Wyangala Water Treatment Plant

Statement of Environmental Effects

October 2021

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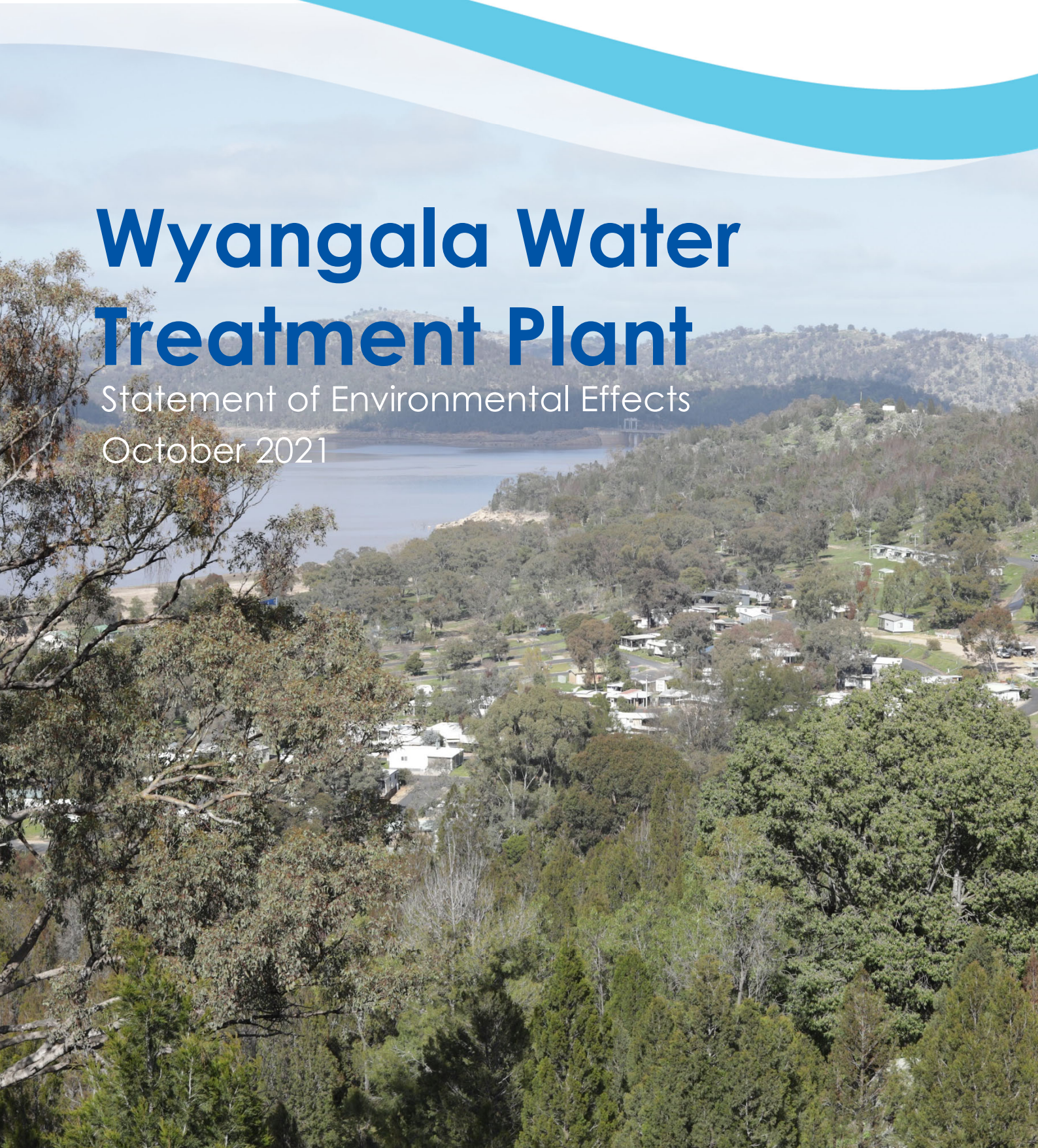

Wyangala Water Treatment Plant

Statement of Environmental Effects

This SEE has been prepared by SGJV for Water Infrastructure NSW.

SGJV Document number: W0067542W-EWK-REP-054 Wyangala Water Treatment Plant: Statement of Environmental Effects

Revision Status

Revision	Status	Date
A	Draft	06/08/21
B	Final Draft	18/08/21
C	Final Draft Version 2	02/09/21
D	Final	07/09/21
E	Final Version 2	07/10/21
F	Final Version 3	12/10/21

Executive summary

Background

The Wyangala Water Treatment Plant (WTP) provides filtered water to Wyangala village and the Wyangala Waters Holiday Park (holiday park). The current level of treatment does not achieve a potable water supply in accordance with the requirements of the *Australian Drinking Water Guidelines* and *Health Based Targets for Drinking Water Safety*. In addition, the WTP is currently only able to operate at 60 percent of its design capacity and is unable to filter the volumes required to meet demand during peak holiday periods.

A new WTP is proposed to provide a potable water supply to the village of Wyangala and the holiday park.

The proposal

Water Infrastructure NSW (WINSW) proposes to replace the existing WTP at Wyangala with a new WTP plant. This new WTP would be located atop of the ridge to the north of the existing WTP, located about 300 metres east of the village Wyangala. Some elements of the proposal would be located to the south of the proposed main plant location in the vicinity of existing WTP infrastructure. The proposal site has an area of about 1.5 hectares.

The proposal consists of the following features:

- new WTP building located north of the existing WTP, adjacent to the existing raw water tanks
- new clear water tank adjacent to the existing raw water tanks
- new sludge handling area adjacent to the existing sludge drying beds, including wash water tank and sludge thickener
- new pipeline between the existing raw water pipeline at the existing WTP and new WTP
- new pipeline between the new WTP and sludge handling area
- adjustment to pipework within the existing WTP to ensure connections to the raw water pipeline and supply to the village of Wyangala
- upgrade of the existing road from the existing WTP to the new WTP
- upgrade of the existing power supply (subject to confirmation with Essential Energy).

Construction of the proposal would take approximately 12 months to complete subject to receipt of development consent.

The proposal does not include the demolition of any redundant aspects of the existing WTP unless they are directly impacted by the proposal.

Statutory considerations

The proposal is situated on land zoned E2 Environmental Conservation under the provisions of *Cowra Local Environmental Plan 2012* (Cowra LEP). The proposal is permissible with consent under the Cowra LEP. The proposal is considered to be regional development as its Crown Development and has a value of over $5 million dollars. As such, these works are being assessed by Cowra Council and determined by the Western Regional Planning Panel under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This Statement of Environmental Effects (SEE) accompanies the Development Application submission to Cowra Council.

The proposal is not integrated or designated development under the EP&A Act.

The proposal does not require a referral under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Environmental impacts

Environmental impacts have been assessed for the proposal in accordance with section 4.15(1) of the EP&A Act with the key impacts associated with the proposal identified below. All other impacts are outlined in Section 6.

Biodiversity

The proposal would result in direct impacts on 0.63 hectares of native vegetation. Up to 0.27 hectares of non-native vegetation would also be removed. No threatened ecological communities are to be cleared as part of the proposal. Impacts on threatened flora and fauna resulting from the proposal have been assessed. The assessment concludes that impacts would not be significant.

The proposal will not impact upon any world heritage areas, national heritage places, Commonwealth marine areas or the Great Barrier Reef Marine Park protected under the EPBC Act.

Aboriginal heritage

The impacts of the proposal would be localised and limited to the proposal site. There are no recorded Aboriginal sites in the proposal site or in its immediate vicinity. A Due Diligence assessment under the Code of Practice for the Protection of Aboriginal Objects in New South Wales concluded impacts on Aboriginal heritage are not expected to occur and an application for an Aboriginal Heritage Impact Permit (AHIP) would not be required.

Water quality

The proposal has the potential to impact upon water quality within Lake Wyangala either through exposure of soils without the proper management and through the discharge of water during the testing and commissioning phase of the project. The proposal site is elevated above Lake Wyangala and should water pollution occur would migrate downslope and into Lake Wyangala.

The migration of soils resulting from exposed surfaces can be managed through the implementation of erosion and sedimentation controls to ensure sedimentation of waterways is avoided.

There would be a discharge of water during testing and commissioning of the proposal. This is water that has been drawn from Lake Wyangala and would be returned during the testing phase. Water is planned to be discharged to land which would allow it to infiltrate, thereby limiting the quantity of water to potentially enter Lake Wyangala. The majority of discharges are likely to consist of treated or partially treated water. Where chlorine is in the water (depending on the stage of the treatment process a discharged is required) the volumes of chlorine in the water is considered to be minimal and should chlorinated water enter Lake Wyangala the small volumes would readily dissipate into the much large water body.

Noise and vibration

Construction of the proposal may result in some noise impacts on nearby receivers located in the village of Wyangala and the holiday park. Noticeable noise would be limited to when high noise equipment is used during the upgrade of the existing access track. Also noisy equipment may impact the park Manager's residence on Reg Hailstone Way and residences along Wirong Road and Wurabinda Road. Overall the impacts are considered to be minimal and manageable through the implementation of mitigation measures.

Conclusion

This SEE assesses the potential impact of the proposal in accordance with section 4.15 of the EP&A Act. This SEE documents the potential environmental impacts of the proposal, considering both the potential positive and negative impacts of the proposal. The document also recommends mitigation measures to protect the environment where required.

The following key impacts associated with the proposal have been identified:

- impacts to biodiversity as a result of vegetation removal (not considered significant in accordance with the Biodiversity Conservation Act 2016 (BC Act) and the EPBC Act)
- water quality due to erosion and sedimentation of disturbed areas
- construction noise due to the operation of machinery and equipment.

The operation of the WTP will operate in a similar manner to the existing plant and is not expected to result in any impacts to the surrounding environment.

Any potential impacts associated with construction of the proposal can be adequately managed by implementing the management measures in section 7.3.

The proposal is consistent with the existing land use, for the purpose of water infrastructure and is in the public interest, as it would provide a reliable potable water source to the village of Wyangala and the holiday park, thus addressing current issues with the operation and water quality of the existing WTP.

Document accompanying the SEE and associated development application

The following documents and plans accompany the SEE and the development application:

- Detail plans of the development including the following plans (see Appendix A):
    - Site Analysis Plan (WDLWYWTP000-LA140013-ENVI-DRG-MM-00033)
    - Site Plan New WTP Area (WDLWYWTP000-LA14003-ENVI-DRG-MM-00034)
    - Site Plan Sludge Handling Area (WDLWYWTP000-LA14003-ENVI-DRG-MM-00035)
    - Site Plan Existing WTP Area (WDLWYWTP000-LA14003-ENVI-DRG-MM-00036)
    - Floor Plan and Elevations (WDLWYAWTP0000-LA140013-ENVI-DRG-CC-00041)
    - Sections (WDLWYAWTP0000-LA140013-ENVI-DRG-CC-00042)
    - WTP Building Layout (WDLWYWTP000-LA14003-ENVI-DRG-MM-00037)

- Metering and Sludge Handling Floor Plans and Elevations (WDLWYWTP000-LA14003-ENVI-DRG-MM-00038)
- Site Elevation (WDLWYWTP000-LA14003-ENVI-DRG-MM-00039)
- Erosion and Sediment Control Plan (WDLWYWTP000-LA14003-ENVI-DRG-MM-00040)

- Biodiversity Assessment Report (Appendix B)
- Due Diligence Archaeological Assessment (Appendix C).

Abbreviations

Abbreviation	Definition
BC Act	*Biodiversity Conservation Act 2016*
Biosecurity Act	*Biosecurity Act 2015*
CEMP	Construction Environment Management Plan
Cowra DCP	Cowra Development Control Plan 2014
Cowra LEP	*Cowra Local Environmental Plant 2012*
DA	Development application
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FM Act	*Fisheries Management Act 1994*
GAC filter	*Granular activated carbon filter*
Heritage Act	*Heritage Act 1977*
Holiday park	Wyangala Waters Holiday Park
ICNG	Interim Construction Noise guidelines (DECC, 2009)
Infrastructure SEPP	*State Environmental Planning Policy (Infrastructure) 2007*
KTPs	Key Threatening Processes
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NASH	National Association for Steel-framed Housing
NCC	National Construction Code
NML	Noise Management Levels

Abbreviation	Definition
NPfI	Noise Policy for Industry (NSW EPA, 2017)
NPW Act	*National Parks and Wildlife Act 1974*
NVMP	Noise and Vibration Management Plan
PCT	Plant community type
RBL	Rating Background Levels
RNP	Road Noise Policy
SEE	Statement of Environmental Effects
SGJV	Stantec GHD Joint Venture
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SSD	State Significant Development
SSI	State Significant Infrastructure
WINSW	Water Infrastructure NSW
WM Act	*Water Management Act 2000*
WTP	Water Treatment Plant

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Appendices

Appendix A – Detailed design plans

Appendix B – Biodiversity Assessment Report

Appendix C – Due Diligence Archeological Assessment

1. Introduction

This chapter describes the background to the proposal, an overview of the proposal, and the purpose and outline of the structure of this Statement of Environmental Effects (SEE).

1.1 Overview

Water Infrastructure NSW (WINSW) proposes to replace the existing water treatment plant (WTP) at Wyangala with a new WTP plant (the proposal). The existing WTP does not meet current drinking water standards and therefore the water is not considered potable. The proposal would provide potable water to the Wyangala village and the holiday park.

The proposal requires development consent under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This SEE is to be submitted to Cowra Council for assessment as part of a development application (DA) for the proposal.

This SEE has been prepared by Stantec GHD Joint Venture (SGJV) on behalf of WINSW. It examines the statutory context of the proposal and assesses its potential impact on the environment. Mitigation measures are proposed to minimise any identified impacts.

1.2 Application particulars

Applicant:	Water Infrastructure NSW
Site:	Lot 1 DP 857511 Lot 2 DP 857511 Lot 11 DP 1187055 Lot 2 DP 259087 Lot 66 DP 750378
Proposal:	Replacement water treatment plant and associated infrastructure
Estimated capital cost:	$5,621,000
Zoning	E2 Environmental Conservation under *Cowra Local Environmental Plan 2012*
Consent authority	Cowra Council

1.3 Overview of the proposal

1.3.1 Location of the proposal

The proposal is located in Wyangala which is located about 28 kilometres to the south-east of Cowra. The proposed WTP would primarily be positioned atop a ridge located north of the existing WTP. Some elements of the proposal would be located to the south in the vicinity of existing WTP infrastructure. The position of the proposal in the regional and local context is shown in Figure 1.1. The existing WTP layout on the site is shown in Figure 1.2.

The village of Wyangala is located about 300 metres to the east. Land about 200 metres to the north of the proposal site consists of the Wyangala Waters Holiday Park which is located on Crown Land and is operated by Reflections Holiday Parks. Land to the east of the proposal site consists of Lake Wyangala (also referred to as Lake Wyangala reservoir) which is the waterbody formed behind Wyangala Dam, located to the south of the proposal. Wyangala Dam and the associated reservoir are managed by WaterNSW.

Further details of the local context are discussed in section 2.1.

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Grid: GDA 1994 MGA Zone 55

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Water Infrastructure NSW
Wyangala Water Treatment Plant
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Date **17/08/2021**

Regional context and site location

Figure 1.1

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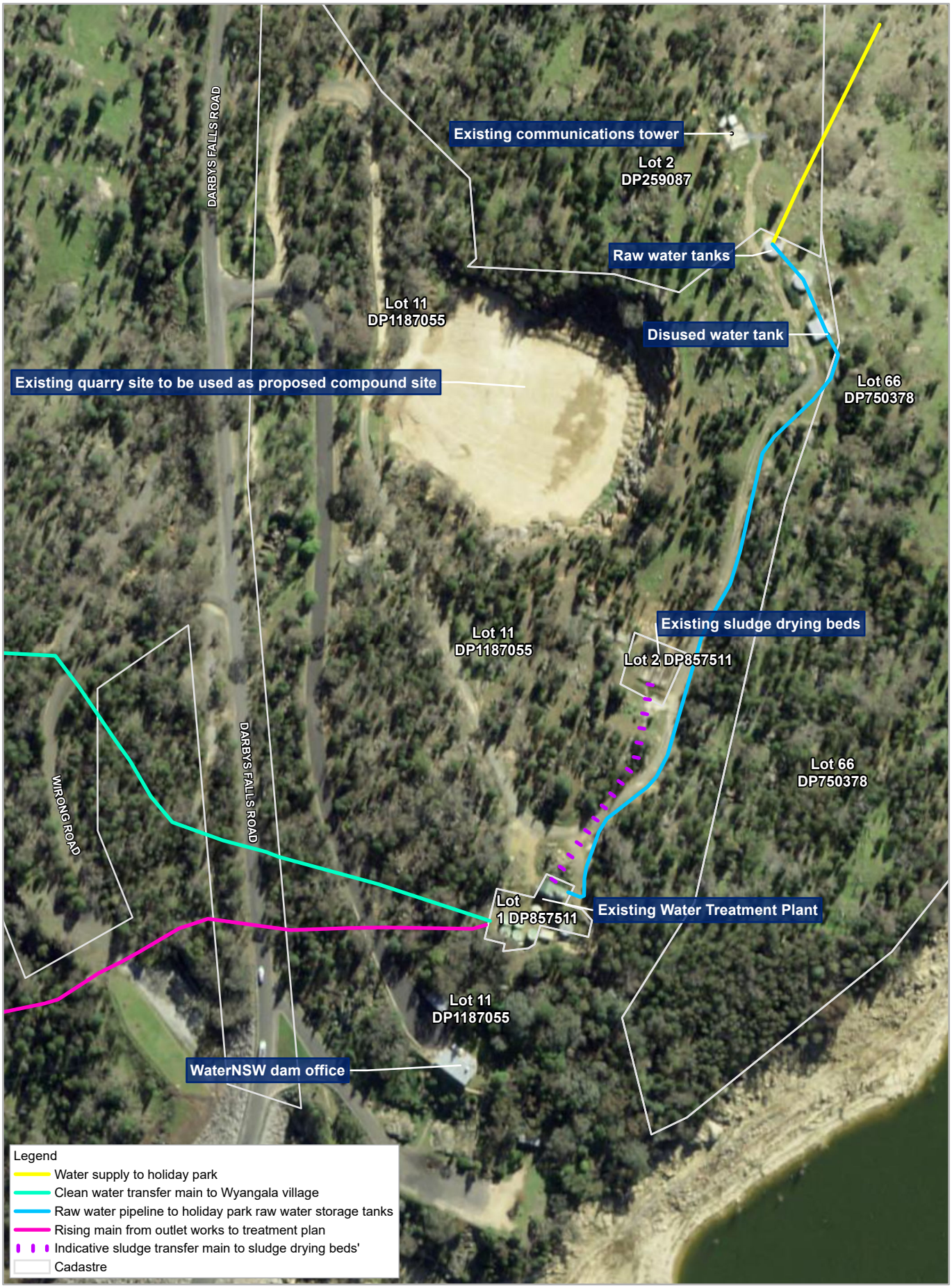
Data source: Site - GHD 2020; Waterway and roads - LPI DTDB 2017 ; World Light Gray Canvas Base: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
World Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by:



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Wyangala Water Treatment Plant
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Existing site layout

Figure 1.2

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1.3.2 Key features of the proposal

The proposal includes the following key features:

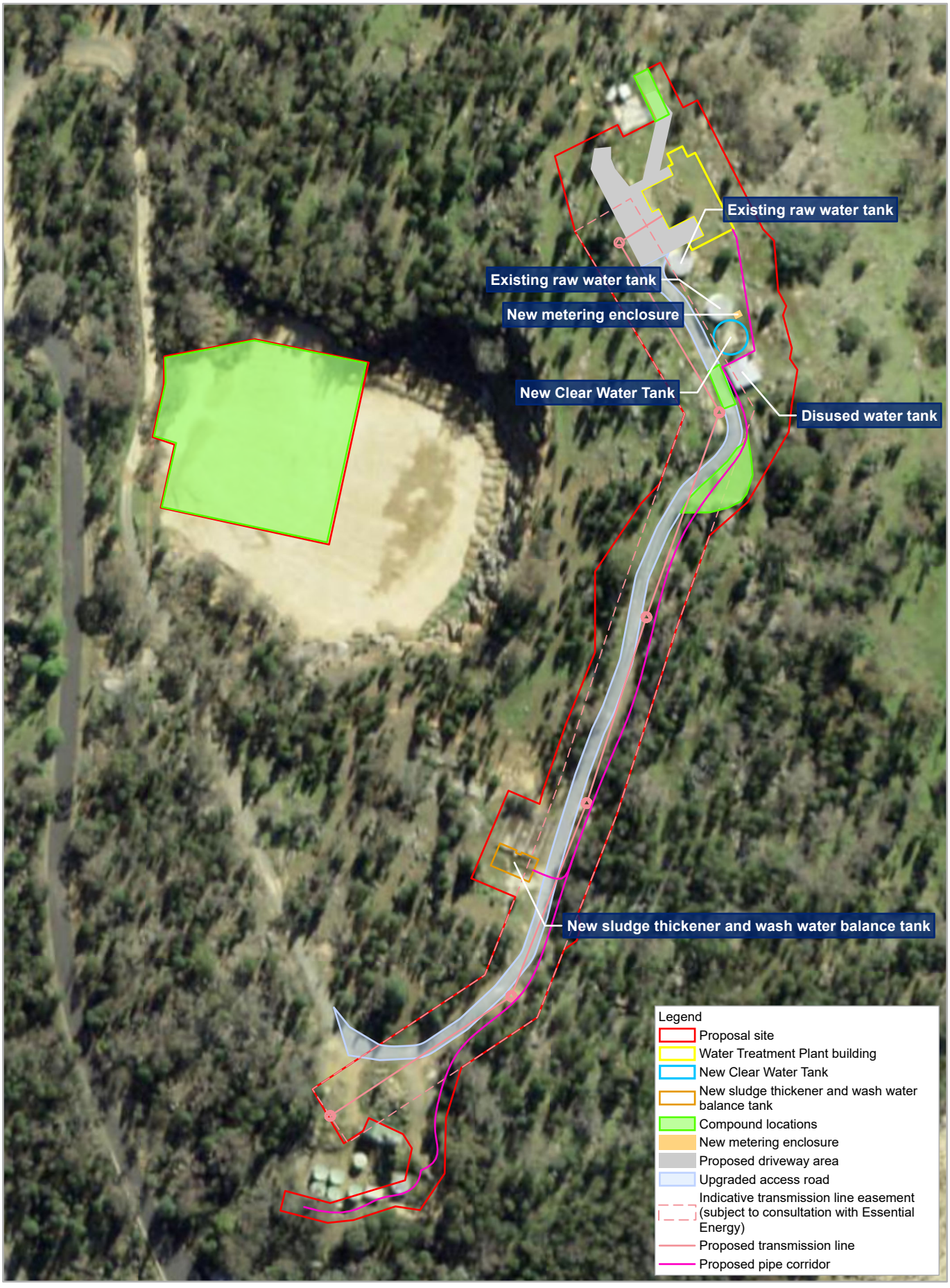
- new WTP building located north of the existing WTP, adjacent to the existing raw water tanks
- new clear water tank adjacent to the existing raw water tanks
- new sludge handling area adjacent to the existing sludge drying beds, including wash water tank and sludge thickener
- new pipeline between the existing raw water pipeline at the existing WTP and new WTP
- new pipeline between the new WTP and sludge handling area
- adjustment to pipework within the existing WTP to ensure connections to the raw water pipeline and supply to the village of Wyangala
- upgrade of the existing road from the existing WTP to the new WTP
- upgrade of the existing power supply (subject to confirmation with Essential Energy).

A detailed description of the proposal is located in section 4.1, while information about the construction of the proposal is outlined in section 4.2. Details of how the WTP would operate are outlined in section 4.3.

Construction would commence after receipt of development consent and would take approximately 12 months to complete.

The proposal does not include the demolition of the redundant existing WTP infrastructure.

An overview of the proposal is shown in Figure 1.3. Detailed plans of the proposal are located in Appendix A.



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Water Infrastructure NSW
Wyangala Water Treatment Plant
Statement of Environmental Effects

Project No. **12528366**
Revision No.
Date **18/08/2021**

Overview of the proposal

Figure 1.3

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Data source: Site, pipework - GHD 2020; roads - LPI DTDB 2017 ; public/NSW_Imagery: © Department of Customer Service 2020. Created by: lmanasan

1.4 The proponent and consent authority

The proponent is Water Infrastructure NSW (WINSW), and Cowra Council is the consent authority. A development application is required to be prepared in accordance with the requirements of the EP&A Act and the *Cowra Local Environmental Plan 2012* (Cowra LEP). The proposal is not designated development and an environmental impact statement is therefore not required.

1.5 Purpose of this report

This report assesses the impacts of the proposal and will accompany the DA to be lodged with Cowra Council.

The SEE has been prepared to address the matters for consideration under section 4.15(1) of the EP&A Act and has considered the provisions of other relevant Acts and environmental planning instruments. It assesses the potential environmental impacts of the proposal and recommends mitigation measures to minimise impacts and protect the environment where possible.

This SEE report only considers the environmental impacts of the proposal.

1.6 Structure and content of the SEE

The SEE is structured as follows:

- Section 1 – provides an introduction
- Section 2 – locates the site and provides information on the existing environment of the site and surrounds
- Section 3 – describes the need for the proposal and considers the suitability of the site
- Section 4 – describes the proposal and provides information on the construction activities and operational phases
- Section 5 – assesses the proposal against the requirements of relevant legislation and environmental planning instruments
- Section 6 – provides an assessment of the potential impacts of the proposal on the environment

- Section 7 – describes how environmental management would be undertaken during construction through preparation of a construction environmental management plan (CEMP)
- Section 8 – describes how the proposal is in the public interest and provides a conclusion to the SEE.

2. Locality and site analysis

2.1 Local context

Land use in the vicinity of the proposal is dominated by Wyangala Dam and the associated reservoir with a number of land uses associated with the operation of the dam also present in the surrounding area. The proposal site is located about 100 metres from the full supply level of Lake Wyangala at its closest point (near existing WTP), while the site is at least 34 metres above the full supply level (once again at the existing WTP).

Land to the west of the proposal site consists of the village of Wyangala, which is a small village with a population of 182 as per the 2016 census (ABS 2016). The village of Wyangala is around 300 metres away and consists primarily of residential dwellings and a number of other services (refer section 6.11.1 for further detail). The key land uses within the village are shown in Figure 1.1. Land to the north-east of the proposal site consists of the Wyangala Waters Holiday Park.

Land to the north of the proposal site predominantly consists of native vegetation bound by Darby Falls Road and the entrance to the holiday park. Directly north of the proposal site, there is a small former quarry which was used during construction of Wyangala Dam in the 1930's.

2.2 The proposal site

2.2.1 The site

The proposal site has an area of about 1.5 hectares.

The site is predominantly disturbed, however sits within a relatively undisturbed area. The site is covered by existing water infrastructure, patches of grassy areas, and large surface rocks. Existing infrastructure at the northern portion of the site comprises two concrete water tanks, a square metal water tank (no longer in use).

Mid-way between the northern and southern portions of the site are sludge beds constructed on a level platform. Linking the sludge beds to the northern portion of the site is an unformed access road.

The southern portion of the proposal site contains the existing WTP which is operated by Cowra Council.

The proposal site includes the former quarry which would be used for construction only.

The proposal site is positioned primarily on Water Administration Ministerial Corporation land (ie WaterNSW land), however part of the site which is only required for construction is located on land (Lot 66 DP 750378) which is owned by The State of New South Wales.

2.2.2 Existing water treatment plant infrastructure

The existing WTP was originally constructed to manage blue green algae events occurring within the reservoir in 1995.

The granular activated carbon (GAC) filter within the process is however currently bypassed and does not form part of the process, while the DynaSand filtration is not operating at the optimum level with the water turbidity at a minimum being double the good practice target for water turbidity.

Other key operational issues with the existing WTP include:

- absence of pre-treatment meaning the filters are required to filter out more material and therefore the filters are regularly overloaded
- frequently overloaded filters resulting in the need for continuous backwashing which results in turbidity limits not being met
- overloaded sludge drying beds as a result of continuous backwashing of filters.

The WTP provides filtered water to the village of Wyangala all year around, while the holiday park generally receives raw water however at times water provided to the holiday park is treated or partially treated to assist in plant operation when demand is low from Wyangala village. However, the existing WTP only supplies a maximum 400 kilolitres per day, well below the designed 700 kilolitres per day.

Raw water extracted at the outlet works for Wyangala Dam. The water is then transferred to the raw water tank located within the existing WTP via a pipeline (as shown in Figure 1.2). Raw water is also transferred to the holiday park raw water storage tanks located north-east of the existing WTP via pipeline owned by the holiday park (see Figure 1.2. Water is then transferred from the raw water tanks to the holiday park based on demand. At times demand for treated water within the Wyangala village does not meet the minimum requirements of the plant. During such times to ensure treated water is provided to the village the holiday park supply may include treated water or a mixture of treated water and raw water.

Raw water which is treated within the existing WTP is then storage in treated water tanks within the existing WTP where it is then transferred to Wyangala village via the pipeline shown in Figure 1.2 based on demand.

Although water from the WTP is filtered, the supply is not considered to be potable due to the high turbidity of the water.

3. Proposal need and alternatives

3.1 Need for the proposal

The existing WTP which services the village of Wyangala and the holiday park provides filtered water, however the level of treatment does not achieve a potable water supply. The water supplied from the existing WTP does not meet the requirements of the current *Australian Drinking Water Guidelines* (2011) and *Health Based Targets for Drinking Water Safety* (2015) standards. The WTP also does not meet the aesthetic targets including turbidity, colour, taste and odour, for customer satisfaction.

The provision of filtered water is also generally limited to the Wyangala village supply with water supplied to the holiday park generally being unfiltered.

Due to the abovementioned issues regarding the quality of water being provided to customers, a new WTP is required to provide a suitable water supply to the village of Wyangala village and the holiday park.

The construction of a new facility is required as the majority of the existing WTP infrastructure is beyond its operational life and/or is using obsolete technology. The augmentation of the existing plant with new equipment was also not considered a viable alternative.

3.1.1 Objectives of the proposal

The following proposal objectives have been identified for the upgraded WTP and any associated supply systems:

- Provide potable water supply to Wyangala including the village and holiday park which meets the current guidelines.
- Ensure the WTP is able to provide for both the existing and future demand for water in Wyangala and the holiday park.
- Provide a WTP which is easy to operate and requires minimal on site control.
- Maximise reuse of existing assets associated with the existing WTP.
- Minimise impacts on the environment, including the village of Wyangala and the holiday park during both construction and operation of the new WTP.

3.2 Alternatives to the proposal

3.2.1 Site selection

Four locations were identified as potential sites for the proposal. Table 3.1 outlines the criteria for site selection.

Table 3.1 Criteria for site selection of the proposal

Criteria	Objective
Disturbance to supply	• Continue to supply the village of Wyangala and the holiday park with existing treated water during construction • Located in close proximity to the village to avoid long detention during winter and the need for booster chlorine
Cost	• Minimise raw and treated water pipeline lengths • Limit rock excavation
Project timing	• Minimise number of land owners affected • Ensure power availability
Environmental constraints	• Minimise impacts on flora, fauna, heritage (both Aboriginal and non-Aboriginal), and noise • Ensure road access is available during construction for both trucks and workforce
Engineering	• Retain an elevated location to avoid double pumping.

The four identified sites are discussed below, and the locations are shown in Figure 3.1.

Site A – Existing WTP

The existing WTP site has limited available space due to the existing process units taking up the majority of the site. This poses difficulties in maintaining customer supply during construction. The existing treated water tanks and sludge lagoons can be reused in this option. Due to the risks in maintaining customer supply of water during construction, this option was not further explored.

Site B – Existing treated water tanks

The existing treated water tanks site is located up on a ridge to the north-east of the existing WTP. There are two 90 kilolitre tanks at the site which would be reused.

The existing sludge drying beds are located downhill from this site between Site A and Site B and are able to be reused if this site is chosen. A telecommunications tower is located at the northern end of the site and access to this asset needs to be retained.

This site is most cost-efficient compared to other sites, as multiple structures can be retained and reused.

Site C – Existing wastewater treatment plant site

The existing wastewater treatment plant is located about one kilometre north of the existing WTP plant (refer to Figure 3.1 for location) and will require new pipework to transfer raw water to the system and treated water to the village of Wyangala and the holiday park. The site was considered due to the ownership of land (that is, WaterNSW) and the reasonable terrain for construction.

However, generally it is not preferred to locate a WTP in close proximity to a wastewater treatment plant, due to the potential risk for cross-contamination. The costs associated with pipework required to connect the village and holiday parks to the new plant were also considered high thus making this option less preferable.

Site D – Purchase new land

The option of purchasing new land was explored to find a site which is easier to construct on and is closer to the village of Wyangala. This option was considered to result in long timeframes due to the requirement to acquire land. Due to this extended likely timeframe extension this option was not considered further, particularly given that both Site B and Site C were considered feasible and are on land already owned by Cowra Council, WaterNSW or the Crown.

Preferred option

The existing treated water tanks site (Site B) was considered the most feasible option, as it best met the criteria. Both Site B and Site C would consume the same amount of energy, however Site B would allow for the reuse of some existing pipelines, is closer to the village of Wyangala, and would cost less to construct. Therefore, Site B was the preferred location for the proposal.

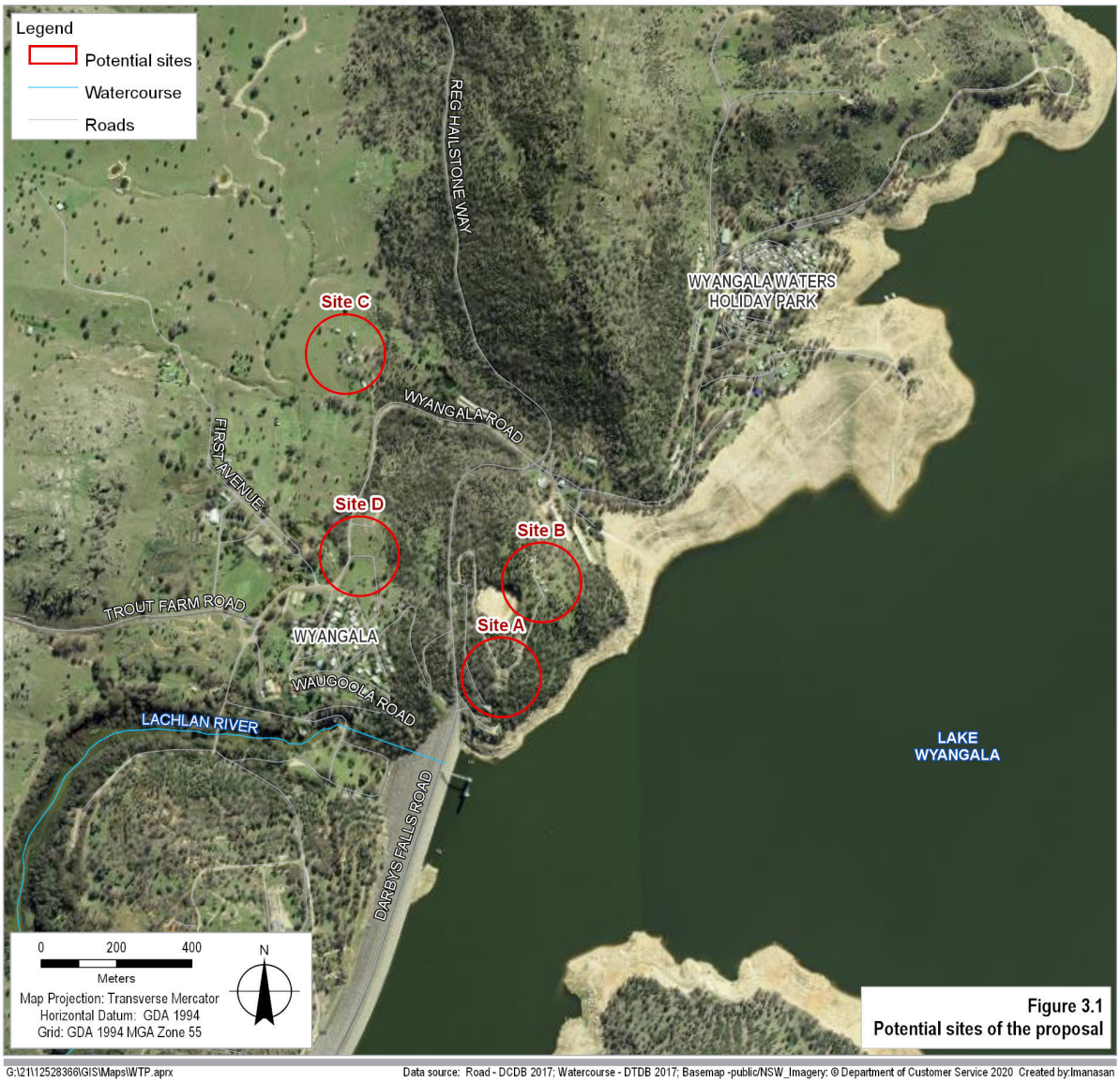


Figure 3.1 Alternative water treatment plant locations

4. Description of the proposal

This chapter describes the proposal and provides descriptions of the major design features, the construction method and associated infrastructure and activities.

4.1 Key elements of the proposal

Detailed plans for the proposal are located in Appendix A. The following sections provide an overview of the key elements of the proposal.

4.1.1 Water treatment plant building and associated infrastructure at top of hill

The majority of the infrastructure required for the new WTP would be positioned north of the existing WTP plant atop of the ridge located between the Wyangala village and the holiday park.

Figure 4.1 shows the proposed new infrastructure which is proposed in the vicinity of the existing raw water tanks. The following infrastructure is proposed in this location:

- WTP building
- clear water tank
- metering enclosure.

Vehicle manoeuvring areas would be established to allow vehicles to turn around at the WTP. These areas have been designed to allow movements of a rigid truck. An upgraded access road would also be provided to the existing telecommunications tower located north of the proposal site to maintain access to this facility. Further detail regarding the road upgrade is provided in section 4.1.4.

Water treatment plant building

The majority of the infrastructure associated with the WTP would be housed within the WTP building which is proposed to be positioned between the existing raw water tanks and the existing telecommunications tower (refer to Figure 1.3).

The proposed WTP building would consist of a split level structure (that is, upper and lower floors) which would be constructed of concrete blockwork reinforced with steel with a colourbond steel roof. The building would have a height of about four metres.

The main building would be about 30 metres long by about 18 metres wide. This area would consist of the split levelled area and would house the following plant equipment:

- Ultra filtration system
- GAC filtration system
- Chlorine dosing system
- CO_2 dosing system
- Part of the clean-in-place system (see below for location of remaining parts of the system).

An additional area off the western frontage of the building would include the buildings switchgear and SCADA console (to allow remote operation of the plant) and the compressor and blower room. This area would be about seven metres wide by about nine metres long. An area about seven metres by about five metres would also be positioned off the south-western corner of the building and would house the CO_2 and chlorine dosing rooms.

