would be harmed, or the harm or desecration was authorised by an Aboriginal Heritage Impact Permit (AHIP). The National Parks and Wildlife Regulation *2009* (NPW Regulation) made under the NPW Act advocates a Due Diligence process to determining likely impacts on Aboriginal objects.

The NPW Regulation made under the NPW Act allows a due diligence process in determining potential impacts of proposed works and actions to Aboriginal objects. The Aboriginal due diligence process provides a defence to the offence of harming Aboriginal objects. The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW, 2010) outlines a series of low impact activities, definitions of disturbed land, and a series of ‘steps’ for the Aboriginal due diligence process.

2.3 Environmental Planning and Assessment Act 1979 (EP&A Act)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the requirements relating to environmental planning and assessment for NSW. It governs matters such as planning administration, planning instruments, development assessments, building certification, infrastructure finance, appeals and enforcement.

Section 1.3(f) of the EP&A Act is to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).

The parts of the EP&A Act relevant to environmental and heritage assessment are:

- Part 4 Development assessment and consent, including local government schedules of heritage items.
- Part 5 Infrastructure and environmental impact assessment, which includes self-determining authorities.

The project will be assessed under Part 5 of the EP&A Act.

3. Environmental context

Understanding the landscape is essential to the interpretation of Aboriginal land use across an area. It helps provide context and is required for any archaeological investigation as an understanding of the landscape of a study area guides survey strategies and the detection of archaeological sites. It also allows archaeologists to better understand natural geomorphic processes such as erosion or deposition of soils, which, in turn affects the preservation of archaeological sites and the degree to which past Aboriginal occupation may be preserved and detected (DEECW 2010: 8).

3.1 Topography and hydrology

The study area is located on Jerrabomberra Hill to the south of Queanbeyan West. Jerrabomberra Hill is part of Mount Jerrabomberra Reserve and is surrounded by residential subdivisions. The southern study area, consisting of the proposed site compound and future chlorination building, is located on a small crest with an elevation between 664–670 m. The northern study area, including the access entrance and existing reservoir site, is located on a sloped area with an elevation of around 672 m.

The closet mapped watercourses are two nonperennial drainage lines to the north of each study area. The closest named watercourses to the study area are Jerrabomberra Creek approximately 2.4 km east and Barracks Creek approximately 2 km southeast of the study area. The Queanbeyan River is located 2.8 km east of the study area.

Figure 3-1 shows the topography and hydrology of the study area and surrounds.

3.2 Geology and soils

The study area is situated on two different soil landscape types. The northern part of the study area is located on Campbell variant b soil landscape and the southern part of the study area is located on Queanbeyan soil landscape (Figure 3-2).

The geology of the Campbell soil landscape consists of Silurian volcanics and sediments of the Canberra Block. The Campbell variant b soil landscape is characterised by rounded steep to rolling volcanic mountains and hills. Soils typical for this landscape is an A1 horizon of brownish black loam (0–10 cm in depth), and A2 horizon for dark brown loam (10–18 cm in depth) and a B horizon (18–48 cm in depth) of dull reddish brown light clay. Variant B of the Campbell soil landscape indicates that the soils will be stony (Jenkins 2002: 52–54).

The geology of the Queanbeyan soil land consists of Ordovician metasediments of the Pittman formation with interbedded sandstone, siltstone, shale and chert. Bedrock tends to be highly weathered, steeply dipping and highly fractured. The complicated lithology includes various tuffs, siltstones, sandstones, rhyolites, dacites and limestones. The Queanbeyan soil landscape is characterised by rolling to undulating low hills and rises on metasediments of the Canberra Lowlands. A typical soil profile for the Queanbeyan soil landscape includes an A1 horizon of dark brown loam (0–5 cm), an A2 Horizon of brown loam (5–30 cm in depth), and a B Horizon of bright reddish brown medium clay (30–70+ cm) (Jenkins 2000: 119–120).

3.3 Vegetation

The native vegetation of Mount Jerrabomberra Reserve area is characterised by Inland Scribbly Gum, Red Stringybark, and Red Box, with a diversity of shrubs and grassy understory. The vegetation in the study area is predominately native vegetation in good condition, though there are locations which have cleared previously. The previous clearing was visible through reduced native canopy and degraded understorey with moderate to high abundance of exotic vegetation species and was predominately along the existing Jerrabomberra Hills Road and in the proposed site compound area (Ecology Consulting 2023).

3.4 Past land use

The study area is located within a mountain reserve. There has been limited development or impacts in the reserve, which are predominately associated with the access road/tracks and existing water storage tanks.

An aerial image from 1960 shows that the Jerrabomberra Hill Road (the main access track) was present by 1960, though the residential suburbs around the base and lower slopes of the mountain had yet to be developed (Figure 3-3). The proposed site compound and chlorinator study area had also been partially cleared of vegetation at this time.

By 1975 there were additional tracks present in the mountain reserve, some of which are near the proposed site compound and chlorinator study area (Figure 3-4). The existing water tank adjacent to the northern study area had been constructed by 1984 (Figure 3-5) and by 1991 residential housing developments had begun being developed around the lower slopes of the mountain reserve (Figure 3-6).

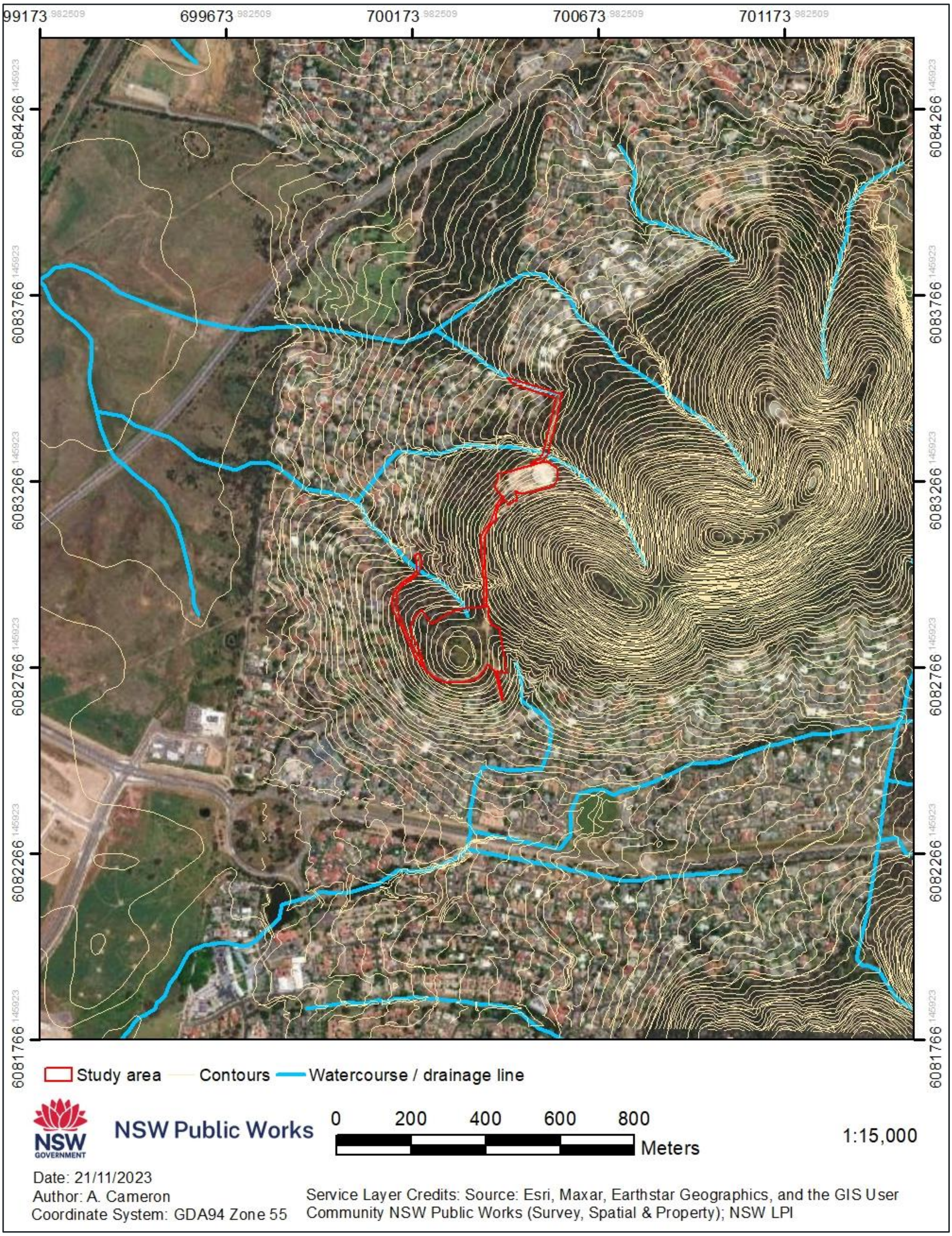


Figure 3-1: Topography and hydrology of study area (NSW PW 2023)

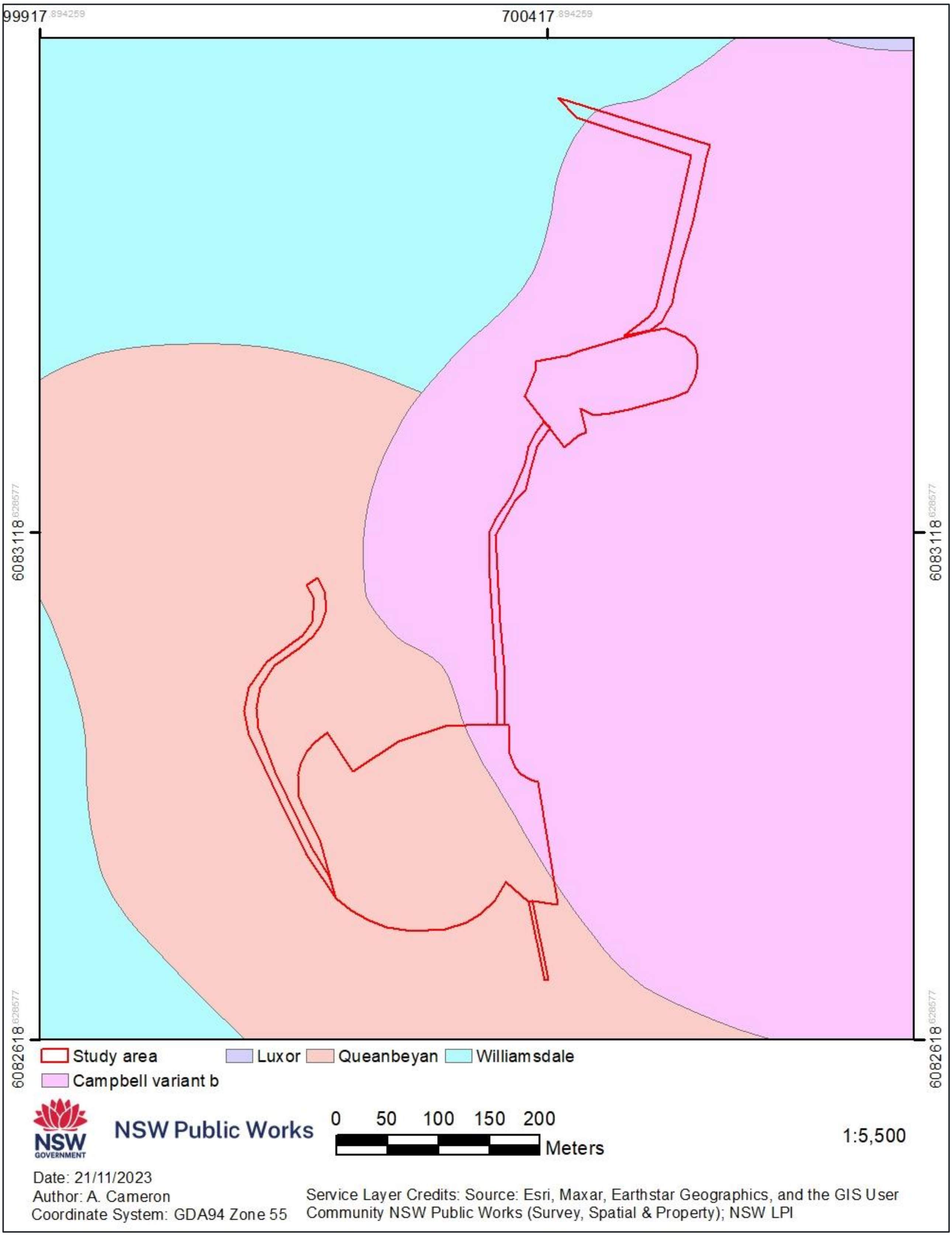


Figure 3-2: Soil landscape of study area (NSW PW 2023)

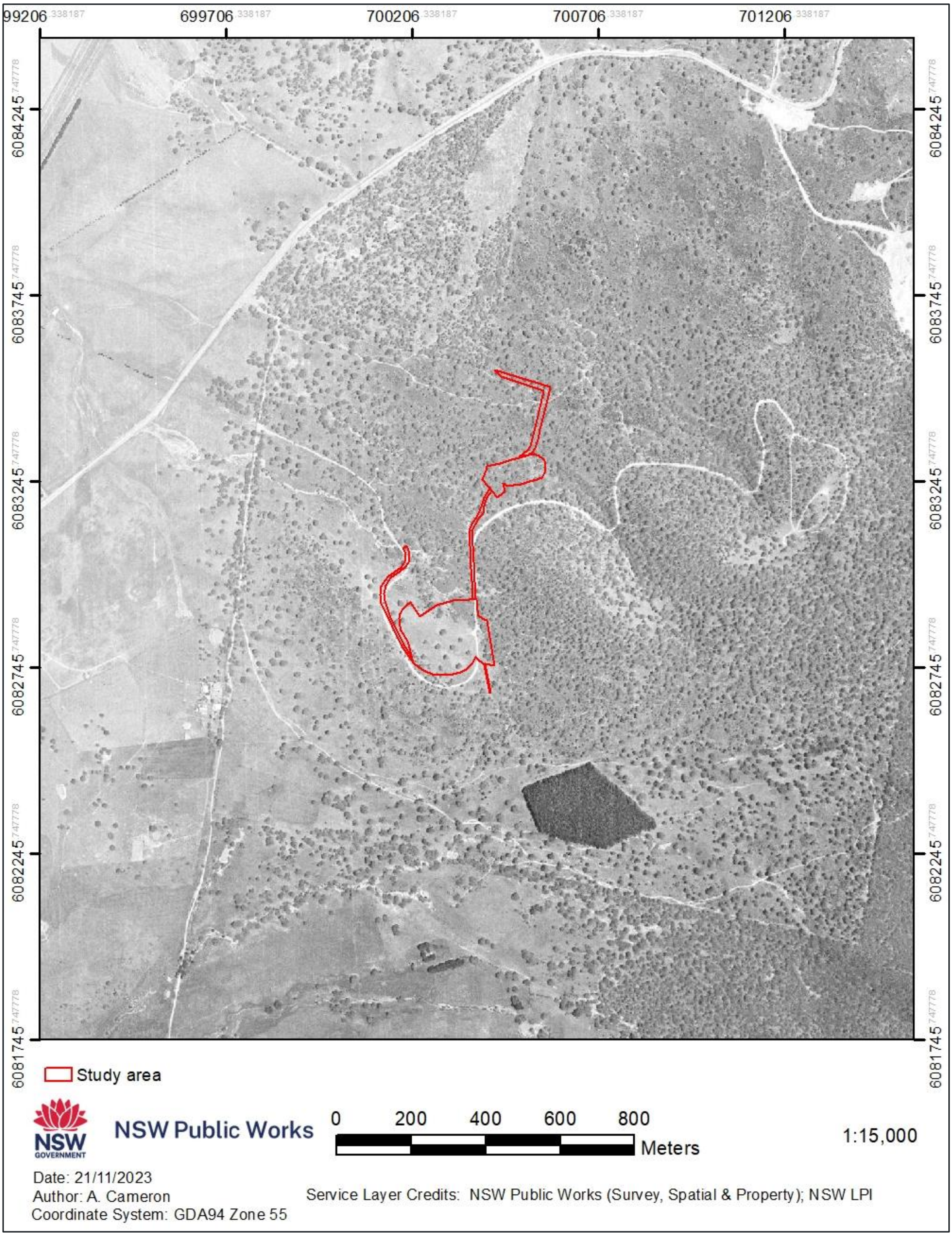


Figure 3-3: Historical aerial 1960 (NSW SS 2023)

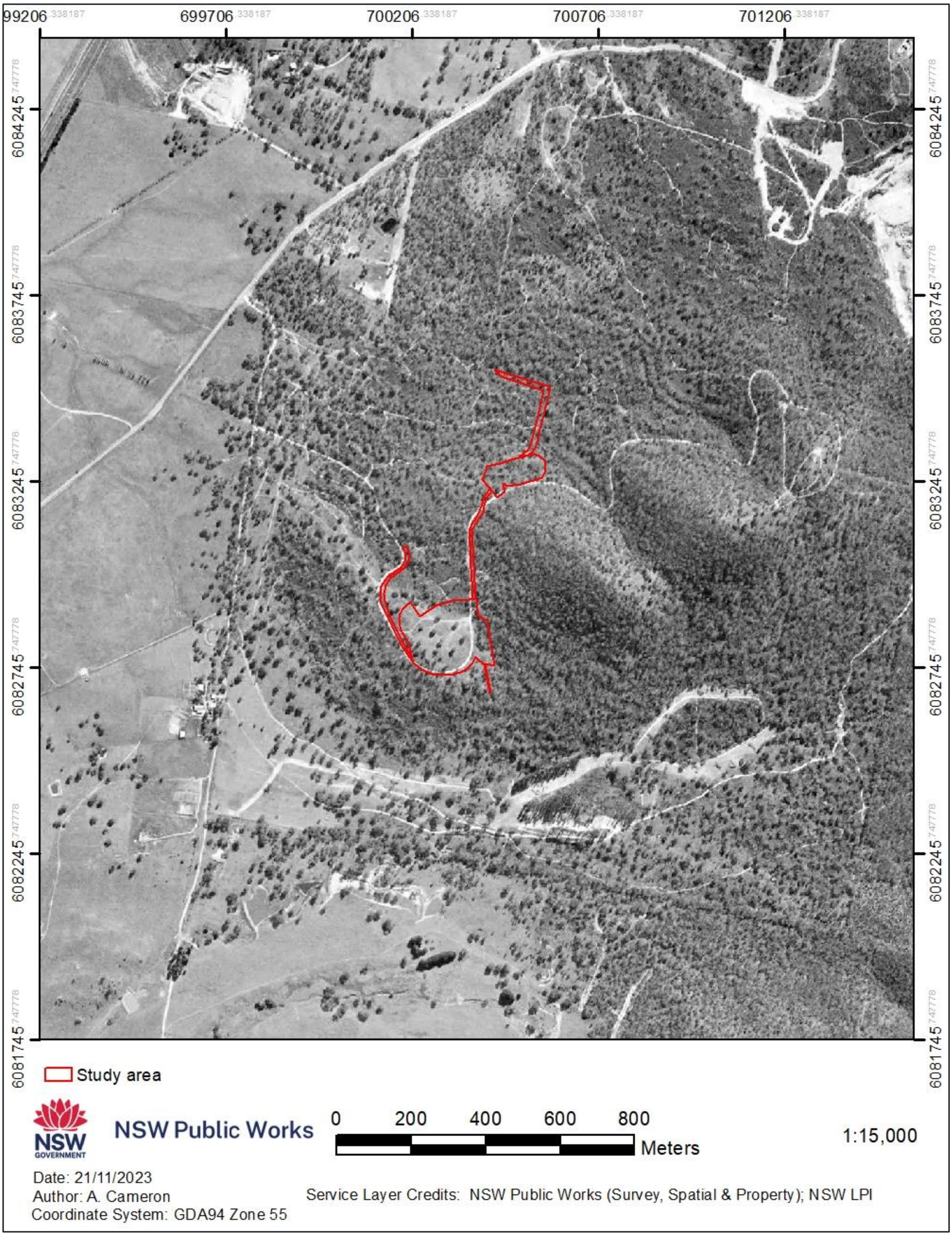


Figure 3-4: Historical aerial 1975 (NSW SS 2023)