Exterior to the building would be the following areas directly adjacent to the main building:

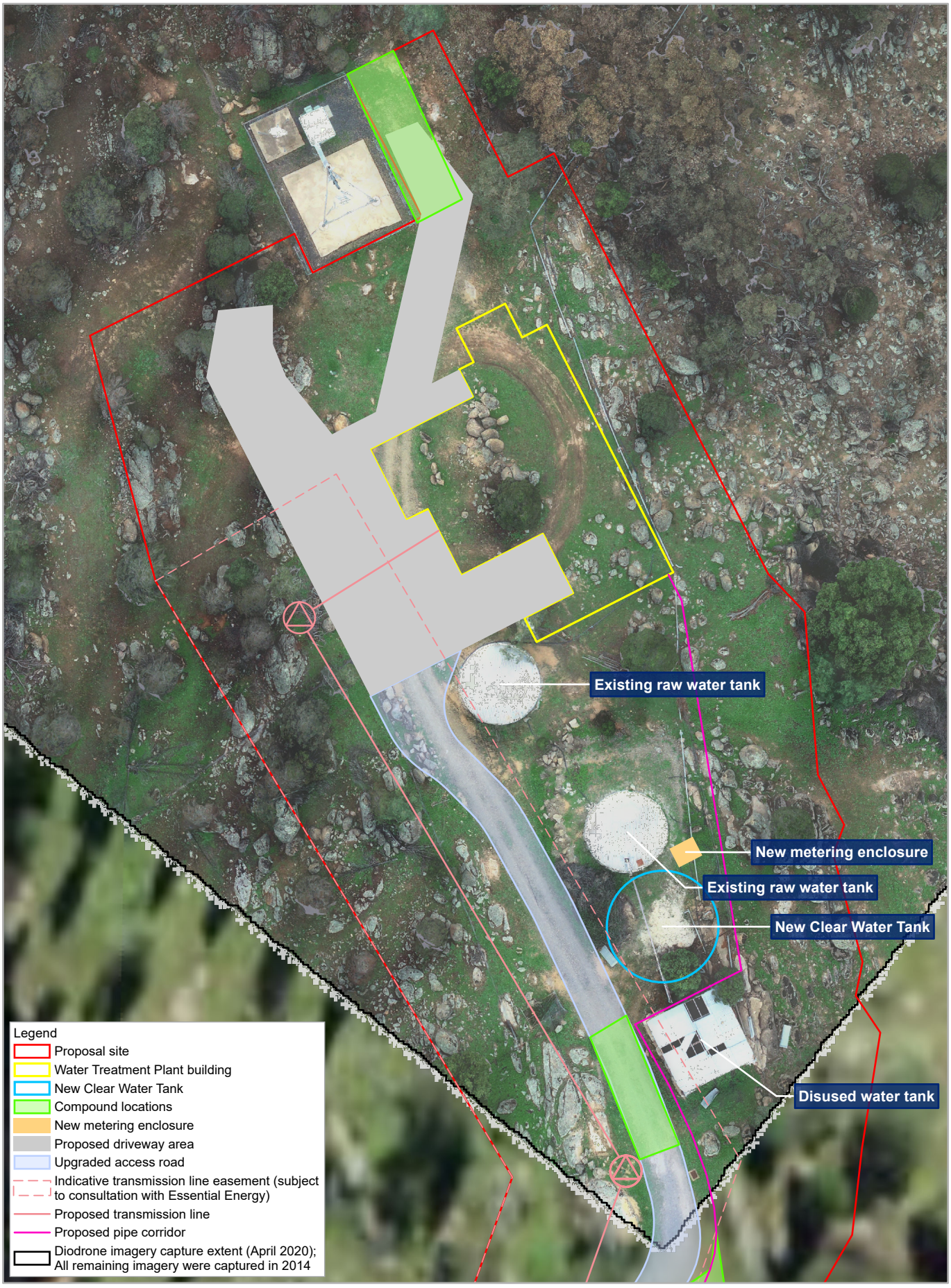
- UV treatment area on the southern face of the main building with the equipment positioned under a colour bond awning
- Clean-in-place waste tank located on the northern face of the building
- Chemical loading and unloading area within a nine kilolitre bund.

Drawing WDLWYAWTP0000-LA140013-ENVI-DRG-CC-00041 in Appendix A shows the proposed building layout.

Clear water tank and metering enclosure

A new 130 kilolitre clear water tank would be constructed between the southern most existing raw water tank and the disused square water tank as shown in Figure 4.1. The proposed tank would have a diameter of about 9.5 metres and a height of about 2.5 metres. This tank would be a stainless steel panel tank.

To the north of the new clear water tank a small metering enclosure would be established containing metering equipment for all water leaving the water treatment plant.



Paper Size ISO A4

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Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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WaterNSW
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Statement of Environmental Effects

Water treatment plant development envelope and indicative layout

Project No. **12528366**
Revision No.
Date **18/08/2021**

Figure 4.1

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Print date: 18 Aug 2021 - 13:05

Data source: Site, layout, pipework - GHD 2020; roads - LPI DTDB 2017 ; public/NSW_Imagery: © Department of Customer Service 2020. Created by: lmanasan

4.1.2 Sludge handling area

The proposal would include the addition of infrastructure in the vicinity of the existing sludge drying beds. A new sludge thickener and wash water balance tank would be installed on the southern side of the existing sludge beds.

The location of this new infrastructure is shown in Figure 1.3, with detailed drawings located in Appendix A.

4.1.3 Pipelines

A number of pipelines are proposed to transfer water to, from and around the WTP. The following pipelines are proposed:

- A new raw water pipeline between the existing WTP and the new WTP. This will be connected to the existing raw water pipeline to form a continuous main from the existing raw water pump station (south of the village) to the new WTP.
- A new wash water pipeline between the new WTP and sludge handling area
- Adjustments to pipework within the existing WTP to allow reuse of the existing raw water pipeline for transfer of treated water from the new WTP to the pipeline supplying water to the Wyangala village.

The location of these pipelines is shown in Figure 1.3 and in Appendix A.

The pipelines would be nominally 100 millimetres in diameter. The majority of the proposed pipeline would high density polyethylene which would be laid on the bed of sand and buried with earthen fill. Stainless steel pipe would be used in areas where the pipeline would be above ground primarily in the vicinity of the WTP building at the top of the hill.

4.1.4 Proposed access upgrades

The existing access road into the proposal site is required to be partially upgraded to ensure suitable access for both construction and ongoing access for operation. The road from Darby Falls Road to the existing WTP would not be upgraded, however north of the existing WTP, the track would be upgraded from an unsealed track to a four metre wide sealed track. The track would generally follow the existing track alignment however some localised realignments may occur to suit the terrain constraints. The proposed new access track alignment is shown in Figure 1.3 along with the extent of the proposed batters for the new road, which would primarily be located on the western side of the new track.

Near the new WTP building the existing track would be realigned to suit the positioning of the new building. To facilitate the manoeuvring of vehicles, including rigid delivery vehicles, a turnaround bay is provided west of the building to allow vehicles to turn around to exit the site. The location of this bay is shown in Figure 4.1.

The access to the existing telecommunications tower would also be modified to suit the new road with a new track to provide access to the towers enclosure (refer to Figure 4.1).

4.1.5 Power supply

A power supply exists within the proposal site including an existing transmission line to the new WTP site. As part of the proposal this transmission line would be upgraded from low voltage supply to high voltage supply to ensure supply is sufficient to power the proposed WTP, including a new pole mounted transformer. The requirements for the upgrade is being developed in consultation with Essential Energy. The upgrade also involves the replacement of poles to provide the required clearance for the new high voltage line. The location of the proposed transmission line and associated poles are shown in Figure 1.3.

The proposed new transmission line would also ensure ongoing power supply to the telecommunications tower located adjacent to the WTP building.

As part of the new transmission line an easement would be cleared of vegetation in accordance with Essential Energy requirements. The width of this corridor would be confirmed with Essential Energy.

4.2 Construction activities

4.2.1 Construction methodology

Overview

The proposed construction methodology would involve the following general scope of works:

- site establishment including:
    - establishment of the site compound and stockpile areas
    - delineation of the construction site
    - set-up of sediment and erosion control measures
    - clearance of the proposal site

- earthworks to level the site as required
- construction of the new structure
- construction of the new pipe work including tie-in with existing pipework
- upgrade of the access road
- testing and commissioning and also performance testing
- site demobilisation.

Water treatment plant construction

Construction of the WTP building would consist of relatively standard construction methods with a slab on piles to be poured initially upon which the masonry block wall structure would be erected. The steel framed roof would then be installed following completion of the block wall structure. The concrete blocks would then be installed on the steel frame followed by the installation of the roof of the building. The fit out of the building would then occur.

For other elements of the proposal such as the sludge handling area and the clear water tank, slabs or ring beams would be constructed on which relevant equipment and infrastructure would be installed.

Pipeline construction

The proposed pipelines would be installed on the surface of the ground with mounding over the pipelines to provide the required protection. The pipeline would be placed on the surface on a bed of sand with the pipeline then buried.

4.2.2 Timeframes and working hours

Duration

Construction of the proposal is anticipated to commence in late 2021 subject to approval and take up to about 12 months to complete.

Construction work hours

Where possible, construction would be undertaken during recommended standard hours as outlined in the *Interim Construction Noise Guideline* (DECC, 2009). The recommended standard hours for construction are:

- Monday to Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm

- no work on Sundays and public holidays.

The works are however expected to require works outside standard hours on minimal isolated occasions. Works outside standard hours could include but are not limited to:

- delivery of materials or equipment as required by police or other authorities for safety reasons (such as wide or long loads)
- pipeline tie in connection with existing water systems a period when demand is very low (that is, overnight)
- work times to correlate with utility outages (for example, connection of proposed utilities to surrounding networks).

Where noise generating works are required outside the standard construction hours, justification in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) would be provided with approval of these works to be obtained from Cowra Council.

4.2.3 Workforce

An estimated peak workforce of around 10 personnel is anticipated during construction.

4.2.4 Equipment

The following equipment is anticipated to be required during construction:

- delivery trucks
- dump trucks
- worker vehicles
- cranes
- chainsaws
- chippers
- excavators
- bulldozers
- backhoes
- graders
- compressor
- vibrating rollers
- static rollers
- jackhammers
- rock breakers
- concrete saws
- concrete trucks
- concrete pumps
- generators
- water carts
- piling rigs
- hand tools.

4.2.5 Source and quantity of materials

Material would include sand, select material, road base, asphalt, topsoil and concrete. It is likely that these materials would be sourced from local quarries and commercial suppliers.

Exact material quantities are not known at this stage, however volumes are not expected to be at levels which cannot be sourced in the local area.

Water may be required during construction to achieve required earthworks moisture content, and to suppress dust. If required, water would be sourced from the raw water supply currently supplied to the proposal site.

4.2.6 Construction compound and temporary laydown areas

To support the construction of the proposal, a construction compound, laydown and parking areas have been identified. A former quarry site located along the access road to the proposal site is proposed to be used as the main compound and laydown area for the works. The location of the main construction compound is shown in Figure 1.3.

The main construction compound would include portable buildings with office space for on-site personnel, amenities (such as lunch facilities and toilets), laydown area (including bunded areas for fuel and chemicals) and concrete washout area.

As the main construction compound is to be positioned within the former quarry area away from the main works the following construction areas are proposed in the vicinity of the WTP building work area to improve the efficiency of construction:

- laydown/parking area on the eastern side of the track at the top of the hill
- refuelling area adjacent to the disused square water tank
- parking area adjacent to telecommunications areas, however access to enclosure would be maintained at all times.

These areas are shown in Figure 1.3.

4.2.7 Traffic management and public access

Traffic generation

Construction of the proposal would generate traffic which would consist of both light and heavy vehicle movements.

Heavy vehicles would deliver equipment and construction materials and removal spoil (if required). Heavy vehicle movements are expected to be up to about 20 movements per day (that is, 10 vehicles accessing and leaving the site) during peak periods which are expected to be over relatively short periods of time throughout the construciton.

Light vehicle movements would be required for the movement of construction personnel and would result in about 20 movements per day during peak construction stages.

Construction traffic routes

Access to the proposal site would be via Darby Falls Road and the existing access track to the existing WTP and other infrastructure located north of Wyangala Dam. Access to the section of Darby Falls Road required for access is via the existing roundabout located at Wyangala Road and Reg Hailstone Way.

Access to this intersection would be dependent on the direction of travel with the two primary routes as follows:

- From Blayney and the Mid-Western Highway: Sheet of Bark Road off the Mid-Western Highway through the town of Woodstock onto Reg Hailstone Way.
- From Cowra: Fitzroy Street off the Mid-Western Highway within Cowra urban area on to Darby Falls Road then Trout Farm Road and Wyangala Road.

Due to the narrow and winding nature of Reg Hailstone Way, the movement of heavy vehicles along this road would not occur as part of the proposal.

Road closures and impacts to access

The proposal would not result in any direct impacts (that is excavation or similar) on any public roads.

The proposal would however potentially impact access along the track to the existing WTP. This track is required for Cowra Council and Optus to access the existing WTP and telecommunications tower respectively. Access to these assets would always be maintained during construction.

4.3 Testing and commissioning

The new WTP would be tested as part of the commissioning process. As part of the testing procedure a requirement to discharge water from the system may be required. The discharge of this water is likely to be treated water which would be discharged to the surrounding land to allow overland flows and absorption into the ground.

Depending on the timing of any discharges water may be chlorinated. De-chlorination of the water would occur through discharge to land. Volumes of chlorinated water are not

expected to be large with discharge of water to occur in areas where risk of flows entering Lake Wyangala would be minimal.

Discharge locations would be confirmed in consultation with Cowra Council and Reflections Holiday Parks as the discharge of water could occur in parallel with any activities (by others) to flush the existing line thus minimising the amount of water required to be discharged between the two activities.

4.4 Operation

While WINSW are the proponent for the proposal, the operation of the plant would be undertaken by Cowra Council with WINSW handing over responsibility of the WTP following the testing and commissioning phase.

The following section provide an overview of the process used within the plant, its operational hours and the access and maintenance requirements.

4.4.1 Overview of treatment process

The proposed treatment process would ensure that water transferred to the village of Wyangala and the holiday park meets the *Australian Drinking Water Guidelines*.

The treatment methodology for the WTP is based on a physio-chemical treatment process which does the following:

- dissolves metals
- removes suspended solids
- dissolves organics
- disinfects the water.

Figure 4.2 outlines the treatment process through the new water treatment plant.

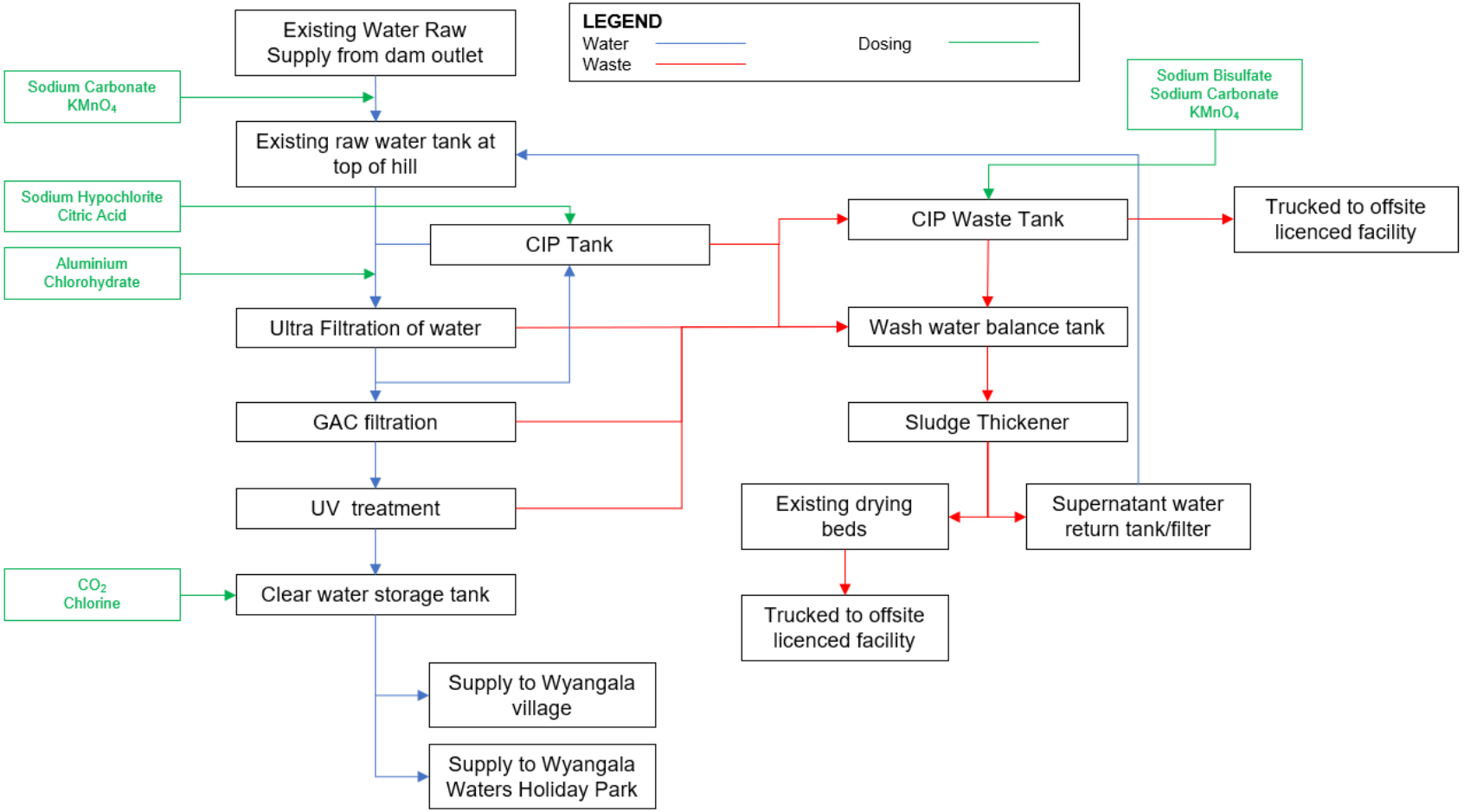


Figure 4.2 Overview of treatment process

4.4.2 Chemical storage

The operation of the WTP would involve the use of several chemicals in the process which would be required to be stored on site. These chemicals are outlined in Table 4.1 including the volumes required. As outlined in Table 4.1 the volumes of these materials means that no specific measures need to be put in place to manage the storage of these materials.

Table 4.1 Chemicals required in operation of plant

Material	Volume	Hazardous material	Above thresholds in accordance with SEPP33
Potassium Permanganate	500 kg	Yes – Class 6	No (though is on threshold)
Aluminium Chloralhydrate (ACH)	1,500 L	No	N/A
Citric Acid	1,500 L	No	N/A
Sodium Hypochlorite	20 L	Yes – Class 8	No
Chlorine	280 kg	Yes – Class 5	No
Carbon Dioxide	279 kg	Yes – Class 5	No
Sodium Metabisulfite (SMBS)	100 L	No	N/A
Sodium Carbonate (Soda Ash)	5,000 L	No	N/A

4.4.3 Plant water treatment volumes

The WTP is proposed to have the capacity to treat up to 0.8 megalitres of water per day, with the minimum treatment volumes to be about 0.2 mega litres per day.

4.4.4 Plant operating hours

The plant would potentially operate 22 hours per day subject to the demand for water. Peak demand is during the summer months during school holidays when holiday park usage is at its highest. During the winter months when demand is low the plant would only operate

periodically to treat water to ensure the clear water tanks have suitable supply to meet the demand at the time.

4.4.5 Maintenance and access requirements

During operation, the need for access to the WTP would be minimal with the operation of the plant to be automated with some remote monitoring to occur. Access to the WTP would only be required for the following activities:

- maintenance
- emergency situations
- delivery of materials/chemicals
- removal of sludge material from drying beds
- removal of wash water which is not able to be sent to the drying beds (for example Citric Acid wash water as part of the clean-in-place system.

Access requirements during operation are expected to result in low numbers of vehicles and would occur over a short period of time. Regular movements to the proposal site during operation are expected to be daily visits for plant operators (that is, Cowra Council staff who will be responsible for ongoing management of the WTP) and fortnightly truck visits to remove wastewater from the clean-in-place system. Outside these movements, movements would be associated with the delivery of chemicals which would only be undertaken on demand. These movement are not expected to be substantial.

The proposed WTP includes a clean-in-place system which allows the plant to be cleaned automatically (initiated by on site operator). The frequency of the cleaning process would be determined by the operator and would largely be linked to the number of backwash cycles or on a regular cycle (such as monthly). The final operational arrangement for the clean-in-place system would be determined by Cowra Council as the end operator of the WTP.

5. Statutory and policy compliance

5.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) provides the statutory basis for planning and environmental assessment in NSW. All development is assessed in accordance with the provisions of the EP&A Act and the Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) which provide the framework for environmental planning and development approvals. They include provisions to ensure that the potential environmental impacts of a development are considered as part of the decision making process. Part 4 provides for the control of development that require development consent.

5.1.1 Summary of approval requirements

The site is zoned E2 Environmental Conservation under the provisions of the *Cowra Local Environmental Plan 2012* (Cowra LEP). The proposal is permissible with consent under the Cowra LEP.

The proposal is regional development (refer to section 5.3.3), with the Western Regional Planning Panel being the consent authority. A development application is required in accordance with the requirements of the EP&A Act and the Cowra LEP. The proposal is not designated development and an environmental impact statement is therefore not required.

The proposal is therefore subject to Part 4 of the EP&A Act. This SEE has been prepared to provide the information required by Cowra Council to assess the development in accordance with the requirements of section 4.15 of the EP&A Act.