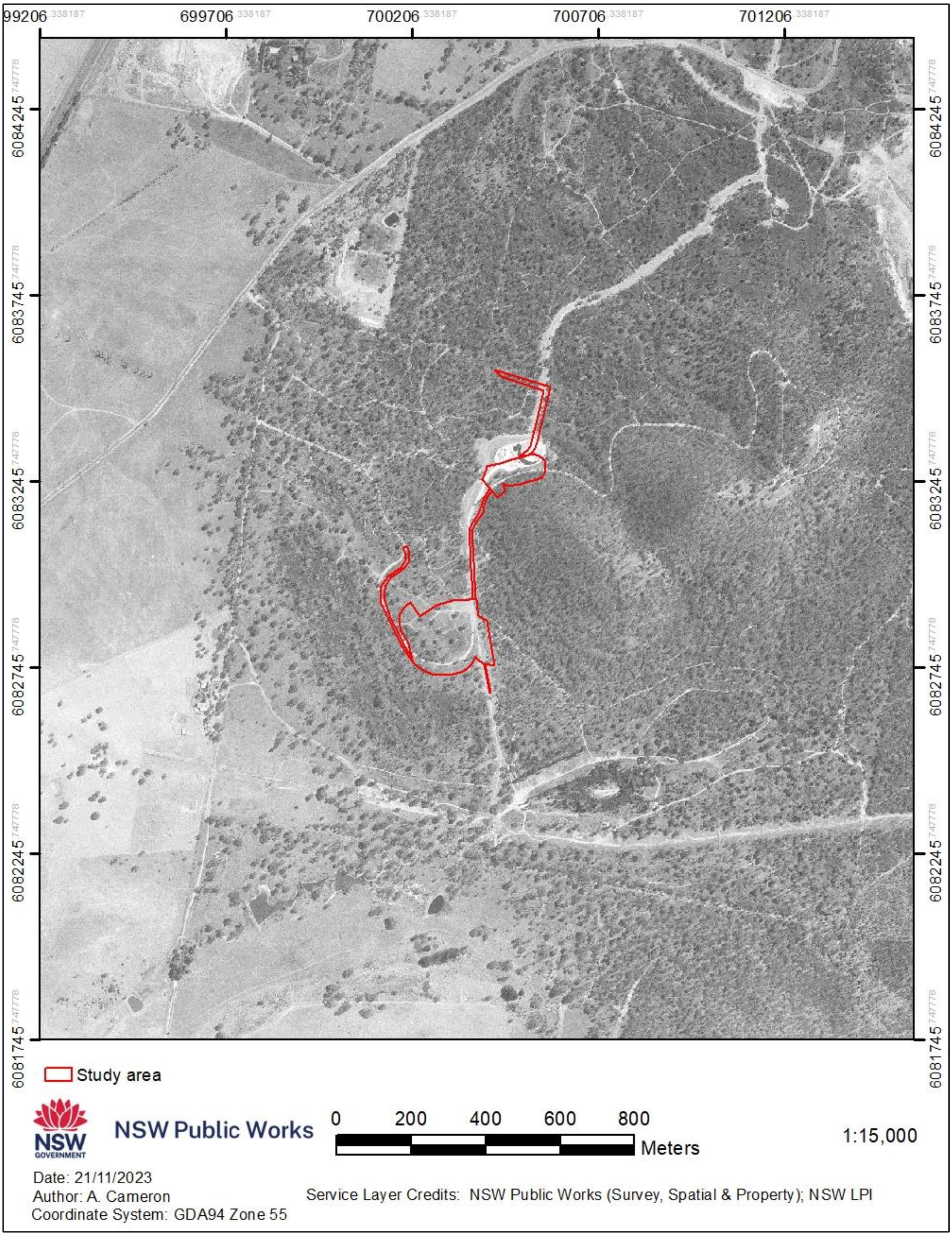


Figure 3-5: Historical aerial 1984 (NSW SS 2023)

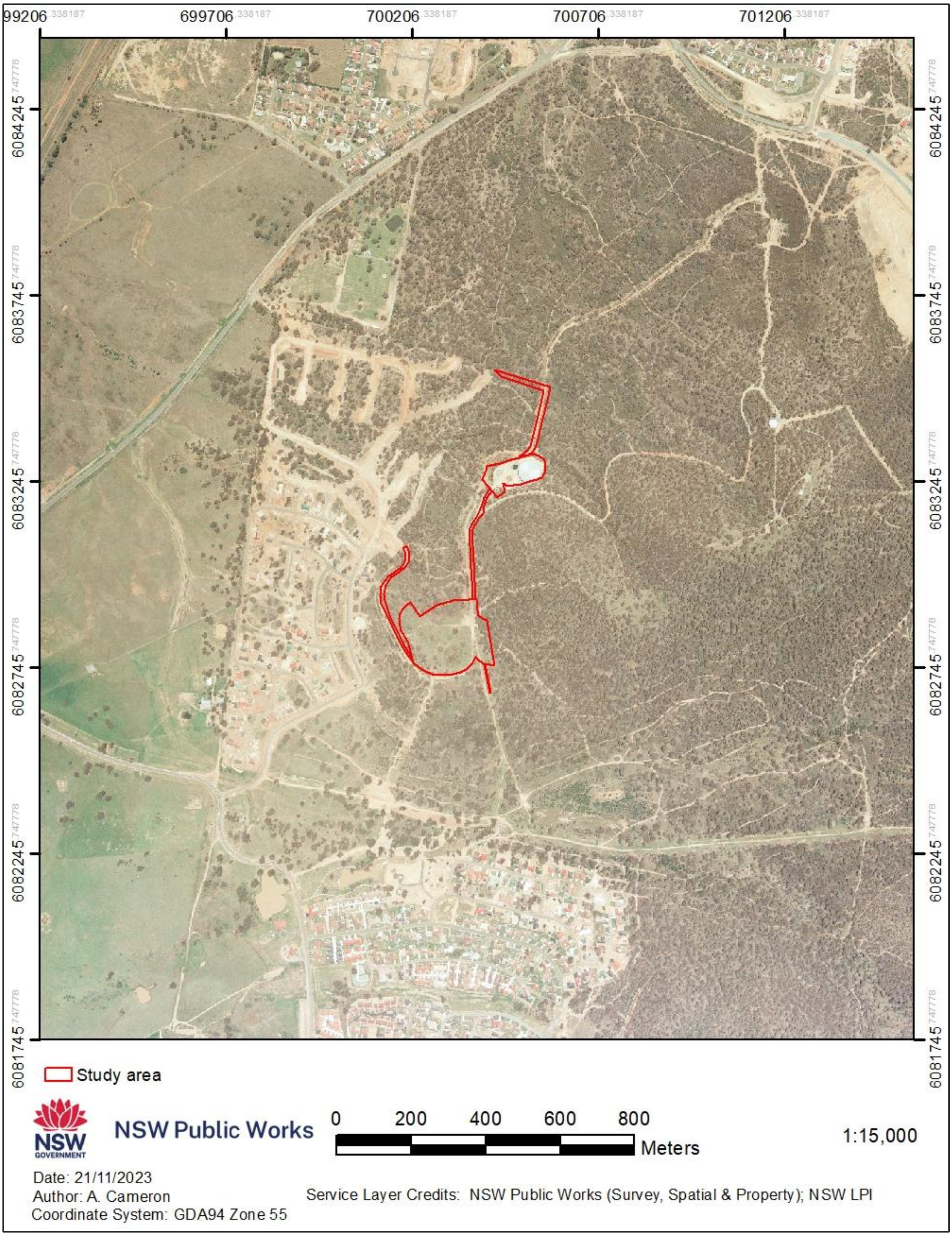


Figure 3-6: Historical aerial 1991 (NSW SS 2023)

4. Aboriginal due diligence

There are series of questions in the Code used to determine whether it is necessary to follow the Aboriginal due diligence process:

- Is the activity a declared project under Part 3A of the EP&A Act?
  - The activity is not a declared project under Part 3A of the EP&A Act.
- Is the activity an exempt activity listed in the National Parks and Wildlife Act or other legislation?
  - The activity is not an exempt activity.
- Will the activity involve harm that is trivial or negligible?
  - The proposed activity includes disturbance of the ground surface inside the study area.
- Is the activity in an Aboriginal Place or are you already aware of Aboriginal objects on the land?
  - The activity is not in an Aboriginal Place. There are no recorded Aboriginal sites present inside the study area.

4.1 4.1. Low impact activities

The NPW Regulation removes the need to follow the Aboriginal due diligence process provided the proposed works are a specifically defined low impact activity. It is important to note that this does not apply to situations where there are already known Aboriginal object/s and that the defence does not authorise harm to known Aboriginal objects (DEECW 2010: 6–8).

The proposal is not considered a low impact activity as defined by the Due Diligence Code (DECCW 2010: 6–7). The proposed works will include ground disturbance inside the study area.

4.2 4.2. Disturbed lands

Disturbed lands are defined as (DEECW 2010: 7–8):

> *Land is disturbed if it has been the subject of human activity that has changes the land's surface, being changes that remain clear and observable.*
>
> *Examples of activities that may have disturbed land include the following:*
>
> - *Soil ploughing*
> - *Construction of rural infrastructure (such as dams and fences)*
> - *Construction of roads, trails and tracks (including fire trails and tracks and walking tracks)*
> - *Clearing of vegetation*
> - *Construction of buildings and the erection of other structures*
> - *Construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure*

- *Substantial grazing involving the construction of rural infrastructure*
- *Construction of earthworks associated with anything referred to in paragraphs (a)¬(g).*

Parts of the study area have been formerly disturbed. The access road (Jerrabomberra Hill Road) is clearly defined and has been in use at least since the 1960s. The road has been previously graded, cut in and gravelled along certain sections as part of its construction and ongoing maintenance. Part of the site compound area adjacent to the road has been previously cleared of vegetation. The area adjacent to the existing fence around the water reservoir has also been previously disturbed by a water culvert and drain and a vehicle access track.

4.3 The Aboriginal Due Diligence Assessment

4.3.1 Step 1

Will the activity disturb the ground surface?

Yes. The proposed activities will disturb the ground surface. The works in the northern part of the study area include a widening the entry access to the existing reservoir location. There will also be a new water reservoir constructed adjacent to the existing one inside the security fence. The works in the southern part of the study area includes construction of a new electricity building, as well as a temporary site compound and laydown area.

4.3.2 Step 2a

Are there any sites registered on the Aboriginal Heritage Information Management System?

An extensive search of AHIMS was conducted on 27 March 2023 covering a search area between:

- Eastings 697245–703391
- Northings 6079763– 6086200

The search area covered approximately 3 km around the study area. The AHIMS search returned 83 sites (Table 4-1). A copy of the extensive AHIMS search is provided Appendix B. Due to changes in the scope of the project during 2024, an updated basic search was undertaken on 27 November 2024. There were no changes in the results of the original extensive AHIMS search and the updated AHIMS basic search using the same search area (see Appendix B).

Figure 4-1 shows the location of recorded AHIMS sites using the GPS coordinates provided by the extensive search. Artefact scatters consist of at least half of the sites recorded in vicinity of the study area (51%), followed by isolated finds (31%). Artefact scatters or isolated finds with potential archaeological deposits are also present, though to a lesser frequency (8% and 2% respectively). There is also one bora / ceremonial & burial/s location.

The closest recorded AHIMS sites to the study area are located 735 m southwest. There are no sites registered on AHIMS in the study area or inside Jerrabomberra Mountain Reserve.