5.1.2 Assessment under Part 4 of the EP&A Act

Section 4.15 of the EP&A Act outlines the matters that must be taken into consideration by a consent authority when assessing a DA under Section 4.15 of the EP&A Act. Table 5.1 provides a summary of these matters and a reference to where they are addressed in the SEE.

Table 5.1 Section 4.15 of the EP&A Act - Matters for consideration

Matters for consideration - general	Report section
(a) the provisions of:	
(i) any environmental planning instrument	Section 5.2
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Planning Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	Not applicable
(iii) any development control plan	Section 5.4
(iii) any planning agreement that has been entered into under section 7.4 or any draft planning agreement that a developer has offered to enter into under section 7.4	Not applicable
(iv) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), that apply to the land to which the development application relates	Section 5.2
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality	Section 6
(c) the suitability of the site for the development	Section 8.1
(d) any submissions made in accordance with this Act or the regulations	Not applicable at this stage of the development application process
(e) the public interest.	Section 8.1

5.1.3 Designated development

Section 4.10 of the EP&A Act outlines development which is considered to be designated development and therefore requiring an EIS to be submitted as part of the development application. Development that is designated development is listed under Schedule 3 of the Environmental Planning and Assessment Regulation 2000. The proposal is not a type of development listed under Schedule 3, and therefore the proposal is not considered designated development.

5.1.4 Integrated development

Integrated development is development that requires development consent and one or more of the approvals listed in section 4.46 of the EP&A Act. No approvals or licences listed in section 4.46 of the EP&A Act would be required for the proposal, and therefore, the proposal is not considered integrated development.

5.1.5 Crown development

Division 4.6 of the EP&A Act relates to development for which a development application is made by or on behalf of the Crown. WINSW is considered the Crown in accordance with Section 226(1)(b) as WINSW is a public authority and therefore the proposal is considered to be Crown Development.

5.2 Environmental Planning and Assessment Regulation 2000

Division 8 of the EP&A Regulation outlines the matters and considerations for consent authorities they must consider as part of a development application. A review of Clauses 92 to 97A of the EP&A Regulation outlines that there are no specific matters or consideration related to the development type forming part of this development application.

5.3 Environmental planning instruments

5.3.1 Cowra Local Environmental Plan 2012

The Cowra LEP is the primary local planning instrument that sets a range of controls for development in the Cowra local government area. The proposal would be located on land that is zoned E2 Environmental Conservation under the Cowra LEP.

Water treatment facilities in the Cowra LEP are defined as '*a building or place used for the treatment of water (such as a desalination plant or a recycled or reclaimed water plant) whether the water produced is potable or not, and includes residuals treatment, storage and disposal facilities, but does not include a water recycling facility*'. The proposal aligns with this definition, and is considered permissible with consent under the E2 zone and therefore, development consent is required.

The objectives of the E2 zone are as follows:

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.

The proposal has regard to the objectives of the E2 zone, which seek to protect manage and restore areas of high ecological, scientific, cultural or aesthetic value, through the positioning of the new WTP infrastructure largely in disturbed areas in the vicinity of the existing WTP. Whilst the proposal would result in some minor impacts on biodiversity as outlined in section 6.2.2, the proposal would not have an adverse effect on threatened flora species and a low likelihood of an adverse effect on threatened fauna species. The proposal is consistent with the existing land use, for the purpose of water infrastructure, and is considered to be in the public interest to address the issues with the operation and water quality of the existing WTP.

Table 5.2 outlines the other consideration detailed in the Cowra LEP which are relevant to the proposal.

Table 5.2 Considerations under the Cowra LEP

Section of LEP	Requirement/objective	Relevance to proposal
7.1	Earthworks – To ensure that earthworks for which development consent is required will not have a detrimental impact on the environment.	The impacts of the proposal and any relevant earthworks are assessed in section 6.
7.3	Terrestrial biodiversity – To maintain terrestrial biodiversity	The northern portion of the proposal site is mapped as 'biodiversity' under the Cowra LEP and therefore this clause applies. Impacts on biodiversity have been considered in section 6.2.
7.6	Groundwater vulnerability – To maintain function of key groundwater systems and to protect vulnerable groundwater resources	The proposal site is in areas mapped as 'Groundwater vulnerable' under the Cowra LEP. Groundwater impacts are discussed in section 6.8.
7.8	Essential services – Ensuring that required services are available for the proposed development.	The proposal is considered to have the required services readily available these include: • Water: existing raw water pipeline • Electricity: upgrade of existing transmission line to proposal site in consultation with Essential Energy • Waste: All waste from the proposal would be disposed of at an appropriately licensed facility • Vehicular access: Existing road and track would be utilised with upgrades to the existing track forming part of the proposal.

5.3.2 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) includes planning provisions and development control for 25 types of infrastructure works or facilities.

Division 24 of Part 3 relates to water supply systems. Clause 125 (3A) of the Infrastructure SEPP states *(3A)* Development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in a prescribed zone.

The E2 Environmental Conservation zone is not defined as a prescribed zone by Clause 124 of the Infrastructure SEPP, and therefore, the proposal is not considered development without consent in accordance with Clause 125(3A) of the Infrastructure SEPP.

Clause 45 outlines the development to which written notice to the electricity supply authority is required to be provided by the consent authority. In accordance with Clause 45(1)(b)(iii) this notification would be required to be undertaken as the works are located within five metres of an exposed overhead electricity power line. WINSW has been in consultation with Essential Energy throughout the development of the project including the confirmation of the required easement widths for the new transmission line.

5.3.3 State Environmental Planning Policy (State and Regional Development) 2011

State Environmental Planning Policy (State and Regional Development) 2011 (the SRD SEPP) identifies development that is State significant development (SSD) or State significant infrastructure (SSI). SSD and SSI require approval from the Minister for Planning. Clause 4 of Schedule 3 of the SRD SEPP includes development for the purpose of water storage or water treatment facilities. For development to be considered SSI under this clause, it must be carried out by or on the behalf of a public authority (WINSW on behalf of Cowra Council) and have a capital investment of more than $30 million. As the proposal has a capital investment value of $5.6 million, the proposal is not considered State Significant Infrastructure under the SRD SEPP. The proposal would therefore not require an EIS under the EP&A Act.

SRD SEPP also outlines development which is considered regionally significant development. The proposal is Crown Development (refer section 5.1.5) and would have a capital investment value of $5.6 million. Under Clause 20 of the SRD SEPP the development is therefore considered regional development and therefore the project would be referred to the Western Regional Planning Panel for determination.

5.3.4 State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 (VNRA SEPP) aims to protect the biodiversity values of trees and other vegetation in non-rural areas of the State and to preserve the amenity of these areas through the preservation of trees and vegetation. The VNRA SEPP applies to the proposal due to its positioning within the E2 Environmental Conservation under the Cowra LEP in accordance with Section 5(1)(b) of the VNRA SEPP.

Part 2 of the VNRA SEPP outlines vegetation clearing which requires authority. In accordance with Section 8 of the VNRA SEPP an authority to clear vegetation is not required for development which is authorised under section 60O of the *Local Land Services Act 2013*. Under the *Local Land Services Act 2013* the proposal does not require an authority as the clearing of vegetation would be authorised by a development consent under Part 4 of the EP&A Act (this development application).

5.4 Cowra Development Control Plan 2014

The matters for consideration under the Cowra Development Control Plan 2014 (Cowra DCP) as relevant to the proposal are outlined in Table 5.3.

Table 5.3 Matters for consideration under the Cowra DCP

Section	Control	Comment
Part M.1 Section 1.4	Off street parking	The proposal is not a development type identified in section M.1 of the Cowra DCP. Parking has not specifically been identified within the proposal site, however there is adequate space for the parking of vehicles as per the existing operation of the WTP within the proposal site.
Part O.2	Bushfire management	The proposal is not a development that has any specific bushfire protection requirements. An assessment has been completed on the development in accordance with Planning for Bushfire Protection (RFS, 2019) in section 6.5.

Section	Control	Comment
Part P	Crime Prevention through Environmental Design	The proposal site is considered to be a low crime risk due to its remote location and that the existing WTP has operated for a number of years with no significant crime issues. The new WTP would be operated by Council in a similar manner to the existing WTP.
Part Q Section 1.4	Land management – erosion and sedimentation plan	The proposed is expected to result in less than 2,500 square metres of ground disturbance and therefore an erosion and sedimentation control plan has been prepared. A copy of this plan is located in Appendix A.

5.5 Other relevant NSW legislation

5.5.1 Water Management Act 2000

The Water Management Act 2000 (WM Act) is the primary piece of legislation established to provide sustainable and integrated management of water in NSW. The *Water Management Act 2000 (WM Act)* governs the sustainable and integrated management of the State's water for the benefit of both present and future generations.

No approvals would be required under the WM Act as the take of water does not form part of this application with water to be sourced as per the existing situation. The proposal would connect into the existing pipeline which supplies the existing WTP with water. The operation of the plant would be as per existing WTP with no additional water required to be drawn for treatment.

5.5.2 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) provides for the sustainable management of fish and fish habitats and outlines approval processes for the activities that may impact on threatened fish species and habitats.

The proposal would not trigger the requirement for any approvals under the FM Act as it would not result in dredging of water land, or result in impacts on fish passage, marine vegetation or result in the construction of an existing dam, weir or reservoir.

5.5.3 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) aims to conserve biodiversity at a bioregional and state scale and lists a number of threatened species, populations and ecological communities to be considered in deciding whether there is likely to be a significant impact on threatened biota, or their habitats.

Section 7.2(1) of the BC Act outlines how a development would be considered likely to significantly affect threatened species and communities, this includes:

(a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or

(b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or

(c) it is carried out in a declared area of outstanding biodiversity value.

As outlined in section 6.2.2 and in Appendix B, the proposal is unlikely to significantly affect threatened species and a biodiversity development assessment report is not required to accompany the development application in accordance with section 7.7(2) of the BC Act.

The development would not exceed the biodiversity offsets scheme threshold and therefore pursuant to Section 7.2(1)(b) the proposal would be considered to not have significant impacts.

The proposal would also not impact upon any declared areas of outstanding biodiversity value and therefore the proposal is not considered likely to significantly affect threatened species in accordance with Section 7.2(1)(c).

5.5.4 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is concerned with all aspects of heritage conservation ranging from basic protection against indiscriminate damage and demolition of buildings and sites, through to restoration and enhancement.

Heritage places and items of particular importance to the people of NSW are listed on the State Heritage Register. Approval under section 60 of the Heritage Act is required for any direct impacts on a state listed heritage item. Approval from the NSW Heritage Council under section 139 of the Heritage Act is required prior to the activities likely to disturb a relic while section 140 of the Heritage Act provides for the application for a permit.

The proposal would not impact upon any heritage items with the nearest being located about 180 metres to the south of the proposal site (Wyangala Dam). As the proposal would not impact beyond the construction footprint, which excludes the heritage item, no approvals under the *Heritage Act 1977* are required.

5.5.5 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) promotes and regulates the management of national parks and historic sites or places of cultural value within the landscape and the conservation of certain fauna, native plants and Aboriginal objects and places.

The NPW Act provides the basis for legal protection and management of Aboriginal sites in NSW. All Aboriginal objects within the state of New South Wales are protected under Part 6 of the NPW Act.

The proposal would not result in any impacts on any known Aboriginal items or areas of potential archaeological deposit and therefore no approvals are required under the NPW Act. Further discussion on impacts to Aboriginal heritage are outlined in section 6.3.

5.5.6 Crown Land Management Act 2006

The *Crown Land Management Act 2016* (Crown Land Act) provides for the ownership, use and management of the Crown land of New South Wales. It requires environmental, social, cultural heritage and economic considerations to be taken into account in decision-making about Crown land. It provides for the consistent, efficient, fair and transparent management of Crown land for the benefit of the people of New South Wales, together with facilitating the use of Crown land by the Aboriginal people of New South Wales.

The proposal site is located within Crown Land, however no permanent infrastructure is positioned on this land with construction only works located on this land to aid with the management of erosion and sedimentation issue. Water Infrastructure NSW will consult with Department of Planning, Industry and Environment – Crown Lands with regards to any licencing or easement required for these works.

5.5.7 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (PoEO Act) aims to, among other things, protect, restore and enhance the quality of the environment in NSW. It includes offences for polluting the environment and establishes a regime of environment protection licences (EPL). The PoEO Act prohibits carrying out development works without a licence of scheduled development work for scheduled activities (as identified in Schedule 1 of the PoEO Act).

The proposal is not listed in Schedule 1 of the PoEO Act and therefore is not considered a scheduled activity based on the overall development. The proposal does however involve the storage of chemicals (refer to Table 4.1) which under Clause 9 of Schedule 1 is considered a scheduled activity subject to criteria being met. The proposal, while requiring the storage of chemicals, would not result in the storage of volumes which would trigger the development to be a scheduled activity. An EPL is therefore not required for the proposal.

5.6 Commonwealth legislation

5.6.1 Environment Protection and Biodiversity Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage environmental values considered to be of national environmental significance.

The EPBC Act requires approval from the Commonwealth Minister for the Environment and Resources for actions that may have a significant impact on listed matters of national environmental significance (MNES).

The primary objective of the EPBC Act is to 'provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance' (MNES). Environmental approvals under the EPBC Act may be required for an 'action' that has, will have or is likely to have a significant impact on:

- MNES matters
- The environment on Commonwealth land (whether or not the action is occurring on Commonwealth land)

- The environment anywhere in the world, where the action is to be undertaken by a Commonwealth agency

Approval for such an action may be required from the Australian Government Minister for the Environment.

An 'action' is considered to include a project, development, undertaking, activity or series of activities. MNES matters include:

- World heritage areas
- National heritage places
- Wetlands of international importance (i.e. Ramsar wetlands)
- Nationally listed threatened species and ecological communities
- Listed migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions.

If the proponent considers that an action will have or is likely to have significant impacts on a MNES or on Commonwealth land, a referral is made to the Australian Government Department of Agriculture, Water and the Environment (DAWE). A proposal may also, but is not required to be referred to the DAWE, where an action will not have or is not likely to have a significant impact. If it is determined through the referral process by the DAWE that an action is likely to have a significant impact on a MNES, or on Commonwealth land, then the project is a 'controlled action' and approval from the Minister would be required.

An EPBC Act protected matters search was undertaken on 6 August 2021 which identified several MNES that may occur in, or may relate to, the proposal area. Table 5.4 provides a summary of the results.

Table 5.4 EPBC protected matters search results

MNES matters	Results	Status
World heritage areas	Nil	N/A
National heritage places	Nil	N/A

MNES matters	Results	Status
Wetlands of international importance (RAMSAR sites)	Four identified: Banrock station wetland complex 700 - 800km downstream Hattah-kulkyne lakes 600 - 700km downstream Riverland 700 - 800km downstream The Coorong, and lakes Alexandrina and Albert wetland 800 - 900km downstream	
Commonwealth marine areas	Nil	N/A
Great Barrier Reef Marine Park	Nil	N/A
Threatened ecological communities	Three communities identified	
	Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	Endangered
	Natural Temperate Grassland of the South Eastern Highlands	Critically endangered
	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically endangered

MNES matters	Results	Status
Threatened species	25 species identified	
	11 bird species	Critically endangered (4) Endangered (2) Vulnerable (5)
	4 fish species	Critically endangered (1) Endangered (2) Vulnerable (1)
	1 frog species	Endangered (1)
	1 insect species	Critically endangered
	7 mammal species	Endangered (1) Vulnerable (6)
	6 plant species	Endangered (3) Vulnerable (3)
	1 reptile species	Vulnerable (1)
Listed migratory species	1 migratory marine bird species	
	4 migratory terrestrial species	Vulnerable (1)
	6 migratory wetland species	Critically endangered (2)

The proposal will not impact upon any world heritage areas, national heritage places, Commonwealth marine areas or the Great Barrier Reef Marine Park. Potential impacts on threatened species, threatened ecological communities, or migratory species that are listed under the EPBC Act are assessed in section 6.2. This assessment determined that the proposal will not have a significant impact on these MNES. Based on this a referral is not considered required for the proposal.

6. Likely impacts of the development

6.1 Overview

This section contains an assessment of the impacts of the proposal in accordance with the matters for consideration under section 4.15(1) of the EP&A Act. It describes the existing environment, assesses the potential environmental impacts of the proposal, and recommends mitigation measures to minimise and impacts.

6.2 Biodiversity

A biodiversity assessment report has been prepared by the SGJV. A summary of this assessment is located in the below sections while a copy of the report is provided in Appendix C.

6.2.1 Existing environment

Vegetation

Vegetation within the proposal site contains a mixture of cleared land and areas containing native vegetation with a degraded understory with introduced groundcover in areas which have been subject to past clearing and in the vicinity of existing infrastructure. A total of 0.9 hectares of vegetation is located within the proposal site, with 0.63 hectares of this consisting of native vegetation. This vegetation is not listed under either the BC Act or the EPBC Act.

The remaining areas within the proposal site are considered to be non-native vegetation or cleared areas.

Table 6.1 outlines the vegetation which is located within the proposal site with these areas shown in Figure 6.1.

Table 6.1 Vegetation within the proposal site

Plant community type	PCT ID	Condition	BC Act Status	EPBC Act Status	Area in proposal site (ha)
Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments (PCT 339)	339	Degraded understorey	Not listed	Not listed	0.63
Non-native vegetation	-	Poor	Not applicable	Not applicable	0.27
Cleared areas	-	-	Not applicable	Not applicable	0.61
Total area of vegetation					**0.90**
Total site area					**1.51**

Flora

A total of 69 flora species were recorded on the proposal site and consisted of 37 native species and 32 exotic species.

No threatened fauna was recorded in the proposal site however potential habitat is present for the following species:

- Yass Daisy (*Ammobium craspedioides*) – listed as a 'vulnerable species' under the BC Act and EPBC Act.
- Small Purple-pea (*Swainsona recta*) – listed as a 'endangered species' under the BC Act and EPBC Act.
- Woolly Ragwort (*Senecio garlandii*) – listed as a 'vulnerable species' under the BC Act.

Targeted surveys, conducted at the proposal site during the appropriate time of year for these species to be present found no sightings. As such, these species are unlikely to be impacted by the proposal. All other threatened species previously recorded or predicted to occur in the locality are unlikely to occur in the proposal site due to a lack of habitat.

Fauna

The proposal site contains the follow two broad habitat types for fauna:

- rocky woodlands
- non native vegetation, including areas of exotic grassland, and developed areas.

Detailed description of these two habitat types is located in section 5.7 of Appendix B including species which are likely to occur within the proposal site. A total of 15 threatened fauna species are considered to have a moderate or high likelihood of occurrence within the proposal site.