Table 4-1: AHIMS site types in the vicinity of the study area

Site type	Number	Frequency (%)
Artefact scatter	42	51
Isolated find	26	31
Artefact scatter & PAD	7	8
PAD	5	6
Isolated find & PAD	2	2
Bora/Ceremonial & Burial/s	1	1
Total	83	100

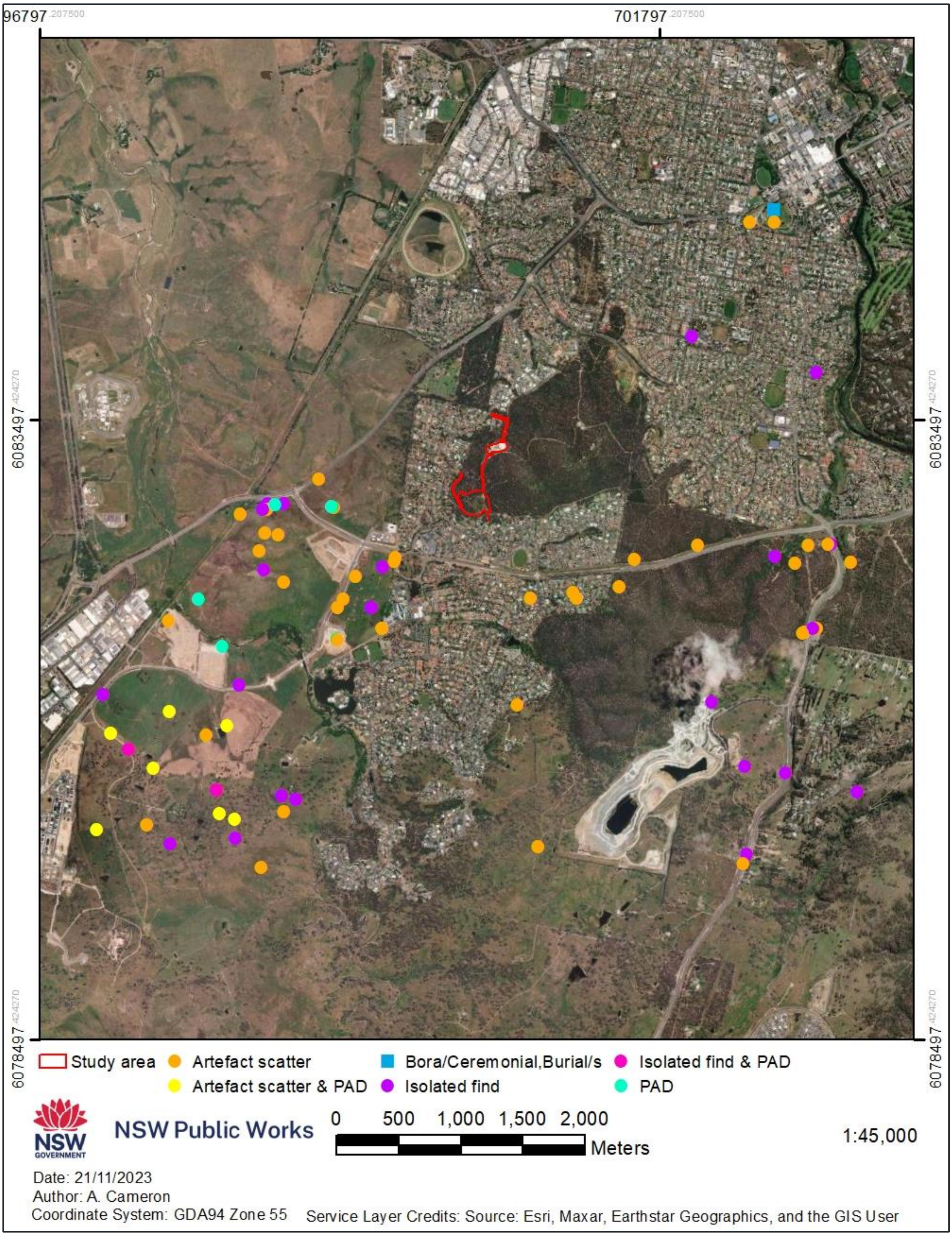


Figure 4-1: AHIMS sites recorded in the vicinity of the study area (NSW PW 2023)

Additional databases and registers

Table 4-2 summarises the results of searches for items listed on alternative databases and registers, such as the State Heritage Register (SHR) and the Local Environmental Plans (LEP).

Figure 4-2 shows the location of any nearby listed items to the study area. The study area is inside one item listed on the Queanbeyan LEP (Mount Jerrabomberra I6) and adjacent to an item listed on the non-statutory Register of the National Estate (Mount Jerrabomberra Area).

According to the AHIP public register and AHIP archive provided by Heritage NSW there are no current or former AHIPs for the study area, though there have been several issued for a residential staged subdivision to the southwest.

Table 4-2: Additional database searches

Name	Comments
State Heritage Register (SHR) and Inventory (SHI)	No SHR or SHI items are within or adjacent to the study area.
Queanbeyan LEP 2012	The study area is inside one listed item on the LEP: Mount Jerrabomberra (I6).
Register of the National Estate (non-statutory listing)	One item listed on the Register of the National Estate is adjacent to the study area: Mount Jerrabomberra Area (Place ID 17021).
Commonwealth Heritage List	No items are within or adjacent to the study area.
National Heritage List	No items are within or adjacent to the study area.
World Heritage List	No items are within or adjacent to the study area.
Previous or nearby AHIPs	No AHIPs are listed on the public register or archive for Jerrabomberra Mountain Reserve. There is one AHIP (C0004264) issued for The South Tralee Residential Development Stage 1 to the southwest of the study area. An AHIP application for the Stage 2 works for The South Traelee Residential Development was submitted in January 2023 and is currently undergoing assessment according to the public AHIP register.

Figure 4-2: LEP listed items in the vicinity of the study area (NSW PW 2023)

4.3.3 Step 2b

Are there any other sources of information?

The study area is situated in Ngambri and Ngunawal Country. The Ngambri have been known as Kamberri, Kgamberry, Kamberra, and Nganbra. Their traditional lands cover the Canberra-Queanbeyan region and extended from Weereewaa (Lake George) southwest, though boundaries between different groups were likely to have been fluid and changed frequently (Jackson-Nakano 2001).

Tindale’s linguistic boundaries included the Ngunawal, Ngargio and Walgalu language groups across the area of the Australian Capital Territory (ACT) and surrounding areas, such as Yass, Queanbeyan and Bungendore. These boundaries were replicated by Horton when producing a map of Indigenous Australia (1996). Research by Jackson-Nakano (2001) indicates that prior to European settlement the area was predominately occupied by the Ngambri group. However, in the time since European settlement, modern descendants of Ngunawal also feel connected the ACT and southwestern surrounds as Country.

The Aboriginal groups in the Canberra-Queanbeyan region and surrounds used to undertake pilgrimages in December and January to the Bogan and Snowy Mountains, where rituals and feasts and roasted bogong moths were held on the high rocky granite outcrops of the mountains (NPWS 2003, Flood 1999).

The Aboriginal groups of the South-eastern Highlands would have relied on a continuous supply of vegetables available in the tablelands. In Spring, summer and autumn, tubers of the yam daisy were available, and in July and August wattle seeds would have been present, with orchid tubers in August and September (NPWS 2003). The region is also rich with mammals such as kangaroos, wallabies, various fish types, and possums that would have also been utilised as food and for resources (Flood 1999).

There are written records that the relationship between the Aboriginal groups in the region and the white settlers was initially friendly, though there are accounts of violent confrontations as well. In addition, the introduction of European diseases such as measles, whooping cough and influenza had a negative impact on the local Aboriginal groups (Osborne 2016).

During the late 1800s and early to mid-1900s many of the Aboriginal families of the region were forcibly moved by the government onto reserves and missions. This includes Cuppacunbalong at Naas Creek south of Tharwa (in use as a reserve between 1895–1899), Quantambone Station at Brungle which is approximately 23 km north of Tumut (in operation as station between 1906–1945), Mongarlow reserve/s located east of Braidwood (in use between 1879–1916), reserve/s at Brickey’s Creek at Boambla, northwest of Murrumbateman (between 1895–1912), Hollywood Reserve at Yass (1929–1963), the Yass ‘Blacks Camp’ (1870s–1934) and Oak Hill Reserve (1888–1950s), as well as other reserves, missions and stations further away from the Canberra-Queanbeyan region (AIATSIS 2022).

4.3.3.1 Archaeological context

The Aboriginal occupation of southeast NSW dates to at least 20 000 years ago. Several sites have been dated in the broader region including the Burrill Lake rock shelter, Cloggs Cave and New Guinea 2, Bulee Brook 2 and Bobs Caves (as reported in Dibden 2010). Excavations at Birrigai rock shelter (Flood et al. 1987) located at the boundary of the Birrigai and Tidbinbilla Nature Reserves have provided dates up to 25 000 years ago for human occupation of the region (Osborne 2016).

In the Pleistocene between 24 000 and 18 000 years ago, Australia was in the Last Glacial Maximum (GLM), a period where the climate in Australia became glacial and dry, especially in south-eastern Australia (Deckker et al. 2020). Mountain peaks would have been glaciated above 1900 m, and periglacial conditions were present to at least 1000 m above sea level.

Most archaeological assessments have been conducted in the area due to developments, including residential housing, schools or water/sewerage infrastructure works. A summary of previous relevant assessments is provided below.

There is a Plan of Management for Mount Jerrabomberra which includes the parts of the study area and the proposed chlorinator location (Eco Logical Australia 2021). The Plan outlines that a cultural heritage assessment of the area was completed in 2015 during which seven Aboriginal artefact sites were identified (Eco Logical Australia 2021: 27), though these sites have not been registered on AHIMS (see Section 4.3.2).

The Plan also considers the cultural heritage values of Mount Jerrabomberra:

> *The area of Mt Jerrabomberra is noted by Walker (1988), as being a meeting place and the location of a large camp for the Aboriginal people of the Queanbeyan area. This information is also included in the Mt Jerrabomberra Wetlands website. As such it is known to hold cultural importance.* (Eco Logical Australia 2021: 27).

It concludes that the sites recorded on or in the vicinity of Mount Jerrabomberra indicates occasional camp sites but that there are no centres of occupation on the mountain.

> *This relates to the meeting point prior to moving on through the Ngunnawal country, and only used for brief periods of time.* (Eco Logical Australia 2021: 27).