Table 6.2 Threatened species with potential to occur within the proposal site

Scientific name	Common name	BC Act	EPBC Act	Recorded in the study area	Likelihood of occurrence in proposal site
Ninox connivens	Barking Owl	V	-	Yes	Moderate (foraging only)
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Yes	High
Stagonopleura guttata	Diamond Firetail	V	-	Yes	Moderate
Artamus cyanopterus	Dusky Woodswallow	V	-	Yes	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Yes	Moderate (foraging only)
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Yes	Moderate
Melanodryas cucullata	Hooded Robin (south-eastern form)	V	-	Yes	Moderate

Scientific name	Common name	BC Act	EPBC Act	Recorded in the study area	Likelihood of occurrence in proposal site
Hieraaetus morphnoides	Little Eagle	V		Yes	High
Grantiella picta	Painted Honeyeater	V	V	No	Moderate
Petroica boodang	Scarlet Robin	V	-	Yes	Moderate
Chthonicola sagittata	Speckled Warbler	V	-	Yes	High
Lophoictinia isura	Square-tailed Kite	V	-	Yes	Moderate
Polytelis swainsonii	Superb Parrot	V	V	Yes	Moderate
Neophema pulchella	Turquoise Parrot	V	-	Yes	High (foraging only)
Daphoenositta chrysoptera	Varied Sittella	V	-	Yes	High
Haliaeetus leucogaster	White-bellied Sea-eagle	V	V	Yes	Moderate
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Yes	Moderate (foraging only)
Myotis macropus	Southern Myotis	V	-	Yes	Moderate (roosting only)
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	V	-	Yes	Moderate

Scientific name	Common name	BC Act	EPBC Act	Recorded in the study area	Likelihood of occurrence in proposal site
Petaurus norfolcensis	Squirrel Glider	V	-	No	Moderate (foraging only)

Note: V – Vulnerable, E – Endangered, CE – Critically Endangered

No migratory species were recorded during field surveys. There is no habitat for migratory waders or wetland birds within the proposal site, however habitat is present for these species in the locality. There is some potential for the following migratory woodland species to forage on occasion within the proposal site:

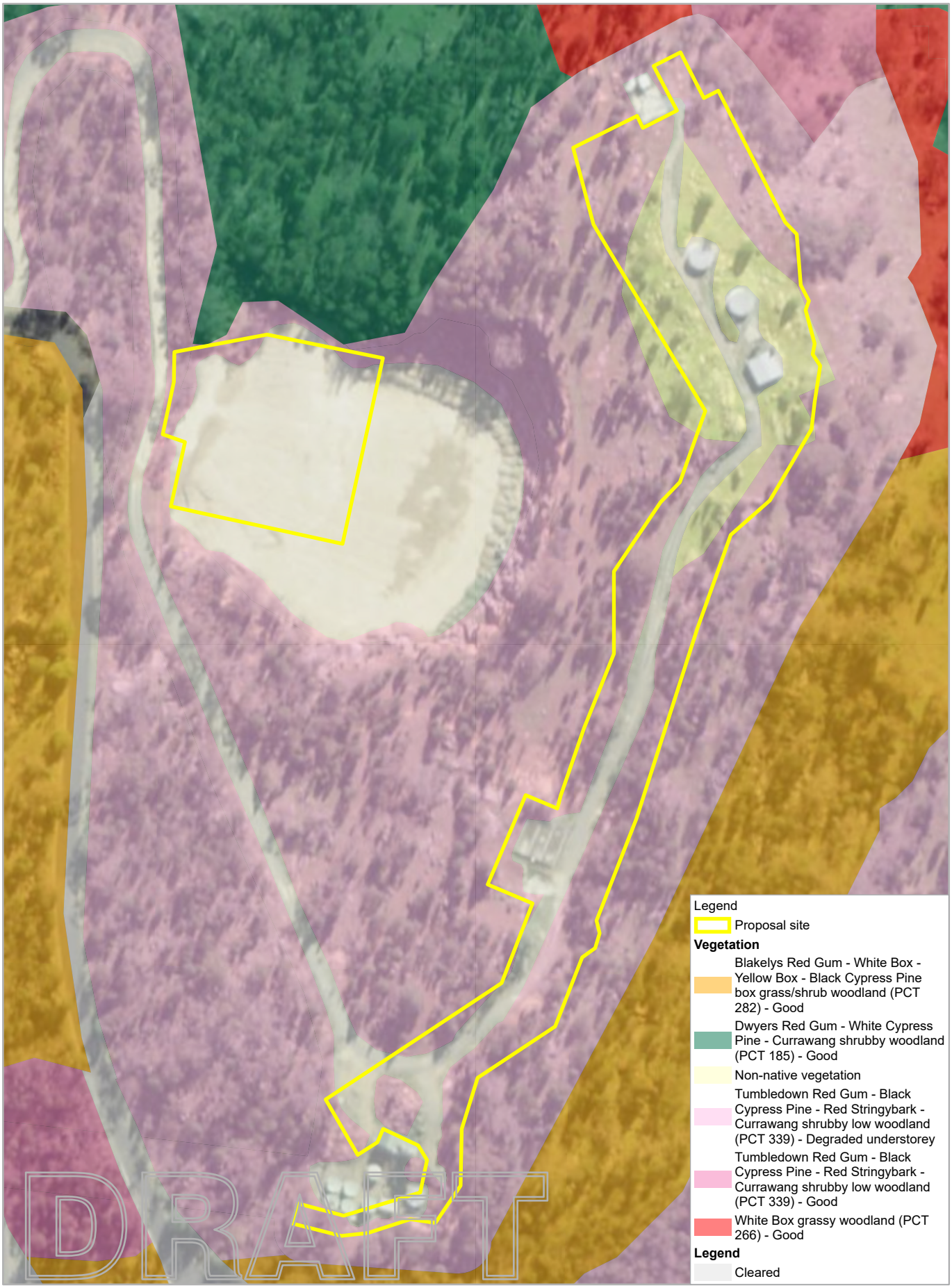
- White-throated Needletail (*Hirundapus caudacutus*)
- Yellow Wagtail (*Motacilla flava*)
- Satin Flycatcher (*Myiagra cyanoleuca*)
- Rufous Fantail (*Rhipidura rufifrons*).

Priority weeds

Three priority weeds species were identified within the proposal site, these include:

- Bridal Creeper (*Asparagus asparagoides*)
- St. John's Wort (*Hypericum perforatum*)
- Blackberry (*Rubus fruticosus species aggregate*).

Blackberry and Bridal Creeper are also listed as weeds of national significance (WONS) under the National Weeds Strategy.



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Stantec

GHD

WaterNSW

Wyangala Water Treatment Plant
Biodiversity Assessment

Vegetation

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FIGURE 6.1

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Print date: 17 Aug 2021 - 18:06

Data source: Footprints - GHD 2020; Cadastre - Sixmaps 2020; Road - LPI DTDB 2017;public/NSW_Imagery: © Department of Customer Service 2020public/NSW_Imagery: © Department of Customer Service 2020. Created by: Imanasan

6.2.2 Impact assessment

Construction

Clearance of vegetation

The proposal would result in direct impacts on 0.63 hectares of native vegetation. Up to 0.27 hectares of non-native vegetation comprising exotic grassland would also be removed. The majority of this vegetation is in moderate condition with a degraded understorey and has a moderate biodiversity value given its landscape context and habitat value for threatened species. No threatened ecological communities are to be cleared as part of the proposal.

It is unlikely the clearing of native vegetation within the proposal site would significantly fragment or reduce the overall connectivity of this vegetation, which would remain connected largely via the vegetation in the western portion of the study area.

The proposal would remove a small proportion of individual plant species, PCTs and associated habitats comparative to that in the surrounding area and locality. The clearing of native vegetation would involve the removal of a moderate diversity of non-threatened native plants, including mature trees.

It is noted that the above impacts are considered likely to be less with clearance of the proposed power transmission line easement (if required by Essential Energy) would only involve the removal of woody vegetation and is likely to retain any low vegetation or groundcover vegetation. Where possible areas within the proposal footprint while assumed to be completely cleared for the purpose of the above, the area to be cleared would be minimised where possible.

Impacts to threatened flora species

There is broadly suitable habitat for three threatened flora species within the proposal site. No threatened flora species were identified during targeted field surveys during the appropriate seasonal survey period.

Given this, the lack of previous records from the study area, and the relatively small area of potential habitat that would be removed, the proposal has a low likelihood of having an adverse impact on these species. As such, assessments of significance have not been completed for these species.

Removal of habitat and habitat resources

The vegetation to be impacted provides potential habitat resources for native fauna species, including threatened species of fauna recorded and likely to occur in the proposal site and surrounds. The proposal will result in impacts to 0.63 hectares of native vegetation and would include the removal of mature trees. The vegetation is a small area of disturbed edge habitat.

The native vegetation to be removed has moderate habitat value for woodland fauna species, including birds, bats and mammals. The removal of woodland will have a minor impact on the availability of foraging, roosting, nesting and movement habitat for a variety of woodland dependent fauna.

Areas of rocky outcrop and scattered rocks occur in the proposal site and occur throughout both woodland and exotic grassland vegetation. These areas are likely to provide habitat for a variety of common reptile species, which would potentially be impacted by the proposal.

In the context of the areas of remaining native vegetation surrounding the proposal site, the proposal would remove a small proportion of available foraging resources for local populations of native fauna with a large continuous patch of native vegetation located to the north, south and west of the proposal site.

Impacts to threatened fauna species

As outlined above habitat in the proposal site has the potential to be utilised by a number of threatened fauna species.

Assessments of significance pursuant to Section 7.3 of the BC Act (5-part test) 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. These include:

- hollow-dependent mammals that may forage in the proposal site and den/roost in nearby habitat - Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat
- hollow-dependent woodland birds that are likely to forage in the proposal site and may breed/nest in nearby habitat - Turquoise Parrot and Brown Treecreeper
- woodland birds that are likely to forage in the proposal site and may breed/nest in the study area - Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin.

It was concluded for the above assessments of significance that impacts resulting from the proposal on these species was not considered significant for the following common reasons while more details reasons for each species are outlined in Appendix B:

- removal of 0.63 hectares of native vegetation represents a small area of habitat which is linked to much large tracts of habitat vegetation
- reduced quality of vegetation within the proposal site in particular the degraded understorey
- lack of hollow-bearing trees for species requiring such habitat
- proposal would not increase habitat fragmentation.

A small number of highly mobile, wide ranging species such as the Little Eagle and Barking Owl that have a moderate likelihood of occurring in the proposal site but are unlikely to be impacted by the proposal given the absence of breeding habitat and the very small area of potential foraging habitat that would be removed. Assessments of significance have not been prepared for these species.

Given the lack of likely impacts on important habitat for migratory species which may occur in the proposal site, no assessments of significance for these species have been prepared.

Other impacts

Table 6.3 outlines other potential impacts resulting from the proposal. These impacts are discussed in further detail in Appendix B.

Table 6.3 Other biodiversity impacts during construction

Impact	Discussion
Fauna injury and mortality	Clearing activities could result in the injury or mortality of some individuals of less mobile fauna species and other small terrestrial fauna that may shelter in vegetation within the proposal site during clearing activities. While no obvious hollows were recorded in the proposal site, there is a potential risk of injury or mortality to species which may be using inconspicuous crevices and fissures under bark not detected during surveys. More mobile native fauna such as birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the

Impact	Discussion
	proposal site are likely to move into adjoining woodland areas during clearing.
Fragmentation and isolation of habitat	Vegetation on site is already fragmented due to the presence of existing clearing and infrastructure. Additional clearing will cause some further fragmentation and widen the existing gap but not likely to create a barrier to movement or isolate any areas of habitat for the species known or likely to occur. Given the small extent of vegetation clearing proposed, it is unlikely that the proposal would create any significant or new barriers to the movement of pollinator and seed dispersal vectors, such as insects and birds.
Indirect impacts	Indirect impacts caused by the proposal would potentially include: • weed invasion and edge effects • introduction and spread of weeds, pests and pathogens • noise, vibration and light impacts on fauna • erosion and sedimentation. These impacts are considered to be manageable through the implementation of mitigation measures. Further details of these impacts are outlined in section 7.2.2 of Appendix B.

Operation

Impacts on biodiversity values would be largely restricted to the construction phase of the proposal. There are however a number of potential impacts that may occur as a result of the operation of the proposal. These include:

- erosion and sedimentation as a result of runoff from hard stand areas
- introduction of weed propagules by vehicle and/or residents/visitors
- fauna mortality as a result of collision with vehicles
- noise and lights associated with the operation of the WTP

Given current land uses in the proposal site, the proposal would not result in a substantial change to the impacts already experience on site. The potential impacts are linked to human occupation of the site and are likely to persist indefinitely.

Key threatening processes

A key threatening process (KTP) is a process that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community. A process can be listed as a KTP if it could:

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

KTPs are listed under the BC Act, FM Act and EPBC Act. Some KTPs are listed under more than one Act. Table 6.4 outlines the key threatening process which are relevant to the proposal.

Table 6.4 Key threatening processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	BC Act EPBC Act	The construction footprint has been located in previously disturbed areas so as to avoid impacts on native vegetation where possible. The proposal would result in the clearing of up to 0.63 hectares of native vegetation. Implementation of vegetation management measures would minimise impacts on native vegetation where possible.
Invasion of plant communities by perennial exotic grasses	BC Act	Construction activities have the potential to introduce and facilitate the establishment of perennial exotic grasses in the proposal site. Serrated Tussock is prevalent in the landscape surrounding Wyangala Dam, although not recorded in the proposal site. Weed management procedures would be implemented to limit any further spread of weeds as a result of the proposal.

KTP	Status	Comment
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Construction activities have the potential to introduce Myrtle Rust to the proposal site and study area. Implementation of hygiene protocols would minimise the risk of introduction or spread of this pathogen.
Infection of native plants by *Phytophthora cinnamomi*	BC Act EPBC Act	The proposal has the potential to introduce the pathogen to the proposal site and study area, through the transport and movement of plant, machinery and vehicles. Implementation of hygiene protocols would minimise the risk of introduction or spread of this pathogen.

6.2.3 Mitigation measures

Table 6.5 details the mitigation measures that will be implemented to manage potential impacts on biodiversity.

Table 6.5 Mitigation measures - biodiversity

Impact	Measure	Responsibility	Timing
Vegetation clearance	Prior to the commencement of any work in or adjoining areas of native vegetation, a survey will be carried out to mark the construction impact boundary. The perimeter of this area will be fenced using high visibility fencing and clearly marked as the limits of clearing. All vegetation outside this fence line will be clearly delineated as an exclusion zone to avoid vegetation and habitat removal. Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Contractor	Pre-construction
Vegetation clearance	Stockpiles of fill or vegetation will be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Contractor	Construction
Introduction of Weeds and Pathogens	All machinery will be appropriately cleaned prior to entry to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust	Contractor	Construction

Impact	Measure	Responsibility	Timing
	(*Pucciniales fungi*) in accordance with the national best practice guidelines.		
Removal of fauna habitat	Prior to the commencement of any vegetation clearing the following will be undertaken: • Pre-clearance fauna surveys, undertaken by a suitably qualified ecologist(s) prior to the commencement of any clearing activities. • The presence of significant environmental or priority weed infestations will be identified and communicated to the contractor • Surrounding vegetation (i.e. non-hollowing bearing trees and understory plants) will be inspected by the ecologist for the presence of fauna.	Contractor	Construction
Removal of fauna habitat	Suitable bush rock habitat will be relocated to nearby adjacent areas outside of the construction footprint and checked by a qualified ecologist prior to construction commencing for any resident fauna.	Contractor	Construction
Removal of fauna habitat	Staged vegetation clearing, commencing with the most disturbed vegetation and progressing towards higher quality	Contractor	Construction

Impact	Measure	Responsibility	Timing
	vegetation to increase the opportunity for fauna to vacate the site and disperse into areas of adjoining habitat to evade injury.		
Removal of fauna habitat	Where possible, clearance of hollow-bearing trees will occur outside of the breeding season of bats and birds with the potential to occur at the site (typically during September-December), and periods when some species (microbats) are in torpor (typically during June-August).	Contractor	Construction

6.3 Aboriginal heritage

A due diligence archaeological assessment has been prepared by Navin Officer Heritage Consultants Pty Ltd in accordance with the NSW Office of Environment and Heritage *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010). A summary of this assessment is located in the below sections while a copy of the report is provided in Appendix C.

6.3.1 Existing environment

A desktop review of historical data, archaeological reports and Aboriginal heritage databases was conducted for the proposal site. Details of this desktop assessment are outlined in Appendix C.

In the broader area of the project site, a review of historical searches undertaken in 2020 identified 339 Aboriginal sites within a 3,000 square kilometre area centred on the dam. Most of these sites are located on the northern area of Wyangala Dam with some located at Copperhead Nature Reserve and Near Reids flat. Generally, these Aboriginal sites are located close to water.

Since the completion of the above search further survey has been undertaken as part of the draft Aboriginal Cultural Heritage Assessment being prepared for the Wyangala Dam Wall Raising project (SGJV 2021).

An archaeological field survey of the proposal site undertaken on the 11 August 2020 did not identify any new Aboriginal items or potential archaeological deposits.

6.3.2 Impact assessment

The impacts of the proposal would be localised and limited to the proposal site. As there are no recorded Aboriginal sites in the proposal site or in its immediate vicinity, impacts on Aboriginal heritage are not predicted. Should previously unknown heritage items be discovered during construction, the measures discussed in section 6.3.3 would be taken.

6.3.3 Mitigation measures

Table 6.6 details the mitigation measures that will be implemented to manage potential impacts on Aboriginal heritage.

Table 6.6 Mitigation measures – Aboriginal heritage

Impact	Mitigation measure	Responsibility	Timing
Unexpected finds	Should archaeological material be found during construction, the unexpected finds protocol (Appendix 2 of Appendix C) will be enacted.	Contractor	Construction

6.4 Non-Aboriginal heritage

6.4.1 Existing environment

Background research on the historical context of the site and heritage listed items was conducted, including reviewing the following heritage databases/lists:

- Commonwealth and National Heritage Lists
- NSW State Heritage Register
- Section 170 NSW Government agency heritage and conservation registers
- Cowra LEP.

There are no heritage items within or in proximity to the proposal site. The closest identified site, Wyangala Dam, is located 180 metres south of the proposal, and is listed under the s170 Heritage Register for WaterNSW.

6.4.2 Impact assessment

Impacts of the proposal would be localised and limited to the proposal site, and therefore no impacts on any non-Aboriginal heritage items are expected.

6.4.3 Mitigation measures

Table 6.7 details the mitigation measures that will be implemented to manage potential impacts on non-Aboriginal heritage.

Table 6.7 Mitigation measures – non-Aboriginal heritage

Impact	Mitigation measure	Responsibility	Timing
Discovery of heritage items	If potential relics or archaeological items are uncovered during the works, all works in the vicinity of the find will cease and the advice from a qualified heritage specialist be sought. Water Infrastructure NSW project representatives will also be informed.	Contractor	Construction

6.5 Noise and vibration

6.5.1 Existing environment

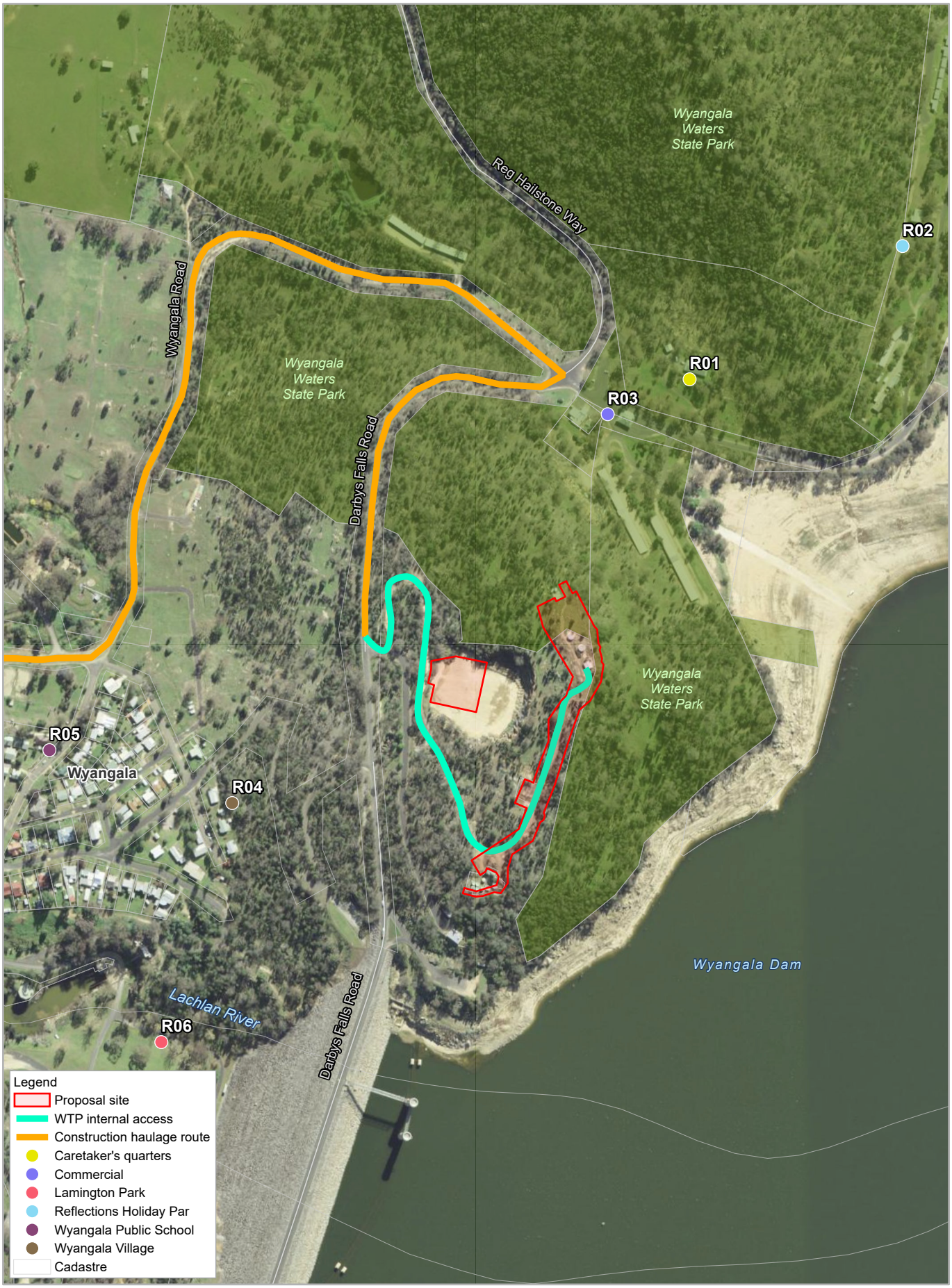
Sensitive receivers

The nearest sensitive receivers with the potential to be impacted by noise during construction and operation are presented in Table 6.8.