The archaeological assessment referred to in the Plan of Management was undertaken by Biosis in 2015. The assessment included survey of the Mount Jerrabomberra Reserve which covers parts of the study area as shown in Figure 4-3. During the survey, seven Aboriginal sites were recorded (MJ-1 to MJ–7) consisting of six artefact scatters and one isolated artefact. All the sites were recorded in the southeast corner of the reserve, approximately 1 km east of the study area for the site compound. The artefacts recorded are predominately chert, silcrete and quartz and consists of primary flakes with no retouch or secondary flaking (Biosis 2015: 43). Biosis concludes that for Mount Jerrabomberra:

> *it would appear that the sites (or the current visible expression of them) indicate occasional camp sites but not major centres of occupation or focus locations for lithic manufacture or maintenance. This does accord with the ethnography that the location was*

> *used as a meeting point prior to moving on through the Ngunnawal country, and only used for these brief periods of time.* (Biosis 2015: 43).

As mentioned previously, the sites recorded during the Biosis 2015 assessment are not registered on AHIMS, or if they are, have the incorrect GPS locations and/or are not named the same as in the report as no relevant site cards are available in AHIMS with the same details.

An assessment was conducted by Lewis in 1984 for a housing subdivision of Jerrabomberra Park located approximately 860 m southeast of the study area. Two Aboriginal sites were identified during the survey, both artefact scatters. The scatters were located on low gradient mid slopes and consisted of fifteen artefacts in total, with several made from quartz.

An archaeological assessment was conducted of The Poplars housing subdivision in 1991 by Access Archaeology. The Poplars is located approximately 750 m southwest of the study area. During the assessment, nine artefact scatters were recorded, as well as one scarred tree and three isolated finds. The sites were located on spur crests and low gradient slopes above Jerrabomberra Creek.

Archaeological Heritage Surveys also conducted an assessment for the housing subdivision the Poplars in 2003. During the assessment, five additional Aboriginal sites were recorded, including several with PAD.

The Poplars assessment area had in total 17 Aboriginal sites and four areas of PAD were identified. A predictive model for the area was developed from the results of the survey:

- Open artefact scatters were most likely to occur near a watercourse, especially on adjacent reasonably level and well-drained ground.
- Larger artefact scatters were most frequently within 100150 m of major drainage lines.
- Smaller artefact scatters tended to be further away from major creeks and have a lower density of artefacts.
- Artefact scatters occurred on major ridgelines which served as natural access routes.
- Scarred trees could occur anywhere there were old growth trees of sufficient age.
- Stone procurement sites could occur where surface exposures of rock suitable for stone tool manufacture is present.

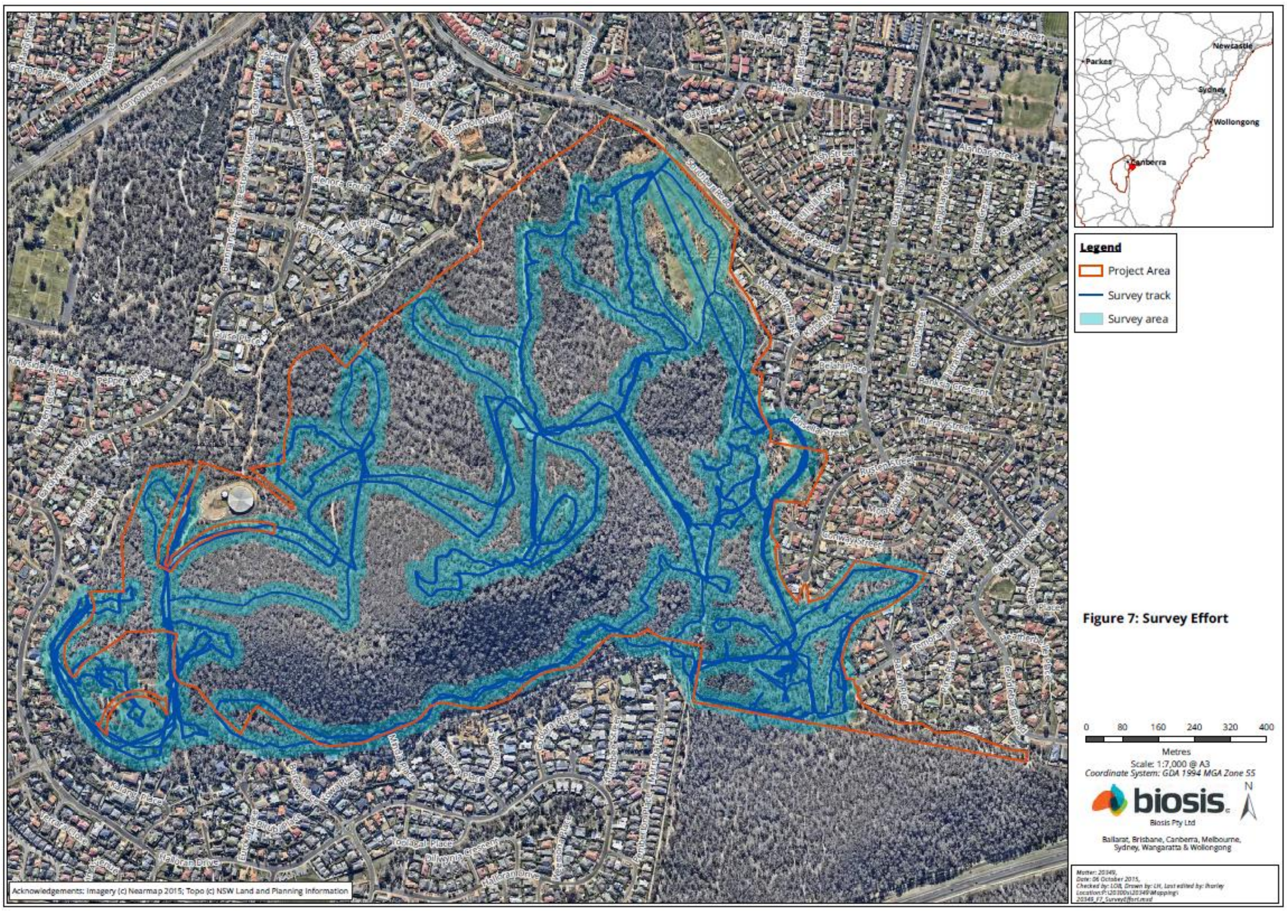


Figure 4-3: Biosis survey of Mount Jerrabomberra (Biosis 2015: 32).

Dearling undertook an archaeological survey for the Edwin Land Parkway located approximately 400 m south of the study. During the survey five Aboriginal sites were recorded, all consisting of four artefact scatters and one isolated find. Dearling concluded that the sites were all occurring in areas of high disturbance with little to no remaining soil depth.

Navin Officer Heritage Consultants (NOHC) conducted a preliminary assessment in 2009 of areas in South Jerrabomberra to support a residential and economic strategy plan. This area is approximately 2.9 km southwest of the study area.

The assessment included background research and field inspections. In total 102 cultural heritage items were identified inside the South Jerrabomberra assessment area comprising of:

- 77 Aboriginal sites (15 artefact scatters, 34 artefact scatters with PAD, 22 isolated finds and 6 isolated finds with PAD)
- 13 historical sites (nine remains of structures/platforms/enclosures, one dump site, one site complex, one ploughlands and one old fence line).
- 12 recordings of indeterminate origin (one stone alignment and 11 stone mounds).

In 2014, NOHC conducted another preliminary archaeological assessment of the Morrison and Forrest properties that were included in their 2010 assessment. Fourteen Aboriginal sites were recorded in the assessment area: two isolated finds, two artefact scatters, nine artefact scatters with PAD and one stone alignment. Artefact materials included chert, tuff, quartz,

quartzite, volcanic and silcrete. Most artefacts recorded were flakes, though there were some cores, hammerstones and anvils also recorded at the sites. Further assessment using an ACHA, and test excavation was recommended for the properties following the rezoning of them from rural to residential.

Ironbark Heritage undertook an Aboriginal due diligence assessment for three lots in South Jerrabomberra (Lots 1-3 DP1001136 and Lots 176 and 148 DP754912) located approximately 2.9 km southwest of the study area. A predictive model was formulated by Ironbark Heritage based on Flood (1980), Barber (2020) and NOHC (2014):

- open artefact scatters are the most common site type and most likely to be found in areas of level, well-drained elevated ground, such as spur and ridge crests, terraces, and elevated creek banks.
- the larger artefact scatters are most likely to be found within 100-150m of major drainage lines.
- where artefact scatters are found away from the major creek lines, they tend to be smaller and lower in density and situated on low gradient basal slopes or low gradient spur slopes.
- major ridgelines which could serve as natural access routes contain artefact scatters.
- suitable topographic features in lower valley contexts in proximity to the tree line may be preferred to otherwise suitable topographic locations in mid valley contexts, (NOHC 2001)
- sites are more often found in locations away from cold air drainage, within sheltered areas from the prevailing winds and with an easterly or north easterly aspect (Flood 1980)
- scarred trees may occur wherever old growth trees of sufficient age have survived.
- stone procurement sites may occur where suitable rock outcrops on the surface.

The assessment area had ten previously recorded Aboriginal sites present and the survey conducted for the due diligence assessment resulted in an additional eight Aboriginal sites being recorded. Three sites were isolated finds, four sites were isolated finds with PAD, and one site was an artefact scatter with PAD. Further archaeological investigation was recommended, including test excavation.

NOHC (2015) conducted an Aboriginal due diligence assessment for the South Tralee Residential Area Sewer and Water Infrastructure Project, part of which is along Edwin Land Parkway approximately 460 m south of the study area. The assessment area had been previously assessed during earlier archaeological investigations, so no additional field survey was conducted. The assessment concluded that there were six previously recorded Aboriginal sites within 35 m of the proposed works, though none of the sites would be impacted.

Eco Logical Australia undertook an Aboriginal due diligence assessment of a proposed location for the Jerrabomberra High School in 2020 located approximately 1.2 km southwest of the study area. Two recorded Aboriginal sites were inside the assessment area (57-2-0115 and 57-2-0977) and the due diligence assessment concluded that any subsurface deposits associated with the sites are likely to remain intact. The assessment recommended further archaeological investigation using an ACHA and test excavation.

The test excavation at 57-2-0115 and 57-2-0977 was undertaken by Eco Logical Australia in 2021. Thirteen artefacts were recorded during the test excavation from eight test pits and between 0-200 mm depth (with a total of 26 test pits excavated). Most artefacts were quartz, followed by fine-grained siliceous, chert and silcrete. Most of the artefacts were small (between 15–40 mm) and are of poor quality and tertiary reduction. It was concluded that the site did not represent a long term or multiple use occupation site, especially as it was in an elevated position and exposed to the elements.

Cultural Heritage Management Australia (CHMA) undertook the Aboriginal cultural heritage assessment for the Ellerton Drive Extension, Queanbeyan in 2015. The assessment for the road extension is approximately 3.8 km east of the study area. Eight previously recorded AHIMS sites were located within 100 m of the road assessment area, consisting of 7 artefact scatters and one isolated find. Of these sites, only three were able to be relocated during the survey. In addition, six Aboriginal sites were recorded, including four artefact scatters and two isolated finds. Most of the site recorded were located on elevated, locally flat landforms in proximity to permanent water sources, along a relatively broad and flat ridgeline that slopes gently towards the Queanbeyan River (CHMA 2015: 87).

In 2019, Navin Officer Heritage Consultants (NOHC) assessed a proposed residential development called Jumping Creek, located on the east side of Ellerton Drive and approximately 3.8 km east of the western end of the study area. The area had been previously surveyed by NSW Archaeology, during which 29 locations for Aboriginal objects were recorded. The survey conducted by NOHC relocated the previously recorded sites inside the assessment area, as well as an additional six Aboriginal sites (five artefact scatters/isolated finds and one scarred tree), and one historic site (JCH13).

4.3.4 Step 2c

Are there any landscape features that are likely to indicate presence of Aboriginal objects?

The Due Diligence Code lists several landscape features that indicate the likely existence of Aboriginal Objects (DEECW 2010a: 12). These include:

- Within 200 metres of waters (including the whole or any part of a river, stream, lake, lagoon, swamp, wetlands, natural watercourse, tidal waters (including the sea)
- Located within a sand dune system.
- Located on a ridge top, ridge line or headland.
- Located within 200 metres below or above a cliff face.
- Within 20 metres of or in a cave, rock shelter, or a cave mouth.

The study area is located within 200 m of mapped watercourses. However, these watercourses are minor drainage lines. The northern part of the study area adjacent to the existing water reservoir location is located on the slope of the mountain. The proposed site compound is on a small flat knoll located mid-slope and the chlorinator area is adjacent to the edge of this knoll at the top of slope (see Figure 3-1).

4.3.5 Step 3

Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and /or can the carrying out of the activity at the relevant landscape features be avoided?

The proposed works will not impact any recorded AHIMS sites.

Though the study area is considered sensitive due to its proximity to two minor drainage lines, the specific landforms in each of the study area are not conducive for Aboriginal heritage sites. The truck turnaround study area is moderately sloped, and the location of the existing track and water reservoirs have been cut into the hill for benches. The location of the electrical building is also sloped and has a previous track present. The location of the proposed site compound and laydown area has been formerly cleared and does not retain sufficient topsoil for subsurface deposits as the bedrock is close to the ground surface.

4.3.6 Step 4

Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

A visual inspection was conducted on Thursday 13 April 2023 by Dr Alyce Cameron (archaeologist, NSW PW). Pedestrian inspection focused on the known extent of the study area at the time and any areas clear of grass and vegetation inside these parts of the study area.

The location of the formerly proposed chlorinator site is located on the east side of Jerrabomberra Hill Road. There is an access track which leads towards Borree Place at the northern end of the location, and the track towards Nyora Place runs through the southern

centre of the area as well (Photo 4-1 and Photo 4-2). Ground surface visibility (GSV) was high along tracks and lower amongst the vegetation due to leaf litter.

The proposed laydown area is located north and west of a bend of Jerrabomberra Hill Road, approximately 330 m south of the reservoir site. The road in this area has been cut in the top and middle of the slope from the small knoll in the centre of the laydown area. The area has been partially cleared of trees previously, especially closest to the road and in its centre (Photo 4-3). GSV was variable, with high visibility across the previously cleared area where there was minimal trees and scattered grasses, and moderate GSV across the remaining area due to leaf litter and ground cover. There is a high density of raw stone across the area, including some small outcrops eroding from the ground surface (Photo 4-4).

The study area adjacent to the fenced water reservoir location is located on a slope between the track into the fenced water reservoir site and another unnamed track which runs north along the outer edge of the mountain reserve (Photo 4-5). The GSV in this area was high, and there is a concrete water culvert and drain running parallel to the north of the track (Photo 4-6). The area has also been affected by water wash and erosion and there is limited or no topsoil remaining.

The existing water reservoir location is located on a on large bench which has been cut into the side slope of the mountain. The area is fenced and there is a large concrete water reservoir present and a security fence. This location has been previously gravelled and is heavily disturbed, with no natural ground surface visible.

The formerly proposed electricity transmission line and track north of the reservoir location was not physically assessed during the survey as it was included in the study area after the pedestrian survey occurred. It has since been removed from the scope by November 2024. Based on photographs of the location provided by the NSW PW project manager (see Photo 4-7 and Photo 4-8), the landform of this section of the study area, and the results of surveying the rest of the track inside the study area, there is low potential for Aboriginal objects or subsurface deposits to be present along the proposed electricity transmission line.

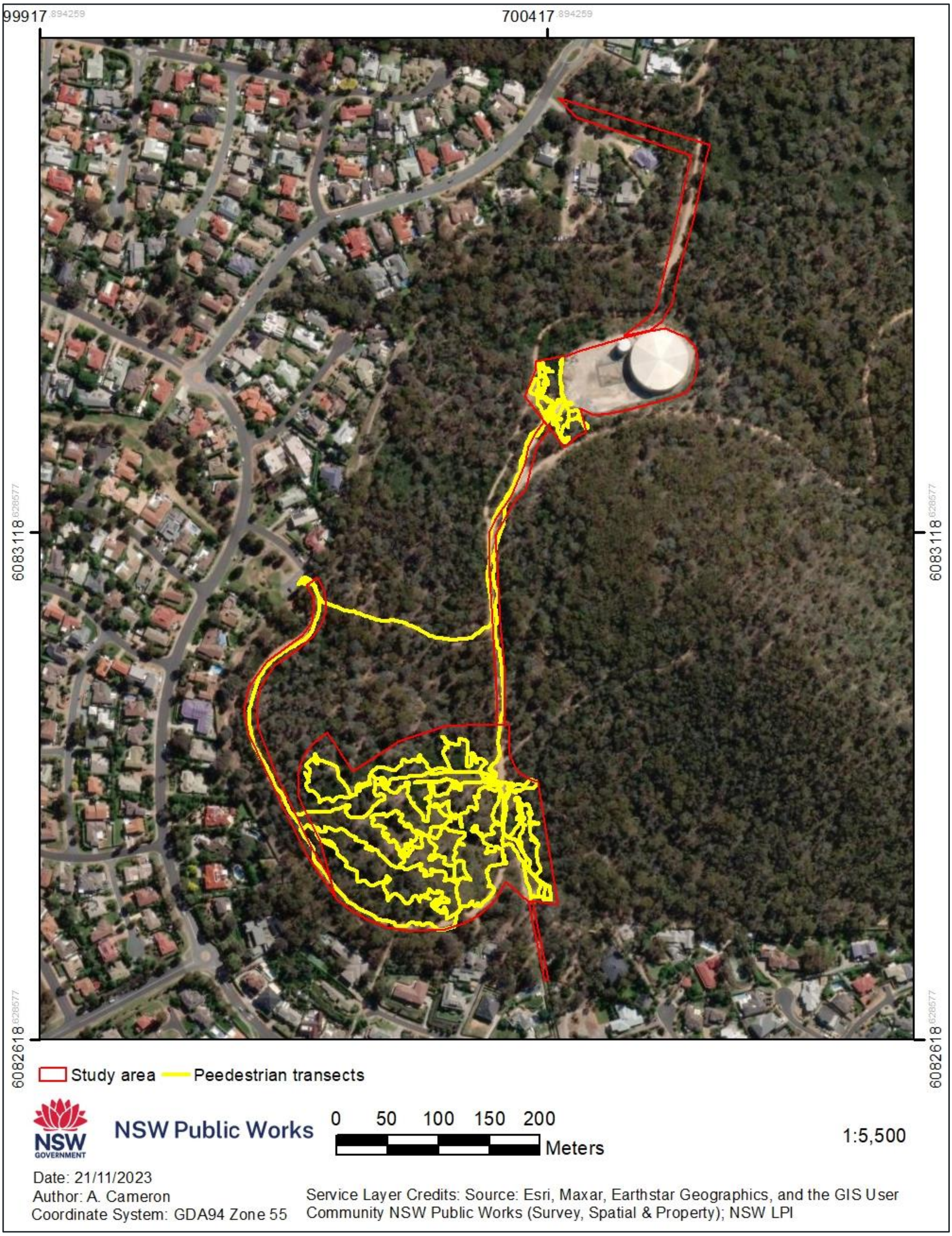


Figure 4-4: Visual inspection locations (NSW PW 2023)

Photo 4-1: View south across southern half of chlorinator area.

Photo 4-2: View north of northern half of chlorinator area with Jerrabomberra Hill Road at left.

Photo 4-3: View northeast across eastern half of proposed site compound area towards Jerrabomberra Road.

Photo 4-4: Typical ground surface conditions in part of proposed site compound area.

Photo 4-5: View northeast of study area adjacent to water reservoir fence.

Photo 4-6: View east of concrete-and-rock drain adjacent to water reservoir fence.

Photo 4-7: View south of track and electricity transmission line alignment.

Photo 4-8: View south of track and electricity transmission line alignment.

5. Recommendations

The results of the Aboriginal due diligence assessment have determined the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community.

No Aboriginal sites or objects have been recorded inside the study area. The study area has a low potential for archaeological deposits to be present. Based on the results of this assessment, no further archaeological assessments are necessary.

The undertaking of the Aboriginal due diligence process has resulted in the conclusion that the proposed works will have an impact on the ground surface, but no Aboriginal objects or intact archaeological deposits will be harmed. The following recommendations are provided as a precautionary measure to ensure the greatest possible protection to the area's Aboriginal cultural heritage values:

1. The Proposal may proceed at the study area with no further archaeological investigation. The Proposal and all land and ground disturbance activities must be confined to inside the study area. Should the Proposal extend outside the study area then further archaeological assessment may be required.
2. All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols.
3. This assessment has concluded that Aboriginal objects are unlikely to be harmed by the proposed works. However, if during works, Aboriginal objects, artefacts, or skeletal material are noted the Unanticipated Finds Protocol (Appendix C) should be followed.

6. References

Archaeological Heritage Surveys. 2003. 'The Poplars', Queanbeyan, NSW - Cultural Heritage Assessment. Report to Queanbeyan City Council.

Biosis. 2015. Mt Jerrabomberra Queanbeyan, NSW Cultural Heritage Assessment. Report to Queanbeyan City Council.

Cultural Heritage Management Australia (CHMA). 2015. Ellerton Drive Extension Queanbeyan Aboriginal Cultural Heritage Archaeological Report (ACHAR). Report to Queanbeyan City Council.

Department of Environment, Climate Change & Water (DECCW). 2010. Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.