Table 6.8 Noise sensitive receivers

Receiver ID	Receiver Type	Land use planning zone	Description	Approx. distance and direction from WTP
R01	Caretaker's quarter	E2 – Environmental Conservation	Park Manager's residence on Reg Hailstone Way	280 m to the north
R02	Temporary accommodation	SP3 – Tourist	Wyangala Waters Holiday Park	540 m to the north east
R03	Commercial	SP3 – Tourist	Wyangala Waters Holiday Park and Postal office	225 m to the north

Receiver ID	Receiver Type	Land use planning zone	Description	Approx. distance and direction from WTP
R04	Residential	RU5 - Village	Residences along Wirong Road and Wurabinda Road	425 m to the south east
R05	Educational institute	RU5 - Village	Wyangala Dam Public School	615 m to the south east
R06	Passive recreation area	RU1 – Primary production	Lamington Park	660 m to the south east



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Metres

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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Stantec GHD

Water Infrastructure NSW
Wyangala Water Treatment Plant
Statement of Environmental Effects

Proposal site, construction haulage route and location of sensitive receivers

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Figure 6.2

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Existing noise environment

The existing noise environment comprises of intermittent road traffic noise from the local road network, boat activity on Lake Wyangala and natural sounds such as birds and wind which is typical for a rural environment.

Noise monitoring has been undertaken as part of preparation of the Wyangala Dam Wall Raising EIS noise and vibration impact assessment at four locations within Wyangala. The rating background levels (RBLs) at all monitoring locations were below the minimum RBLs as specified in the Noise Policy for Industry (NSW EPA, 2017). As such. to establish the construction noise management levels and the intrusiveness noise levels for the proposal, the minimum assumed RBLs have been used as presented in Table 6.9.

Table 6.9 Minimum assumed RBLs

Time of day	Minimum assumed RBL (L_{A90})
Day	35 dBA
Evening	30 dBA
Night	30 dBA

Construction noise management levels

As outlined in the Interim Construction Noise Guideline (ICNG) (DECC, 2009), construction noise management levels (NMLs) at sensitive receivers are shown in Table 6.10. The construction NMLs during recommended standard hours represent a noise level, that if exceeded would require management measures including:

- reasonable and feasible work practices
- contact with the residences to inform them of the nature or works to be carried out, the expected noise levels and durations and contact details.

Construction is anticipated to take about 12 months to complete, however the back end of this period would be for testing and commissioning purposes with less intensive construction occurring during this period. Where possible construction would be undertaken during recommended standard hours as outlined in the ICNG.

Table 6.10 Construction noise management levels

Receiver Type	Time period	Construction noise management levels, $L_{Aeq(15min)}$
Residential	Day – standard hours	45 dBA
	Day – outside of standard hours	40 dBA
	Evening – outside of standard hours	35 dBA
	Night – outside of standard hours	35 dBA
Commercial	When in use	70 dBA
Wyangala Public School	When in use	55 dBA[1]
Wyangala Waters Reflections Holiday Park [2]	When in use	60 dBA
Lamington Park	When in use	60 dBA

Notes:

1) External noise management levels are based on a 10 dB noise reduction through an open window
2) The ICNG does not prescribe a NML for temporary accommodation land uses. However, the ICNG states that the NML for commercial and industrial land uses are based on the maximum amenity noise levels in the NSW Industrial Noise Policy (EPA) plus 5 dBA. This assumes all construction work will be undertaken during the day period.

Receivers that receive noise levels above 75 dBA are classified as highly noise affected. The highly affected noise level represents the point above which there may be strong community reaction to noise. Where construction noise is experienced above this level, the relevant authority (consent, determining or regulatory) may require respite periods where very high noise activities would have restricted hours.

Construction vibration management levels

The screening criteria presented in Table 6.11 have been adopted and is based on vibration guideline values from the following documents:

- *Assessing vibration: A Technical Guideline* (DEC, 2006) for human comfort
- British Standard 7385-2 1993 *Evaluation and measurement for vibration in buildings Part 2 - Guide to damage levels from ground borne vibration for cosmetic damage to buildings.*

Table 6.11 Vibration screening criteria

Receiver Type	Peak particle velocity (PPV) screening criteria
Human comfort screening criteria at residences	1 mm/s
Cosmetic damage to reinforced structures	25 mm/s
Cosmetic damage to unreinforced structures	7.5 mm/s

Notes:

1) It is likely that vibration at this level in residential environments will cause complaints but can be tolerated if prior warning and explanation has been given to residents (BS 5228.2 – 2009), Code of Practice Part 2 Vibration
2) Based on British Standard 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2 - Guide to damage levels from ground borne vibration. Guideline values have been reduced by 50% to account for potential dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance

Construction traffic

The application notes for the Road Noise Policy (RNP) (DECCW, 2011) states:

> *For existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.*

This is also applicable for construction noise. As such, if construction road traffic noise is within a 2 dB(A) increase of current levels then the objectives of the Road Noise Policy are achieved.

Where construction traffic generation results in a noise increase greater than 2 dBA above current levels, then the road traffic noise criteria in Table 6.12 would apply.

Table 6.12 Construction traffic criteria

Development type	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 Leq(15hr)	55 Leq(9hr)
Existing residence affected by additional traffic on local roads generated by land use developments	55 Leq(1hr)	50 Leq(1hr)

Operational noise

The Noise Policy for Industry (NPfI)(NSW EPA, 2017) provides guidance on the assessment of operational noise impacts. The guideline includes both intrusiveness and project amenity noise levels that are designed to protect receivers from noise significantly louder than the background level, and to limit the total noise level from industry near a receiver.

For residential receivers, the project noise trigger levels are provided in Table 6.13. The project noise trigger levels reflect the most stringent noise level requirements derived from the intrusiveness (RBL + 5 dBA at residences) and project amenity noise level (recommended ANL – 5 dBA). The NPfI recommends that the $L_{Aeq(15min)}$ is equal to the $L_{Aeq(period)}$ + 3 dBA, unless an alternative approach can be justified.

Daytime, evening and night-time project noise trigger levels (PNTLs) should aim to be achieved as the WTP is expected to be in operation 22 hours per day, seven days per week. For non-residential receivers, the project amenity noise level is set at 5 dBA below the recommended amenity noise level for the various land use types and are shown in Table 6.14.

Table 6.13 Residential project noise trigger levels, dBA

Time period	Minimum RBL ($L_{A90,(15\ min)}$)[1]	Intrusive noise level ($L_{A90,(15\ min)}$)	Recommended amenity noise level ($L_{Aeq,(period)}$) – rural residential	Project amenity noise level, $L_{Aeq,(15min)}$[3]	Project noise trigger level, $L_{Aeq,(15min)}$[4]
Day[2]	35	40	50	48	40
Evening[2]	30	35	45	43	35
Night[2]	30	35	40	38	35

Notes:

1. The minimum project intrusive noise level $L_{Aeq(15min)}$ of 40 dBA has been used for the day period and $L_{Aeq(15min)}$ 35 for the night period
2. The NPI defines Day as 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sunday & Public Holidays. The evening period is between 6 pm to 10 pm. The night is the remaining period.
3. The NPfI recommends that the $L_{Aeq(15min)} = L_{Aeq(period)}$ + 3 dBA
4. Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the project noise trigger levels, except where otherwise specified below.

Table 6.14 Non-residential project amenity noise levels, dBA

Time period	Time period	Recommended amenity noise level ($L_{A90,(15\ min)}$)	Project amenity noise level
Commercial	When in use	65	63
Wyangala Public School	When in use	45	43
Lamington Park	When in use	50	48
Wyangala Waters Holiday Park	Day	55	53
	Evening	50	48
	Night	45	43

6.5.2 Impact assessment

Construction noise impacts

Construction works are anticipated to be completed during standard hours. It is expected that construction would take up to 12 months. The following indicative construction scenarios associated with the proposal have been assessed:

- site establishment and mobilisation
- road upgrades
- earthworks
- construction of buildings including footings for structures
- installation of pipework
- testing and commissioning

The sound power levels of plant and equipment for the likely construction scenarios were used to determine the potential impacts on nearby residential receivers and sensitive land uses. Source noise level data has been obtained from the following:

- Australian Standard, AS 2436 – 2010 '*Guide to Noise Control on Construction, Maintenance and Demolition Sites*'
- *Construction Noise and Vibration Strategy* (CNVS) (Transport for NSW, 2016).

Other equipment may be used, however, they would likely produce similar net noise emissions when used concurrently with listed equipment. Scenario sound power levels have been calculated by assuming simultaneous operation of the two loudest equipment during a worst-case 15 minute period.

The indicative construction scenarios used for modelling are shown in Table 6.15.

Table 6.15 Modelled construction scenarios

ID	Description	Plant/equipment	Sound power level (dBA)	Source	Scenario sound power level (dBA)
S01	Site establishment and demobilisation	Truck	107	AS 2436	110
		Truck (water cart)	107	AS 2436	
		Crane (mobile)	104	AS 2436	
		Generator (diesel)	100	AS 2436	
S02	Road upgrade	Dump trucks	117	AS 2436	119
		Chainsaws	114	AS 2436	
		Graders	110	AS 2436	
		Bulldozers	108	AS 2436	
S03	Earthworks	Jack hammers	121	AS 2436	123
		Rock breakers	118	AS 2436	
		Dump trucks	117	AS 2436	
		Excavators	107	AS 2436	
S04	Construction buildings and footings for structures	Concrete trucks	108	AS 2436	118
		Concrete pump	109	AS 2436	
		Concrete saw	117	AS 2436	
		Hand tools	102	AS 2436	
		Generator (diesel)	100	AS 2436	
S05	Installation of pipework	Trucks	107	AS 2436	110
		Excavators	107	AS 2436	
S06	Testing and commissioning	Hand tools	102	CNVS	102

Noise modelling methodology

Noise modelling was carried out using *CadnaA Version 2021*. CadnaA is a computer program for the calculation, assessment and prognosis of noise propagation. Environmental sound propagation was calculated using *ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors*. The *ISO 9613-2* algorithm also takes into account the presence of a well-developed, moderate ground based temperature inversion. This commonly occurs on clear calm nights or 'downwind' conditions which are favourable for sound propagation.

Ground absorption, reflection and terrain have been taken into account in the model configuration, however, the shielding effects of the trees have not. The noise model parameters and assumptions for the construction assessment are provided in Table 6.16.

Table 6.16 Noise modelling parameters

Parameter	Assumption
Software	CadnaA Version 2021
Prediction algorithm	ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors
Meteorology	ISO 9613-2 considers the presence of a well developed ground based temperature inversion
Ground absorption coefficient	G = 0.75
Atmospheric absorption	Based on an average temperature of 10°C and an average humidity of 70%.

The predicted levels presented in Table 6.17 are conservative as it assumes construction equipment is located at the worst-case location within the proposal site relative to each receiver. The actual noise levels during construction would likely be lower than those predicted as construction equipment moves away from the receiver. Exceedances of the NMLs at sensitive receivers are shaded in blue.

Exceedances of the construction NMLs are typical for construction projects of this scale. The predicted noise impacts would be limited to the construction period only, are temporary and would not have lasting effects on the community. The level of exceedance is dependent on the type of work being undertaken and the proximity of the works to each receiver.

Table 6.17 Predicted construction noise levels

Receiver	NML	Predicted construction noise level					
		S01	S02	S03	S04	S05	S06
R01	45	39	57	61	57	44	40
R02	70	28	42	49	43	35	28
R03	60	42	60	63	60	40	42
R04	45	34	56	60	51	50	34
R05	55	31	52	56	48	45	31
R06	60	23	46	53	37	46	23

The following impacts have been identified:

- Predicted noise levels at residential receivers on Wirong Road, Wurabinda Road (R04) have the potential to exceed the daytime noise management levels during S02 , S03, S04 and S05. Exceedances would be predicted to occur when high-noise equipment is used such as dump trucks, chainsaws, rock breakers, jackhammers and concrete saws.
- Predicted noise levels at the caretaker's quarter (R01) have the potential to exceed the noise management levels during S02 , S03 and S04.
- A 1 dBA exceedance of the noise management level is predicted during S03 at Wyangala Public School.
- It is not anticipated that construction noise levels will exceed noise management levels at any other identified sensitive receiver locations during the construction period
- There are no predicted exceedances of the highly noise affected level for residential receivers in the area.

Mitigation measures outlined in Section 6.5.3 would be implemented to minimise any noise impacts during construction.

Construction vibration impacts

Safe working buffer distances to comply with the human comfort and cosmetic damage screening criteria in Table 6.18 have been sourced from the *Construction Noise and Vibration Guideline* (CNVG) (RMS, 2016) and are provided in Table 6.18. The minimum distances are

presented to comply with the "cosmetic" damage (refer to BS 7385) and human comfort (refer to OH&E's Assessing Vibration – a technical guideline) vibration management levels.

Table 6.18 Safe working buffer distances

Activity	Human comfort	Cosmetic damage
Piling rig – Bored	N/A	2 m (nominal)
Vibratory roller (7-13 tonnes)	100 m	15 m
Vibratory roller (4-6 tonnes)	40 m	12 m
Vibratory roller (2-4 tonnes)	20 m	6 m
Large hydraulic hammer	73 m	22 m
Jackhammer	Avoid contact with structure	1 m
Rock breaker[1]	36	9

Notes:

1) Buffer distances calculated assuming large rock breaker with a PPV of 6 mm/s at 10 m

No structures have been identified within the safe working distances presented in Table 6.18. As such, no vibration impacts are anticipated during the construction of the proposal.

Should any structures fall within the safe working buffer distances, the mitigation measures identified in Section 6.5.3 would be applied.

Construction traffic noise impacts

It is estimated that up to about 20 heavy vehicle movements would be required each day. In addition, up to 20 light vehicle movements would be required to transport staff to and from the site. Construction traffic is expected to access the construction site via Darby Falls Road, Wyangala Road and Trout Farm Road (from Cowra). Traffic volumes along these roads during the RNP day period (7 am to 10 pm) are approximately 300 light vehicles and between 35 and 40 heavy vehicles. The additional construction traffic on the road is predicted to increase road traffic noise levels by 1.2 dBA, and as such, the noise requirements of the Road Noise Policy are predicted to be met at all residences along the haulage route. Traffic on local roads would be managed in accordance with a traffic management plan which would be prepared by the contractor and would detail specific

routes that construction traffic and local traffic would follow throughout the construction phase.

Operational noise impact assessment

It is expected that the WTP will be operating up to 22 hours per day. The key noise generating equipment identified at this stage are presented in Table 6.19.

The following noise sources have been excluded from the noise model at they are not expected to generate significant noise:

- Potassium Permanganate Batching Tank Mixer (MIX-8621)
- Subnatant Pump 1 (PMP-7010) and 2 (PMP-7010)(wet well pumps)
- Raw Water Static Mixer (MIX-1020).

Additionally, the standby generator has been excluded from the noise modelling as it is for emergency use only.

A noise assessment has been made based on conservative assumptions and are subject to change. Once more detail has been provided regarding the equipment models, vendor noise data, size and power, a detailed noise assessment would be undertaken to ensure the design of the WTP is compliant with the project noise trigger levels at the nearest sensitive receivers.

The following assumptions have been made regarding the source noise levels and the operating conditions:

- All internal areas (main building, compressor/blower room and dosing rooms) are to be designed to have an internal sound pressure level (SPL) of 80 dBA.
- All other external equipment listed are to be designed to have a SPL of 80 dBA at 1 metre. For pump and motor systems, this includes noise from both the pump and the motor.
- It is assumed that one truck either arrives or departs the site within a 15 minute period (modelled with a sound power level of 107 dBA travelling at 20 km/hr).
- Six ventilation extraction fans have been modelled on the roof of the main building with a sound power level of 85 dBA (each) as a worst-case scenario.

Table 6.19 Equipment and modelling assumptions

Equipment ID	Description	Enclosed in building?	Equipment location
PMP-1030	Raw Water Sample Pump	No	Raw Water Tank at Existing Pump Station
PMP-1040	Raw Water Sample Pump	No	Raw Water Tank at Existing Pump Station
PMP-1110	UF Membrane Feed Pump 1	Yes	Main Building
PMP-1120	UF Membrane Feed Pump 2	Yes	Main Building
PMP-2010	Waste Sump Pump 1	Yes	Main Building
PMP-2020	Waste Sump Pump 2	Yes	Main Building
PMP-2110	CIP Waste Pump 1	No	External to CIP Waste Tank
PMP-2120	CIP Waste Pump 2	No	External to CIP Waste Tank
PMP-2210	Backwash Pump 1	Yes	Main Building
PMP-2220	Backwash Pump 2	Yes	Main Building
PMP-9030	Service Water Pump 1	Yes	Main Building
PMP-9040	Service Water Pump 2	Yes	Main Building
BLR-3010	Air Scour Blower 1	Yes	Compressor / Blower room
PMP-4060	Product Water Sample Pump	No	Clear Water Storage Tanks
PMP-4070	Product Water Sample Pump	No	Clear Water Storage Tanks
PMP-4080	Potable Water Sample Pump	No	Clear Water Storage Tanks

Equipment ID	Description	Enclosed in building?	Equipment location
PMP-5110	Wash Water Transfer Pump 1	No	Wash Water Balance Tanks
PMP-50120	Wash Water Transfer Pump 2	No	Wash Water Balance Tanks
PMP-5010	Sludge Transfer Pump 1	No	Sludge Thickening Area
PMP-5020	Sludge Transfer Pump 2	No	Sludge Thickening Area
PMP-6010	Thickener Supernatant Return Pump 1	No	Sludge Thickening Area
PMP-6020	Thickener Supernatant Return Pump 2	No	Sludge Thickening Area
PMP-8010	Sodium Carbonate Pump 1	Dosing Building	Dosing Room
PMP-8020	Sodium Carbonate Pump 2	Dosing Building	Dosing Room
PMP-8030	Sodium Carbonate Pump 3	Yes	Dosing Room
PMP-8110	Potassium Permanganate Dosing Pump 1	Yes	Dosing Room
PMP-8120	Potassium Permanganate Dosing Pump 2	Yes	Dosing Room
PMP-8210	ACH Dosing Pump 1	Yes	Dosing Room

Equipment ID	Description	Enclosed in building?	Equipment location
PMP-8220	ACH Dosing Pump 2	Yes	Dosing Room
PMP-8310	Sodium Hypochlorite Dosing Pump 1	Yes	Dosing Room
PMP-8320	Sodium Hypochlorite Dosing Pump 2	Yes	Dosing Room
PMP-8410	Citric Acid Dosing Pump 1	Yes	Dosing Room
PMP-8420	Citric Acid Dosing Pump 2	Yes	Dosing Room
PMP-8510	SBS Dosing Pump 1	Yes	Dosing Room
PMP-8520	SBS Dosing Pump 2	Yes	Dosing Room
FAN-8831	Chlorine Room Extraction Fan	No	Roof of Chlorine Room
PMP-9030	Potable Water Pump 1	No	Southern façade of Main Building
PMP-9040	Potable Water Pump 2	No	Southern façade of Main Building
ACO-9040	Air Compressor Package 1	Yes	Compressor / Blower room
ACO-9050	Air Compressor Package 2	Yes	Compressor / Blower room

The noise model assumes the building components have the properties outlined in Table 6.20.