Eco Logical Australia. 2020. Monaro Cluster; Jerrabomberra Aboriginal Due Diligence Assessment. Report to School Infrastructure NSW.

Flood, J. 1980 *The Moth Hunters*. Australian Institute of Aboriginal Studies, Canberra.

Flood, J. 1999. The Archaeology of the Dreamtime: The story of prehistoric Australia and its people. Updated edition. Angus & Robertson: Sydney.

Flood, J., David, B., Magee, J. and English, B. 1987. Birragai: A Pleistocene Site in south-eastern highlands. Archaeology in Oceania 22: 9–26.

Ironbark Heritage. 2014. A Cultural Heritage Due Diligence Assessment for South Jerrabomberra, NSW. Report to Queanbeyan City Council.

Jackson-Nakano, A. 2001. The Kamberri: A history from the records of Aboriginal families in the Canberra-Queanbeyan district and surrounds 1820–1927, and historical overview 1928–2001. Weereewaa History Series Volume I, Aboriginal History Monograph 8.

Jenkins, B.R. 2000. Soil Landscapes of the Canberra 1:100 000 Sheet. Department of Land and Water Conservation, Sydney.

Lewis, D. 1984. Jerrabomberra Park Development Queanbeyan Archaeological Sites Survey. Report to David Hogg Pty Ltd Environmental Consultants.

Navin Officer Heritage Consultants Pty Ltd (NOHC). 2010. South Jerrabomberra: Forrest, Morrison, Robin and Environa Properties, NSW Preliminary Archaeological Assessment. Report to Village Building Company.

Navin Officer Heritage Consultants (NOHC). 2019. Jumping Creek, Queanbeyan, NSW. Cultural Heritage Assessment. Report to SPACELAB Studio Pty Ltd on behalf of PEET Limited.

Appendix A Plans

Appendix B Extensive AHIMS search results & basic search update

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Jerrabomberra Res 3km

Client Service ID : 767685

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
57-2-1135	QS-1	GDA	55	702517	6085089	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Cultural Heritage Management Australia - (Australian Archaeological Survey Consu					**Permits**		
57-2-0975	PAD1-South	GDA	55	698265	6081669	Open site	Not a Site	Potential Archaeological Deposit (PAD) : -		103419
	Contact	**Recorders**	Mrs.Nicola Hayes,Apex Archaeology,Apex Archaeology,Ms.Jenni Bate,Ms.Jenni Bate					**Permits**	4791	
57-2-0860	South Jerrabomberra 64 (SJ64)	GDA	55	698305	6081025	Open site	Valid	Artefact : 3, Potential Archaeological Deposit (PAD) : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-1099	OCR4 return location	GDA	55	703059	6081811	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					**Permits**		
57-2-0577	THIF1	GDA	55	703390	6080495	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Archaeological Heritage Surveys					**Permits**		
57-2-0341	PIF5	AGD	55	698485	6082590	Open site	Valid	Artefact : 1		98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-0338	PPS11	AGD	55	698515	6082590	Open site	Valid	Artefact : 3		98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-0474	PIF 1	AGD	55	698520	6082635	Open site	Valid	Artefact : 1		98808,98919
	Contact T Russell	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-0111	PPS 1;	AGD	55	698600	6082380	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-0342	PIF6	AGD	55	698650	6082630	Open site	Valid	Artefact : 1		98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-0055	Jerrabomberra/1	AGD	55	701010	6081870	Open site	Valid	Artefact : -	Open Camp Site	794
	Contact	**Recorders**	Darrel Lewis					**Permits**		
57-2-0859	South Jerrabomberra 63 (SJ63)	GDA	55	697843	6081141	Open site	Valid	Artefact : 2, Potential Archaeological Deposit (PAD) : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0223	SQBN-W1	AGD	55	700700	6079870	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-1086	OCR6	GDA	55	702964	6081780	Open site	Destroyed	Artefact : -		104010
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Navin Officer Heritage Consultants Pty I					**Permits**	4385	
57-2-0636	OCR4	GDA	55	703031	6081811	Open site	Destroyed	Artefact : 1		104010
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Navin Officer Heritage Consultants Pty I					**Permits**	4385	
57-2-0475	PIF 2	AGD	55	698490	6082100	Open site	Valid	Artefact : 1		98808,98919
	Contact T Russell	**Recorders**	Mr.K Heffernan					**Permits**		

Report generated by AHIMS Web Service on 27/03/2023 for Alyce Cameron for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 83

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Jerrabomberra Res 3km

Client Service ID : 767685

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
57-2-0976	PAD:2	GDA	55	698697	6082806	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
Contact		Recorders	Mrs.Nicola Hayes					Permits		
57-2-0854	South Jerrabomberra 58 (SJ58)	GDA	55	698748	6080463	Open site	Valid	Artefact : 1		103029
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0852	South Jerrabomberra 56 (SJ56)	GDA	55	698765	6080331	Open site	Valid	Artefact : 4		103029
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0853	South Jerrabomberra 57 (SJ57)	GDA	55	698864	6080432	Open site	Valid	Artefact : 1		103029
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0339	PPS12	AGD	55	699440	6081630	Open site	Valid	Artefact : 2		98919
Contact		Recorders	Ms.Trish Saunders					Permits		
57-2-0673	ELP 5 (duplicate of 57-2-0672)	GDA	55	702099	6082480	Open site	Destroyed	Artefact : 5		
Contact		Recorders	Mr.Charles Dearling					Permits		
57-2-0881	Cooma Quarry 2	GDA	55	702213	6081217	Open site	Valid	Artefact : 1		
Contact		Recorders	Ms.Amanda Reynolds					Permits		
57-2-0629	OCR 3 SAME AS 57-2-0627	GDA	55	702462	6079916	Open site	Valid	Artefact : 1		
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0626	OCR2	GDA	55	702494	6079992	Open site	Destroyed	Artefact : -		101523
Contact		Recorders	Mr.Kelvin Officer,Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					Permits	3160,4385	
57-2-0833	South Jerrabomberra 36 (SJ36)	GDA	55	697252	6080189	Open site	Valid	Artefact : 9, Potential Archaeological Deposit (PAD) : 1		103029
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0848	South Jerrabomberra 52 (SJ52)	GDA	55	697369	6080968	Open site	Valid	Artefact : 5, Potential Archaeological Deposit (PAD) : 1		103029
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0857	South Jerrabomberra 61 (SJ61)	GDA	55	697850	6080074	Open site	Valid	Artefact : 1		103029
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd					Permits		
57-2-0345	PIF 4	AGD	55	699360	6081795	Open site	Valid	Artefact : 1		98808,98919
Contact		Recorders	Ms.Trish Saunders					Permits		
57-2-0056	Jerrabomberra/2	AGD	55	700530	6081010	Open site	Valid	Artefact : -	Open Camp Site	794
Contact		Recorders	Darrel Lewis					Permits		
57-2-1098	OCR6 return location	GDA	55	702945	6081775	Open site	Valid	Artefact : -		
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					Permits		
57-2-0637	OCR5	GDA	55	703171	6082491	Open site	Destroyed	Artefact : 1		104010
Contact		Recorders	Navin Officer Heritage Consultants Pty Ltd,Navin Officer Heritage Consultants Pty l					Permits	4385	

Report generated by AHIMS Web Service on 27/03/2023 for Alyce Cameron for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 83

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Jerrabomberra Res 3km

Client Service ID : 767685

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
57-2-0855	South Jerrabomberra 59 (SJ59)	GDA	55	698364	6080273	Open site	Valid	Artefact : 6, Potential Archaeological Deposit (PAD) : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0830	South Jerrabomberra 29 (SJ29)	GDA	55	698580	6079886	Open site	Valid	Artefact : 8		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0476	PIF 3	GDA	55	699560	6082308	Open site	Valid	Artefact : 1		98808,98919,103928,103929
	Contact T Russell	**Recorders**	Mr.K Heffernan,Mrs.Nicola Hayes					**Permits**		
57-2-1094	Karabar High School	GDA	55	702053	6084169	Open site	Valid	Artefact : 1		104120,104121,104122
	Contact	**Recorders**	Ms.Tory Stening,Unearthed Archaeology & Heritage					**Permits**	4410,4411,4447,4529	
57-2-0571	ELP 4	GDA	55	702721	6082388	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**	3048	
57-2-0625	OCR1	GDA	55	702806	6080647	Open site	Destroyed	Artefact : -		101523
	Contact	**Recorders**	Mr.Kelvin Officer,Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					**Permits**	3160	
57-2-0570	ELP 5	GDA	55	702887	6082339	Open site	Valid	Artefact : 13		
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**	3048	
57-2-0574	ELP 1	GDA	55	700754	6082053	Open site	Valid	Artefact : 2		
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**	3048	
57-2-0116	PPS 6;	AGD	55	698450	6082250	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-0343	PPS 11	AGD	55	698515	6082590	Open site	Valid	Artefact : 3		98808,98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-1226	Poplars Artefact Scatter	GDA	55	699241	6082047	Open site	Valid	Artefact : -		
	Contact	**Recorders**	ERM Australia Pty Ltd- Sydney CBD,Ms.Lorien Perchard					**Permits**		
57-2-0344	PPS 12	AGD	55	699440	6081630	Open site	Valid	Artefact : 2		98808,98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-0573	ELP 2	GDA	55	701097	6082100	Open site	Valid	Artefact : 2		
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**	3048	
57-2-0628	OCR 1 SAME AS 57-2-0625	GDA	55	702806	6080647	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**	4385	
57-2-0850	South Jerrabomberra 54 (SJ54)	GDA	55	697709	6080686	Open site	Valid	Artefact : 2, Potential Archaeological Deposit (PAD) : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0851	South Jerrabomberra 55 (SJ55)	GDA	55	698220	6080512	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		103029

Report generated by AHIMS Web Service on 27/03/2023 for Alyce Cameron for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 83

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Jerrabomberra Res 3km

Client Service ID : 767685

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0856	South Jerrabomberra 60 (SJ60)	GDA	55	698244	6080320	Open site	Valid	Artefact : 4, Potential Archaeological Deposit (PAD) : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0672	ELP 5 (relocated)	GDA	55	702990	6082480	Open site	Valid	Artefact : 5		101861
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**		
57-2-0346	PIF 5	AGD	55	698485	6082590	Open site	Valid	Artefact : 1		98808,98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-0347	PIF 6	AGD	55	698650	6082630	Open site	Valid	Artefact : 1		98808,98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-0119	PPS 9;	AGD	55	698930	6082830	Open site	Valid	Artefact : -	Open Camp Site	98808
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-0117	PPS 7;	GDA	55	699664	6082384	Open site	Valid	Artefact : -	Open Camp Site	103928,103929
	Contact	**Recorders**	Mr.K Heffernan,Mrs.Nicola Hayes					**Permits**		
57-2-0880	Cooma Quarry 1	GDA	55	702481	6080700	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Ms.Amanda Reynolds					**Permits**		
57-2-0630	OCR 2 SAME AS 57-2-0626	GDA	55	702494	6079992	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-1127	South Jerrabomberra 01	GDA	55	697832	6081871	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					**Permits**		
57-2-0861	South Jerrabomberra 65 (SJ65)	GDA	55	698137	6080953	Open site	Valid	Artefact : 3		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0666	TA2	GDA	55	698404	6081351	Open site	Not a Site	Artefact : 1		103419,103928,103929,103930
	Contact	**Recorders**	Mrs.Nicola Hayes,Ms.Deirdre Lewis-Cook					**Permits**		
57-2-0112	PPS 2;	AGD	55	698500	6082400	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-0114	PPS 4;	AGD	55	698650	6082000	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-1239	PIJ1	GDA	55	699342	6082229	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Past Traces Pty Ltd,Mr.Nathaniel Cracknell					**Permits**		
57-2-0118	PPS 8;	GDA	55	699656	6082353	Open site	Valid	Artefact : -	Open Camp Site	103928,103929
	Contact	**Recorders**	Mr.K Heffernan,Mrs.Nicola Hayes					**Permits**		

Report generated by AHIMS Web Service on 27/03/2023 for Alyce Cameron for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 83

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Jerrabomberra Res 3km

Client Service ID : 767685

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
57-2-0064	Queanbeyan Showground Reserve	AGD	55	702600	6085000	Open site	Valid	Burial : -, Ceremonial Ring (Stone or Earth) : -	Bora/Ceremonial,Burial/s	1632,103561,103562
	Contact	**Recorders**	Doctor.Sue Feary,Mr.Douglas Williams					**Permits**	4185	
57-2-0802	NER1	GDA	55	697306	6081280	Open site	Valid	Artefact : 1		103928,103929
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0849	South Jerrabomberra 53 (SJ53)	GDA	55	697513	6080839	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0858	South Jerrabomberra 62 (SJ62)	GDA	55	697661	6080227	Open site	Valid	Artefact : 3		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0974	PAD1 - North	GDA	55	698075	6082045	Open site	Valid	Potential Archaeological Deposit (PAD) : -		103419
	Contact	**Recorders**	Mrs.Nicola Hayes					**Permits**		
57-2-0113	PPS 3;	AGD	55	698300	6082550	Open site	Valid	Artefact : -	Open Camp Site	98808
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-0340	PIF4	AGD	55	699360	6081795	Open site	Valid	Artefact : 1		98919
	Contact	**Recorders**	Ms.Trish Saunders					**Permits**		
57-2-1095	OCR5 return location	GDA	55	703154	6082487	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					**Permits**		
57-2-0831	South Jerrabomberra 30 (SJ30)	GDA	55	698375	6080118	Open site	Valid	Artefact : 1		103029
	Contact	**Recorders**	Navin Officer Heritage Consultants Pty Ltd					**Permits**		
57-2-0978	PAD:4	GDA	55	699154	6082794	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mrs.Nicola Hayes					**Permits**		
57-2-0120	PPS 10;	AGD	55	699050	6082600	Open site	Valid	Artefact : -	Open Camp Site	98808
	Contact	**Recorders**	Mr.K Heffernan					**Permits**		
57-2-1240	PIJ2	GDA	55	699196	6081979	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Past Traces Pty Ltd,Mr.Nathaniel Cracknell					**Permits**		
57-2-0977	PAD:3	GDA	55	699193	6081729	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mrs.Nicola Hayes					**Permits**		
57-2-0115	PPS 5;	GDA	55	699194	6081721	Open site	Valid	Artefact : -	Open Camp Site	98808
	Contact	**Recorders**	Mr.K Heffernan,Mrs.Nicola Hayes					**Permits**		

Report generated by AHIMS Web Service on 27/03/2023 for Alyce Cameron for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 83

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Jerrabomberra Res 3km

Client Service ID : 767685

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
57-2-0627	OCR3	GDA	55	702462	6079916	Open site	Destroyed	Artefact : -		101523
	Contact	**Recorders**	Mr.Kelvin Officer,Navin Officer Heritage Consultants Pty Ltd,Mrs.Nicola Hayes					**Permits**	3160,4385	
57-2-0065	Queanbeyan Showground (Artefact Scatter)	AGD	55	702600	6084900	Open site	Valid	Artefact : -	Open Camp Site	1632,103561,103562
	Contact	**Recorders**	H Cooke,F Bentley					**Permits**	4185	
57-2-0572	ELP 3	GDA	55	701466	6082144	Open site	Valid	Artefact : 9		
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**	3048	
57-2-0674	ELP 1-2-3 (relocated)	GDA	55	701586	6082369	Open site	Valid	Artefact : 23		
	Contact	**Recorders**	Mr.Charles Dearling					**Permits**		
57-2-0699	Lot 65 DP242927 46 Pindari Cr	AGD	55	702945	6083690	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Ian Barndt					**Permits**		
57-2-0107	Gale Precinct 8;	AGD	55	703220	6082160	Open site	Valid	Artefact : -	Open Camp Site	2083,102775
	Contact	**Recorders**	Kerry Navin,Mr.Kelvin Officer					**Permits**		

**** Site Status**

Valid - The site has been recorded and accepted onto the system as valid

Destroyed - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.

Partially Destroyed - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground

Not a site - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 27/03/2023 for Alyce Cameron for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 83

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Jerrabomberra Reservoir

Client Service ID : 954707

NSW Public Works Dept, Coffs Harbour

Date: 27 November 2024

Coffs harbour
Coffs Harbour New South Wales 2450

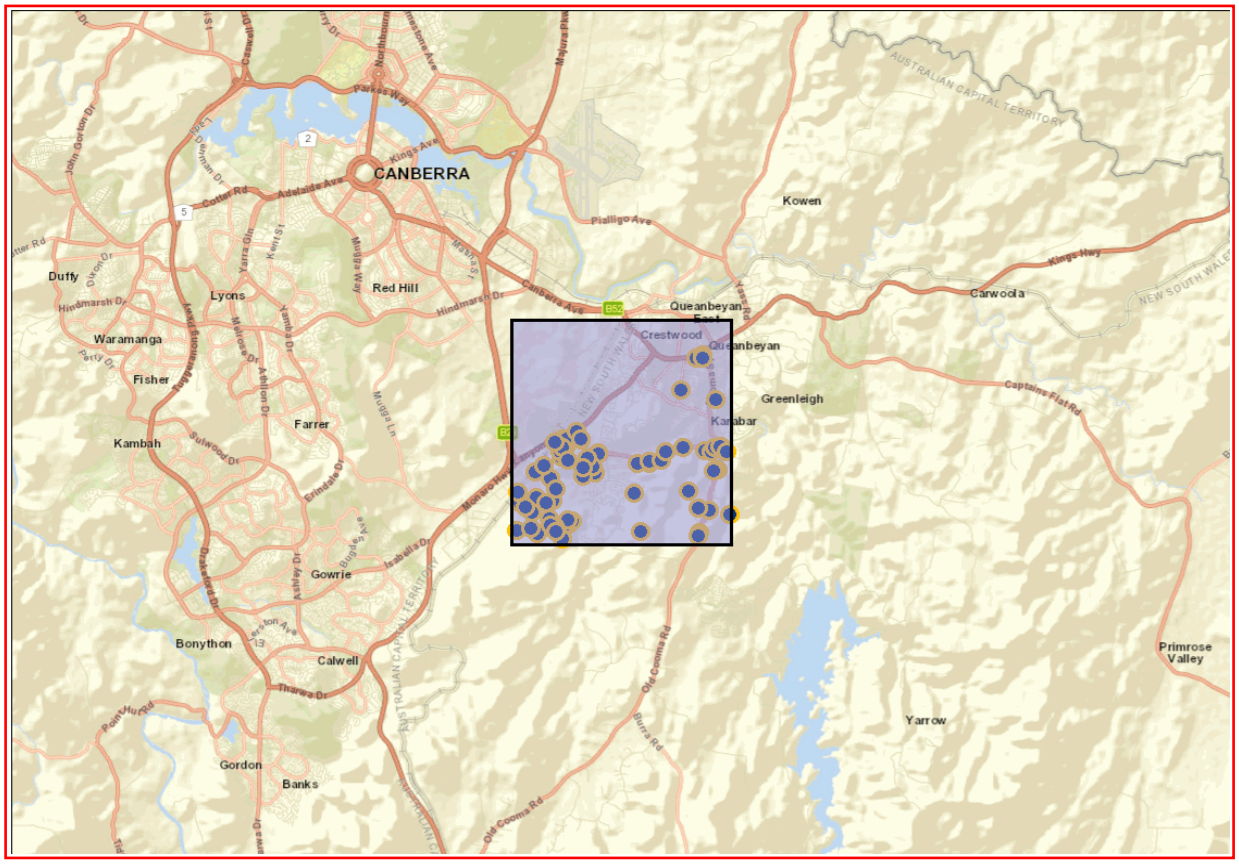
Attention: Alyce Cameron

Email: alyce.cameron@pwa.nsw.gov.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 55, Eastings : 697245.0 - 703391.0, Northings : 6079763.0 - 6086200.0 with a Buffer of 0 meters, conducted by Alyce Cameron on 27 November 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

83	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

Appendix C Unexpected finds protocols

If an unrecorded or unanticipated Aboriginal object, artefact, culturally modified tree or feature, are uncovered or identified while onsite, the following protocol is to be followed:

- Do not further harm the Aboriginal object/s and immediately cease all work at that location.
- Secure the area to avoid further harm to the Aboriginal object/s.
- Notify Heritage NSW via Environment Line as soon as practical on 1300 361 967 providing details of the Aboriginal object/s and its location.

Do not recommence any work at the location unless authorised in writing by Heritage NSW.

If human skeletal remains are unexpectedly encountered during the works:

- All works must immediately cease.
- The area should be secured to prevent unauthorised access or further harm to the remains.
- NSW Police and Heritage NSW should be contacted.

Everybody should cooperate with the appropriate authorities and relevant Aboriginal community representatives. They should help facilitate the recording and assessment of the find/s, and the fulfilment of legal constraints, including complying with NSW Police and/or Heritage NSW directions.

Do not recommence any work at the location unless authorised in writing by Heritage NSW or NSW Police.

If find/s have been determined to be Aboriginal object/s or skeletal remains, the recommencement of work at the location/s can only occur after gaining written approval from Heritage NSW, usually in the form of an Aboriginal Heritage Impact Permit (AHIP).