Table 6.20 WTP building assumptions

Building component	Assumptions	R_w Sound transmission index	Source
External walls	Cavity brickwork (~270 mm thick)	50	Bies & Hansen – Engineering Noise Control
Roof	0.6 mm corrugated steel sheet	17	Bies & Hansen – Engineering Noise Control
Doors[1]	Metal faced with rigid polystyrene core set in galvanised pressed metal frames	31	Bies & Hansen – Engineering Noise Control
Roller door[1]	0.6 mm corrugated steel sheet	17	Bies & Hansen – Engineering Noise Control
Air intake louvres[1]	6 m^2 weather louvres on the northern and southern facades 20 m^2 weather louvre on the eastern facade	0	Conservative assumption

Notes:

1) These building components are yet to be designed and are based on generic (worst-case) assumptions

Based on the assumptions outlined above, the predicted noise levels for identified receivers are presented below in Table 6.21.

Table 6.21 Operational noise assessment predicted noise level

Receiver	Receiver Types	Period	NPfI Project Noise Trigger Level	Predicted noise level
R01	Caretaker's residence	Night	35	34
R02	Wyangala Waters Holiday Park	Night	43	24
R03	Commercial	When in use	63	35
R04	Wyangala Village	Night	35	31
R05	Wyangala Public School	When in use	43	28
R06	Lamington Park	When in use	48	19

Noise predictions indicate that the proposed WTP operations would not exceed the project noise trigger levels. Detailed noise modelling should be undertaken prior to construction to ensure the noise levels at the nearest sensitive receivers are below the NPfI project noise trigger levels once all equipment is confirmed.

6.5.3 Mitigation measures

Table 6.22 details the proposed mitigation measures to reduce the impacts of noise and vibration.

Table 6.22 Mitigation measures - noise and vibration

Impact	Mitigation measure	Responsibility	Timing
Consultation	All sensitive receivers (e.g. schools, local residents) likely to be affected (within about two kilometres) will be notified prior to commencement of any work associated with the activity that may have an adverse noise or vibration impact.	Contractor	Construction
Construction noise impacts	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration management measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities (ie restrictions on locations and times) • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures	Contractor	Construction

Impact	Mitigation measure	Responsibility	Timing
	• site opening/closing times (including deliveries) • environmental incident procedures.		
Out of hours works	If works outside standard construction hours is required then the contractor's environmental representative would: • justify the need for the out of hours works • consider potential noise impacts and implement relevant safeguards • identify community notification requirements • seek an out of hours work approval.	Contractor	Construction
Consultation with highly noise affected receivers	The proponent should communicate in advance with the potentially impacted residents by clearly explaining the duration and noise level of the works, and inform of any respite periods.	Contractor	Construction
Operational noise	The buildings enclosing mechanical equipment should be designed to meet the project noise trigger levels at the nearest sensitive receivers in accordance with the requirements of the Noise Policy for Industry. Additional considerations include: • Internal areas of the main building should be designed to have an (average) internal noise level of 80 dBA or lower	Contractor	Pre-Construction

Impact	Mitigation measure	Responsibility	Timing
	• Locating louvres on facades away from sensitive receivers • Designing exhaust ventilation systems with appropriate mitigation, if required. Testing after installation would be undertaken to confirm whether impacts are experience with further noise attenuation measure to be implemented into the building if required.		
Operational noise	Any external noise sources should be selected and designed to meet the project noise trigger levels at the nearest sensitive receivers. i.e. have a maximum sound pressure level of 80 dBA at 1m.	Contractor	Pre-Construction

6.6 Air quality

6.6.1 Existing environment

Air quality in the vicinity of the proposal is considered to be relatively good and consistent with a small village located in a rural area. Sources which contribute to a reduction in local air quality are:

- agricultural and water infrastructure land uses, primarily linked to the operation of equipment and machinery
- boat users at Wyangala Dam (particularly when water levels are higher and during holiday periods)
- dust that is generated by wind over exposed surfaces in the agricultural areas, particularly during periods of drought, and wind over the reservoir when water levels are low, exposing bare earth.

A search of the National Pollutant Inventory on 25 August 2020 found no facilities in close proximity to the proposal which reported the emission of pollutants, with the nearest facility located in Cowra.

The nearest sensitive receivers are residents of the Wyangala Village and users of the holiday park.

6.6.2 Impact assessment

Construction

The proposal has the potential to impact air quality through the generation of dust during construction as a result of soil disturbance as part of excavation, vehicle movements over exposed soils, and stockpiling of material. The proposal has the potential to impact on the amenity of those occupying nearby residential dwellings, including residents of Wyangala Village and visitors at the holiday park.

Construction of the proposal would minimise surface disturbance at any one time as the excavation works and rehabilitation of the site would happen progressively. Therefore, potential impacts would be minor, localised and short term.

Exhaust emissions from vehicles, plant and machinery has the potential to impact upon local air quality. Such impacts are considered minimal as any emissions are likely to dissipate into

the surrounding environment result in minor impact locally and negligible impacts on regional scale. As works are temporary, air quality is unlikely to be significantly impacted by emissions.

Impacts on air quality would be minimised by implementing the mitigation measures outlined in section 6.6.3.

Operation

The proposal would not impact on air quality during operation.

6.6.3 Mitigation measures

Table 6.23 details the mitigation measures that will be implemented to manage potential impacts on air quality.

Table 6.23 Mitigation measures – air quality

Impact	Mitigation measure	Responsibility	Timing
Dust emissions	Stabilisation of disturbed surfaces will take place as soon as practicable.	Contractor	Construction
Exhaust emissions	Construction plant and equipment will be maintained in a good working condition in order to limit impacts on air quality.	Contractor	Construction
Exhaust emissions	Plant and machinery will be turned off when not in use.	Contractor	Construction

6.7 Surface water and flooding

6.7.1 Existing environment

Surface water

The nearest watercourse/waterbody to the proposal site is Lake Wyangala which is located about 100 metres from the proposal site at its closest point when the dam is full. Part of the proposal site drains to the east towards Lake Wyangala, however the proposal site due to its position atop a ridge does drain in all directions. The nearest watercourse to the west of the

proposal site is Green Creek which flows to the west of Wyangala village about 650 metres from the proposal site.

Water quality within Lake Wyangala varies, however the quality of water within the reservoir is largely driven by the mobilisation of sediments during inflow events along with other debris follow rain periods.

Flooding

Flooding within the proposal site is considered to be very unlikely limited due to the elevation of the proposal site on a ridge or associated side slopes. Some pooling of water during rain events may occur in flat areas such as the former quarry to be used as a construction compound.

Flooding within Lake Wyangala is not considered to pose any threat to the proposal site with floodwaters within the reservoir managed through the operation of the gates. Floodwaters are managed within a designated flood managed zone which does not impacted upon the proposal site.

6.7.2 Impact assessment

Surface water

During construction, impacts to surface water hydrology (overlands flows) would be associated with changes in the local topography and changes to the existing drainage patterns in the vicinity of the proposal site. Such impacts would potentially be a result of earthworks, positioning of ancillary facilities (for example, compound buildings or stockpiles) or the positioning of plant and equipment.

The proposal would allow existing overland flows to occur which currently generally flow across the site. As the proposal site is generally located along high points the potential for clean water flows entering the proposal site is considered minimal. Clean water divisions would be considered as part of the erosion and sedimentation plan for the proposal. Overall the proposal is not considered to dramatically alter the amount of surface water entering Lake Wyangala due to the relatively small catchment located above the proposal.

Flooding

Due to the positioning of the proposal site along the high points (that is, ridges at top of hill and also along access tracks) the risk of flooding to the proposal site is considered minimal as any surface water is likely to flow off the proposal site due to the existing slopes. Some

localised flooding may occur within the construction areas however these would be minimised where possible through careful management of excavations.

The risk of flooding from offsite (that is, Lake Wyangala) is considered to be nil as any flood events would be managed through the operation of the dam to ensure that any floodwaters would remain outside the proposal site.

Water quality due to testing and commissioning phase

Water quality impacts associated with erosion and sedimentation and spills and leaks are discussed in section 6.8.2.

As outlined in section 4.3, as part of the testing and commissioning phase there is a requirement for the discharge of water during testing of the system. Water is proposed to be discharged to land with this water to flow over land for it to slowly be absorbed into the ground. Over a seven day testing period it is expected that up to 4.2 megalitres of water could be discharged. Discharges would occur at locations which would be confirmed with Cowra Council and Reflections Holiday Parks as the water to be discharged would most likely be used to flush the reticulation networks to Wyangala village and the holiday park.

The discharge of this water is not considered to result in any impacts to water quality within any receiving environments (that is, primarily Lake Wyangala) as the majority of the water to be discharge would be treated or would be raw water as extracted from the dam. The discharge of treated water would mean that any water which does enter Lake Wyangala would be considered to be potable and would be of higher quality than the water which is extracted from the dam for treatment. The distance between discharge locations and the dam would be maximised where possible to allow discharged water absorbed into the ground prior to entering the reservoir. Erosion measures would be considered for implementation to minimise the mobilisation of sediment depending on the conditions at the selected discharge location.

In some instances, if water is required to be discharged during a particular phase of the treatment process the water would potentially be chlorinated. The volumes of chlorinated water are considered to be minimal however the de-chlorination of this water would be achieved by discharging to land to allow any chlorine in the water to dissipate into the ground or into the air. The volume of chlorine present in water likely to be discharged is considered to be minimal particularly considering the volume of water which are to be discharged at any one time. Regardless discharge of water is proposed to be undertaken in a designated area which would minimise the likelihood of any chlorinated water migrating

towards the reservoir. In the event chlorinated water is to enter the reservoir the volumes of water are considered to be minimal and likely to dissipate into the much larger volumes within the dam.

6.7.3 Mitigation measures

Table 6.24 details the mitigation measures that will be implemented to manage potential impacts on water quality and hydrology.

Table 6.24 Mitigation measures – water quality and hydrology

Impact	Mitigation measure	Responsibility	Timing
Discharge of water during testing	Volumes of water to be discharged to land during testing phase are to be minimised where possible and is to occur to areas which are relatively flat to allow absorption into the ground and not allow run-off particularly towards Lake Wyangala.	Contractor	Construction
	Discharge location for water during testing phase will be confirmed in consultation with Cowra Council and the Wyangala Waters Holiday Park as to minimise any impacts.	Contractor	Construction
	Erosion control devices are to be considered at discharge locations based on conditions located at the selected location.	Contractor	Construction
Discharge of chlorinated water	A protocol which outlines the procedures for the discharge of any chlorinated water is to be developed and included in the CEMP. This will include any methods to dechlorinate water prior to discharge or outline locations where discharges of	Contractor	Pre-construction

Impact	Mitigation measure	Responsibility	Timing
	chlorinated water will occur to minimise impacts.		

6.8 Geology, soils and hydrogeology

6.8.1 Existing environment

Geology, topography and soils

The proposal site is underlain by Wyangala Batholith of Wyangala granites, comprising of foliated porphyritic biotite granite (Krynen and Moffitt, 1997).

The site is generally characterised by undulating to flat topography. The elevation varies across the site from about 420 metres AHD to 455 metres AHD and slopes are generally between five degrees and ten degrees with frequent granite outcrops. The site occupies the crest and southern side of a hill with a relief of about 70 metres above Wyangala Dam shoreline that lies at the eastern toe of the hill.

The Great Soil Group classified on the site is predominantly less fertile Yellow Podzolic Soils (granites and metasediment) (DPIE 2019b). The soil at the site is classed as Kurosols under the Australian Soil Classification (DPIE 2019). A search of the Australian Soil Resource Information System (ASRIS) classified the proposal area as extremely low probability/low confidence in terms of acid sulfate soil occurrence.

Results from test pit investigations identified fill, residual soils, and granite bedrock at depths of 1.1 metres below the surface.

Fill was characterised as gravelly sand with schist and granite gravel. Residual soils were predominantly characterised as sand with inclusions of granite gravel, cobbles and boulders. Some clayey silt was encountered. Granite bedrock was encountered at depths between 0.48 metres and 1.1 metres overlain by weathered granite.

Groundwater

A search of the Australian Groundwater Explorer in June 2020 showed no recorded salinity in groundwater boreholes within eight kilometres of the proposal. However, groundwater in the Lachlan Valley is considered to have good water quality, and suitable for the allocated uses (Office of Water 2012). The predominant use of groundwater in the area is water supply, and

some boreholes are used for monitoring. Groundwater was not encountered during or upon completion of excavation of test pit investigations at the proposal site.

Contamination

A search of the EPA Contaminated Land Record website undertaken for the Cowra local government area indicated that no notices have been issued for the proposal area under the *Contaminated Land Management Act 1997*. A search of the List of NSW Contaminated Sites Notified to EPA on 25 August 2020 indicates that no notification of contaminated land has been received by the EPA in the vicinity of the proposal site. No other known contaminated risk have been identified in the vicinity of the proposal site.

6.8.2 Impact assessment

Construction

Topography

The proposal is not expected to result in any substantial changes to the topography of the proposal site. Some localised levelling of the land would occur at the proposed WTP building location which would require up to 1.5 metres of fill to form a level platform for construction of the building. The proposed new pipelines would be laid on the surface with mounding to cover and protect the pipelines. This would result in a change in topography on the proposal site, however this change is considered minimal and does not impact on topography in a way which impacts the surrounding land.

Soil disturbance, erosion and sedimentation

Soil disturbance during earthworks and mounding over pipelines and would result in the exposure of soils and stockpiling of materials which may erode throughout the construction period. This could result in increased sediment loads entering Lake Wyangala which is located downslope of the proposal site. The impacts of the earthworks are considered manageable with an erosion and sediment control plan. Post-construction stabilisation works would involve reinstating and protecting soil profiles such as batters and retaining walls. Mitigation measures discussed in section 6.8.3.

Water quality impact due to erosion and sedimentation

The proposal site is located upslope from Lake Wyangala which is a water supply dam for irrigation and town water supply purposes, thus Lake Wyangala is considered to have increased sensitivity in terms of water quality. Impacts on water quality during construction

could impact water quality should environmental safeguards not be implemented for the proposal.

The proposal requires earthworks for the establishment of a level building pad for both the building at the water treatment building and sludge handling area. If not appropriately managed the mobilisation of disturbed spoils have the potential to migrate downslope and potentially impact upon the water quality within Lake Wyangala.

Erosion and sedimentation impacts would be managed through the implementation of management measures and would include the implementation of erosion and sediment control measures in accordance with an erosion and sedimentation control plan.

Water quality impact due to spills and leaks

There is potential for impacts to water quality due to spills and leaks of oils and other chemicals from plant and equipment operating upslope from Lake Wyangala, as well as any uncovered loads coming to or exiting the proposal site. Any spills or leaks within the proposal site have the potential to end up in Lake Wyangala due to its close proximity to the works and that all works areas are upslope. Impacts on Lake Wyangala would be mitigated through the implementation of safeguards and management measures to ensure spills are contained and removed. The incorrect storage of fuel, oils and other chemicals could also result in impacts on water quality.

These impacts are considered manageable through the implementation of safeguards and management measures outlined in section 6.8.3.

Groundwater

Any groundwater encountered during construction is likely to be from shallow aquifers associated with watercourses or surface rainwater infiltration. Therefore the quality of this water is anticipated to be similar to surface water and able to be managed as such.

Soil Contamination

There is also potential for chemical and fuel spills during construction, which may result in localised contamination of soil. Large quantities of fuels would not generally be stored on or around the site because vehicles and equipment would be refuelled offsite, where practicable, or within an appropriately bunded areas. If re-fuelling in the field is necessary, it would be undertaken away from drainage lines and spill response kits would be provided. All chemicals would be stored in a secure bunded area within the construction compound.

However, as the number of vehicles and equipment to be used on-site is relatively low, the mitigation measures provided section 6.8.3 would manage impacts.

Although there are no registered contaminated sites within the proposal area, measures would be implemented to manage contaminated soils if they are encountered during construction.

Operation

Operation of the proposal would have negligible impacts on topography, soils or geology. There is the potential for there to be leaks from vehicles that would access the proposal for maintenance and inspections. These vehicle movements would be infrequent.

Potential impacts would be managed by implementing the measures described section 6.8.3.

6.8.3 Mitigation measures

Table 6.25 details the mitigation measures that would be implemented to manage potential impacts on topography, soils and geology.

Table 6.25 Mitigation measures - topography, soils and geology

Impact	Mitigation measure	Responsibility	Timing
Water quality	Dirty water will not be released into drainage lines and/or waterways and will be disposed of at an appropriately licensed facility.	Contractor	Construction
Contamination of water	All fuels, chemicals, and liquids will be stored at least 40 m away from waterways (including existing stormwater drainage system) and will be stored in an impervious bunded area within the compound/laydown areas. Bunded areas will be check each day to ensure that are in working order.	Contractor	Construction

Impact	Mitigation measure	Responsibility	Timing
Contamination of water	The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas in the compound/laydown areas.	Contractor	Construction
Contamination of water	Vehicle wash downs and/or concrete truck washouts will be carried out within the designated bunded area on an impervious surface or carried out off-site.	Contractor	Construction
Contamination of water	Visual monitoring of water quality of surface water leaving the proposal site will be carried out on a regular basis to identify potential spills or the effects of sediment-laden runoff.	Contractor	Construction
Spills and leaks	A site specific emergency spill plan will be developed, and include spill management measures in accordance with all relevant guidelines including relevant EPA guidelines.	Contractor	Construction
Unknown contamination	In the event that indicators of contamination are encountered during construction (such as odours or visually contaminated materials), work in the area will cease until an environmental consultant can advise on the need for remediation or other action.	Contractor	Construction

6.9 Traffic, transport and access

6.9.1 Existing environment

Access to the site is primarily from Cowra which is the nearest major town to the proposal site. Access from Cowra to the proposal site is via Darby Falls Road, Trout Farm Road, Wyangala

Road and Darby Falls Road (section located north of Wyangala Dam). Access is also available from the Mid Western Highway towards Blayney via Sheet of Bark Road at Woodstock to the north of the site and then via Reg Hailstone Drive.

Access to the site is via existing access track located off Darby Falls Road (north of dam) and the road to the WaterNSW operations office. This track provides access to the existing WTP and water storage tanks. This access consists of sealed roadway to the existing WTP and unsealed for the remainder of the track to the water storage tanks and communications tower.

Traffic on the road network in the vicinity of the proposal is generally low however during peak holiday peaks the number of vehicles on the roads increase with visitation to the holiday park increasing these numbers.

6.9.2 Impact assessment

Construction

Construction traffic generation

Construction is likely to result in an increase in vehicles on surrounding roads due to construction workers' vehicles and the delivery of materials and equipment (including heavy vehicles). As outlined in section 4.2.7, the proposal is expected to generate about 20 light vehicle movements and up to about 20 heavy vehicle trips per day. These peaks movements are not expected to occur throughout the 12 month construction period with vehicles movements considered to be less than this for the majority of the construction period. The existing surrounding road network has capacity to accommodate the predicted additional vehicles resulting from the proposal. As the construction is temporary in nature, impacts to traffic and access are considered minor. Any potential impacts would be managed through the implementation of mitigation measures which would be incorporated into the CEMP.

The proposal would also avoid the use of Reg Hailstone Way for heavy vehicles due to the safety issues associated with the running of large vehicles along this road due to its narrow and winding nature.

Impacts on access

The proposal would result in works along existing access tracks which provide access to the existing WTP and the telecommunications towers located at the top of the hill adjacent to the proposal site. The proposal has the potential to impact upon the access to these two

land uses particularly during upgrades to the existing track between the existing WTP and infrastructure at the top of the hill (including telecommunications tower). While impacts could occur both facilities are infrequently visited and during construction access to these assets would be maintained. Consultation with asset owners would be undertaken to confirm access requirements throughout the construction of the project.

Operation

Impacts on traffic and access are not predicted during the operation of the proposal, as access requirements are not considered to differ substantially to the existing WTP. Maintenance activities would generate low traffic numbers which would not impact upon operation of the road network.

Access to the communications tower located adjacent to the northern end of the proposal site would be maintained.

6.9.3 Mitigation measures

Table 6.26 details the mitigation measures that will be implemented to manage potential impacts on traffic, transport and access.

Table 6.26 Mitigation measures – traffic, transport and access

Impact	Mitigation measure	Responsibility	Timing
Impacts on road network	Vehicle movements along Reg Hailstone Way are to be limited to light vehicles only with heavy vehicles to access the site from Cowra via Darbys Falls Road.	Contractor	Construction
Access to other land uses	Vehicular access is to be maintained to the existing WTP and the telecommunications tower located adjacent to the proposal site. Consultation with the asset owners will be undertaken to confirm the access requirements for these assets.	Contractor	Construction

6.10 Bushfire risk

6.10.1 Existing environment

The proposal is located within category 1 bushfire prone land, as shown in Figure 6.3.

Much of the proposal site is steep and vegetated which makes the land higher risk for bushfires. The majority of the proposal site is located upslope of vegetation and therefore is at greater risk to bushfires. However, due to the overall extent of vegetation around the proposal site being limited by Lake Wyangala, the village of Wyangala and the holiday park, this risk is considered to be reduced. The proposal site is also located on the south facing slope further reducing the risk of bushfire.

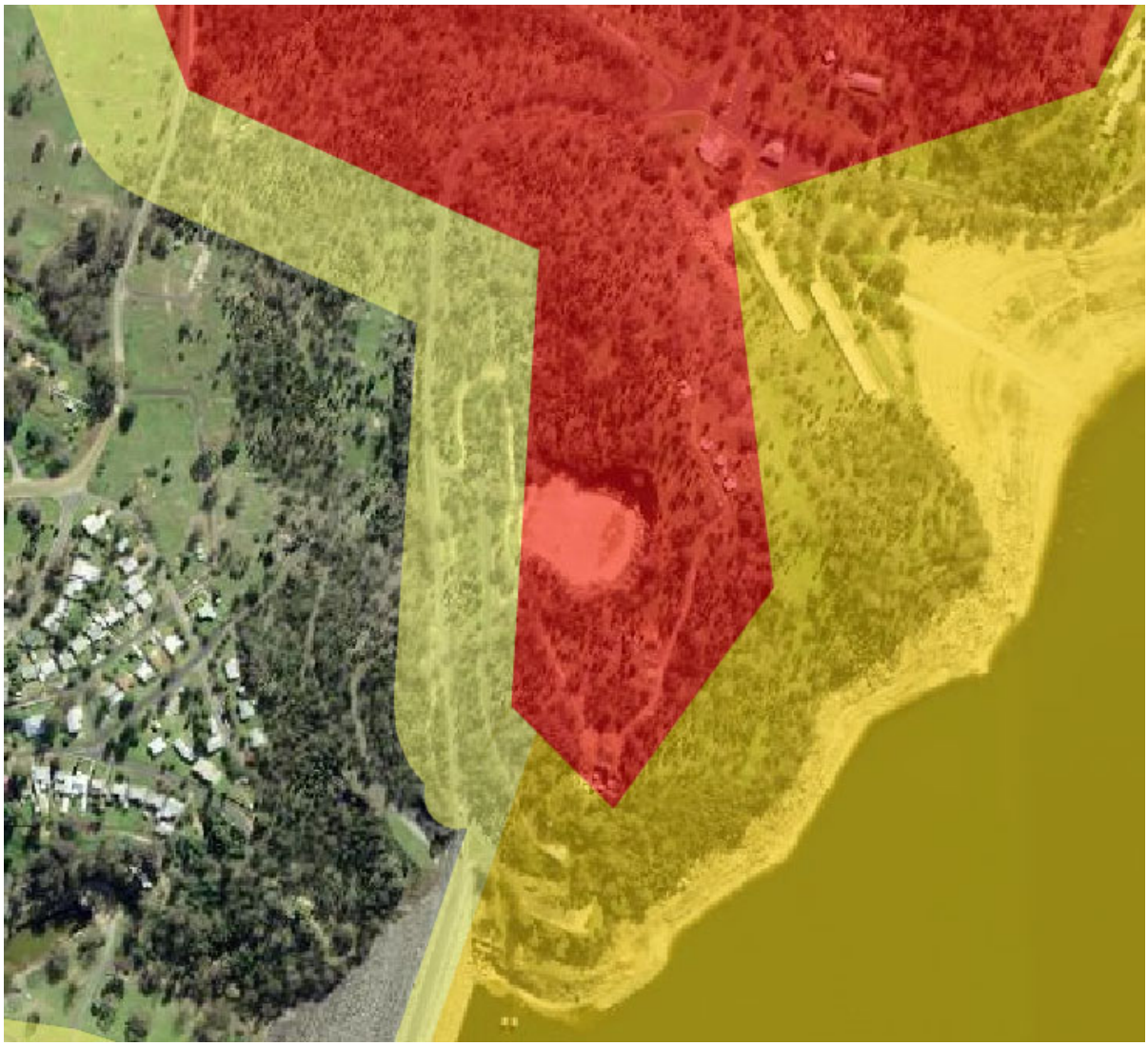

Figure 6.3 Bushfire prone land

6.10.2 Impact assessment

Construction

During construction, the proposal would be at potential risk of being impacted by a bushfire, due to its position within a high-risk vegetation area. Impacts of bushfires on the proposal would be minimised through the implementation of a bush fire management procedure as part of the CEMP to identify the measures to be put in place in the event of a bushfire occurring within the proposal site or posing a threat to the site.

The nature of the existing road network (that is, single one-way track into the site) means there is only one access route into and out of the proposal site. The proposal would result in some works along this sole access track, and therefore during a bushfire the capacity of this road would potentially be reduced where works are occurring along existing sections of roads which would be required by staff evacuating or emergency services entering the site. Such impacts would be managed through the implementation of a bush fire management procedure which would detail the measures and requirements to ensure safe access is available at all times. This would ensure safe passage to and/or from the site in the event of a bushfire.

The construction of the proposal while working in vegetated areas could potentially result in the ignition of a fire, resulting in fires at the WTP, which may spread to adjacent vegetated areas and around the holiday park. Potential ignition sources include but are not limited to the following:

- hot works (that is, welding) being undertaken in high wind conditions or hot days without the appropriate measures in place
- vehicles and equipment igniting grasses or forest vegetation.

These risks are considered unlikely with the implementation of management measures outlined in section 6.10.3.

Operation

The proposed WTP infrastructure is mostly likely classed as a Class 8 building in accordance with the National Construction Code (NCC), though the development could also be considered a Class 10a development as well. For the purpose of this assessment the building is considered to be a Class 8 building as this classification is considered to be more conservative in terms of any requirements. As detailed in Planning for Bushfire Protection (RFS,

2019) the NCC does not provide for any specific bush fire performance requirements for Class 8 buildings (there are no requirements for Class 10a). While compliance with Australian Standard 3959 or the NASH (National Association of Steel-framed Housing) standard are not considered in the Deemed to Satisfy provisions, compliance with AS3959 and the NASH Standard must be considered when meeting the aims and objectives of Planning for Bushfire Protection. The objectives outlined in Table 6.27 are required to be considered in accordance with Planning for Bushfire Protection, with Table 6.27 outlining how these objectives are met by the proposal.

Table 6.27 Compliance with objectives in Planning for Bushfire Protection

Objective	Compliance of proposal
To provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation	Access to the proposed WTP would be similar to the existing WTP access however the proposed access road north of the existing WTP would be upgraded to be sealed, improving access. The proposal would also improve vehicle turnaround at the top of the hill adjacent to the proposed WTP with vehicle manoeuvring areas proposed providing an improvement to the existing situation. These improvements would also improve access for those access the telecommunication tower located at the top of the hill.
To provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development	The development would generally be unmanned with only maintenance visits undertaken by a single staff member. These visits would be relatively short in duration and would not be undertaken during period where bushfire risk is considered high for the site. Due to the short distance to nearby safe places in the event of a bushfire any onsite workers are considered to have sufficient warning of any bushfire.
To provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to	The proposal being for the purpose of a WTP includes the provision of clear water tanks (and includes existing raw water tanks) which have been designed to be able to be used during a bushfire for the

Objective	Compliance of proposal
locate gas and electricity so as not to contribute to the risk of fire to a building	protection of infrastructure if required. All external pipework would either be buried below the surface or consist of steel pipework thus reducing the risk to infrastructure in the event of a bushfire. The proposal does not include any gas infrastructure. The proposal includes an upgrade of the existing power supply to the site. This upgrade would include a suitable easement area which would be cleared of vegetation. The width of this easement would be confirmed as part of discussions with Essential Energy depending on the final capacity of the proposed line. The proposed water treatment building would be positioned outside the easement of the proposed upgrade transmission line.
Provide for the storage of hazardous materials away from the hazard wherever possible	The proposed would include the storage of some hazardous materials (chemicals used in the treatment of water). These materials would be stored within the proposed water treatment building which as outlined below has included design elements to reduce the risk to bushfires. The proposal does not include the storage of any flammable materials on site.

The following design elements have been included into the proposal design which minimise the risk of the proposed water treatment plant from bushfire:

- walls of building are masonry blocks filled with concrete
- no underfloor space is provided with building built directly onto slab
- roof consists of non-combustible colorbond material with steel roof framing.
- no eaves are provided, with masonry blockwork extending to underside of roofing
- roof ventilation for compressor room consists of smooth line bush fire roof ventilators
- no windows or glazed penetrations are provided
- all doors are facing paved areas

- roller doors have guides and do not contain any ventilation penetrations
- pedestrian access doors are metal clad in steel frames
- wall vents are in accordance with AS3959 BAL-FZ (Chlorine Storage only).

The proposal site is considered to have at a minimum, a similar bushfire risk profile to the existing WTP and associated infrastructure site. However, as outlined above the proposal does include a number of additional measures which are considered to improve the risk profile of the site.

6.10.3 Mitigation measures

Table 6.28 details the mitigation measures that will be implemented to manage potential impacts of bushfire.

Table 6.28 Mitigation measures – bushfire risk

Impact	Mitigation measure	Responsibility	Timing
General	A bushfire management procedure will be developed and incorporated into the CEMP.	Contractor	Construction
Hot works and ignition of fire	A hot works procedure will be developed and include in the CEMP.	Contractor	Construction

6.11 Land use

6.11.1 Existing environment

The majority of the proposal site consists of the existing WTP and supporting infrastructure (that is, pipelines and water storage tanks) which are outlined in section 2.2.2. The existing WTP is owned and operated by Cowra Council.

Directly south of the site is the existing WaterNSW office, which is accessible by WaterNSW staff. Further south is Wyangala Dam, a public waterbody that offers year-round recreational access for fishing, and water sports such as swimming, power boating, sailing, sail boarding and water skiing.

The Wyangala Waters Holiday Park is directly north of the proposal site, and is the main tourist destination in the local area with usage of this area focus to peak holiday periods such as Christmas school holidays.

The main non-water infrastructure or tourist related land uses in the vicinity of the proposal site are land uses located within the Wyangala village which is located west of the proposal site. Other non-residential land uses of the Wyangala village include a public school, wastewater treatment plant, Rural Fire Service Station, country club, St Vincent's Church and WaterNSW buildings. Lamington Park is located to the south of Wyangala village below the dam wall.

6.11.2 Impact assessment

Construction

Direct impacts on land use during construction would mainly relate to the short-term presence of work within the proposal site and use of the construction compound(s). The use of the proposal site as a construction site would have limited impacts on existing land uses with the following two existing land uses potentially impacted by the proposal:

- existing WTP
- existing telecommunications tower at top of hill which is currently used by Optus.

During construction it is a requirement that the existing WTP remains operational throughout the construction period. Access to the existing WTP would be retained for Cowra Council staff to ensure the ongoing operation of the plant.

Some disruptions to the existing treatment plants operation would occur for some aspects of the proposal however these would be minimal in duration. The timing of any interruptions to the operation of the existing WTP would also occur to periods of low demand such as during off peak periods within the holiday park or to periods when the plant is not required to be operation due to sufficient treated water being stored in tanks on site. The planning of any disruptions to existing WTP operations are considered to be minimal and not considered to result in any impacts the use of the land as a water treatment plant.

While the existing telecommunications towers is located adjacent to the proposal site and access to this tower is via the proposal site, impacts on the use of this land use are not expected as it is largely an unmanned site with impacts likely to be limited to access to the facility being lost and any short term loss of power to the tower due to power supply

updates. Alternate power supply would be considered in consultation with the operators of the tower. The construction of the proposal would ensure that access to the tower would be maintained where possible and in consultation with the asset owner.

Operation

The proposal would result in the decommissioning of the existing WTP, and thus a change in land use in some areas of the proposal site (from water infrastructure to disused water infrastructure). The proposal would however maintain the overall use of the general area in the vicinity of the proposal site with the new WTP ensuring the continued use of the area for water infrastructure.

6.11.3 Mitigation measures

Table 6.29 details the mitigation measures that will be implemented to manage potential impacts on land use.

Table 6.29 Mitigation measures – land use

Impact	Mitigation measure	Responsibility	Timing
Impacts to utilities	The contractor will consult with relevant utility providers and the potentially impacted landholder (Council) to minimise impacts on access to existing assets where possible and to coordinate any loss of power to existing infrastructure include alternate supply.	Contractor	Pre-construction

6.12 Visual amenity

6.12.1 Existing environment

The proposal site is situated on a hill, and is visible from the surrounding areas. Views from the village are limited due to the vegetation surrounding the site, which acts as a screen, and also due to the change in elevation between the village and the proposal site meaning views require a receptor to look well above the normal field of vision. Wyangala Dam is a large aspect of the landscape, and dominates the view, drawing attention away from the proposal site.

The site has some visibility from the holiday park. However, views are limited due to the elevation of the site and vegetation screens.

Some areas surrounding the village, which include some rural properties, may have some visibility of the site. However, these areas are distant and views are obstructed by vegetation. The views in these areas are also focused on the dam, which draws focus away from the proposal site.

6.12.2 Impact assessment

Construction

During construction, there would be short term impacts to the visual environment due to the presence of plant, machinery, construction vehicles and the construction compound. As the site is elevated above normal field of vision from most key receptors and is surrounded by a vegetation screen, it is unlikely that the proposal would have a major impact on any views. Impacts would generally be limited to users of the holiday park, boat users on Lake Wyangala and road users near the entrance to the holiday park (Wyangala Road and Reg Hailstone Way) however many of these views are distant and largely screened. Given the distance to the nearest residential receivers and local topography impacts on any residential receptors would be minimal.

As some vegetation removal would be required, the construction area may be more visible from the holiday park, however remaining vegetation is likely to provide screening which would limit views of the proposal site.

Operation

The proposal would result in an intensification of infrastructure at the top of the hill with the new water treatment building being the most visible new aspect of the proposal. The new building would have a height of about four metres above the ground which would be slightly taller than the existing tanks located atop the hill. While taller than existing infrastructure the proposed building is not considered to be any more visible than the existing infrastructure as it would be largely positioned on the lower part of the proposal site with the existing tanks being located on higher land. The new clear water tank in the vicinity of the existing tanks is considered to be of a similar structure (including height) to the existing tanks. Overall the inclusion of the new structure is not considered to result in a noticeable change in views towards the proposal site as existing vegetation screening would largely not be impacted by the proposal thus would continue to screen any new infrastructure. The new structure would

also be constructed of non-reflective materials to allow it to blend into the surrounding landscape.

Overall views of any new infrastructure are considered limited due to screening and where views require looking well above the normal field of vision. Where views are more likely to occur in the normal field of visions, receptors are located both east and west of the site. The increased distance of these receptors means changes in the views are minimal. Views from both of the east and west are also dominated by the dam wall (from west) or Lake Wyangala (from the east) which draw the attention away from the partially screened proposal site and associated infrastructure.

Visual impacts would be managed using the mitigation measures discussed in section 6.12.3.

6.12.3 Mitigation measures

Table 6.30 details the mitigation measures that will be implemented to manage potential impacts on visual amenity.

Table 6.30 Mitigation measures – visual amenity

Impact	Mitigation measure	Responsibility	Timing
Construction area impacts	All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the proposal site and will be removed from the site following the completion of construction.	Contractor	Construction

6.13 Waste generation

6.13.1 Existing environment

The existing site results in minimal waste streams with sludge from the existing treatment process transferred to the existing sludge drying beds where it is allowed to dry out. This material is then removed when required by truck to an appropriately licenced facility.

6.13.2 Impact assessment

Construction

The proposal has the potential to generate the following wastes during construction:

- surplus materials used during site establishment such as safety fencing and barriers which may include plastics and metal
- general construction waste such as excess concrete, redundant pieces of pipe/fittings, broken bricks, timber, paper, plastic and metal
- green waste from vegetation clearing and noxious weeds
- domestic waste including food scraps, aluminium cans, glass bottles, plastic and paper containers, and putrescible waste generated by site construction personnel
- contaminated material, if it is encountered
- wastewater from the compound sites and the associated amenities.

Waste produced during construction would be managed in accordance with the waste management hierarchy principles of the *Waste Avoidance and Resource Recovery Act 2001*, within which waste avoidance is a priority, followed by re-use and recycling/reprocessing, with disposal as a last resort.

Wherever possible, suitable excavated spoil would be re-used on site for backfilling, landscaping and other uses. If spoil is unable to be re-used on-site, opportunities for off-site re-use would be investigated. If re-use opportunities are unable to be identified, or the spoil is unsuitable for re-use due to its geotechnical or contamination characteristics, spoil would be tested and classified according to the *Waste Classification Guidelines* (NSW EPA, 2014) and disposed of at an appropriately licensed waste management facility.

Significant volumes of liquid wastes, including oils or fuels are unlikely to be generated during construction. Liquid and non-liquid waste would be assessed for reuse potential in accordance with the EPA's general resource recovery exemptions before considered for disposal. If no reuse potential exists, the waster would be classified and managed in accordance with the *Waste Classification Guidelines* (EPA, 2014) and disposed of at an EPA licensed facility capable of accepting the waste.

Overall waste generated by the proposal is not expected to be in great volumes.

Operation

During operation waste streams from the proposal are considered to be limited to the following streams:

- sludge material in sludge drying beds (as per existing arrangement)
- waste material from the clean-in-place system
- domestic waste from onsite personnel
- surplus materials from maintenance activities such as excess concrete, redundant pieces of pipe/fittings, paper, plastic and metal.

Waste material streams from the treatment process would potentially include increase volumes of waste however these would only be generated infrequently. These streams would be collected from site in a truck and disposed of at an appropriately licenced facility.

All other waste streams are considered to be relatively small in volume and would only be generated during maintenance periods. All waste generated on site would be collected by onsite staff and removed from site to an appropriately licenced facility.

6.13.3 Mitigation measures

Table 6.31 details the mitigation measures that will be implemented to manage potential impacts of waste.

Table 6.31 Mitigation measures – waste

Impact	Mitigation measure	Responsibility	Timing
Waste minimisation	A resource and waste management plan will be prepared and implemented as part of the CEMP.	Contractor	Pre-construction and construction
Demand on resources	Excavated material will be reused on-site for fill where feasible to reduce demand on resources.	Contractor	Construction
Waste management	Waste bins will be provided and recycling of materials encouraged. Waste will be transported to an appropriate waste disposal facility.	Contractor	Construction

6.14 Socio-economic issues

6.14.1 Existing environment

The proposal site is located about 300 metres to the east of the village of Wyangala in the LGA of Cowra. In 2016, the population of the township of Wyangala was 182 (ABS, 2020). In 2016, The Cowra LGA had a median age of 47 relative to the slightly older population of Wyangala at 57. Both the LGA and township of Wyangala had significantly higher median ages than the national average of 38.

Wyangala Waters Holiday Park which is located about 200 metres north of the proposal site on Crown Land and is operated by Reflections Holiday Parks. The holiday park offers a range of accommodation types and provides key recreational facilities at Lake Wyangala. It is a tourist location, often more populated during holiday peak seasons.

Land to the east of the proposal site consists of Lake Wyangala (also referred to as Lake Wyangala reservoir) which is a public waterbody formed behind Wyangala Dam that offers year-round recreational access for fishing, and water sports such as swimming, power boating, sailing, sail boarding and water skiing.

6.14.2 Impact assessment

Construction

Construction of the proposal may result in minor amenity impacts on the local community and holiday park and include the following:

- potential increase in construction traffic due to the delivery of plant, materials and construction personnel
- increases in noise due to the operation of construction plant and equipment
- visual impacts associated with construction work
- potential dust disturbance due to exposed soils
- potential temporary interruption of utilities supply.

Impacts would be localised, minor and temporary and would be managed through the relevant mitigation measures provided in section 6.14.3 and those outlined in Table 7.1.

Operation

Provision of an upgraded water treatment facility would improve availability of potable water for the Wyangala village and holiday park. It will improve reliability of supply to meet the current and future demands. Overall, the proposal with have a long-term positive benefit to the Wyangala community.

6.14.3 Mitigation measures

Table 6.32 details the mitigation measures that will be implemented to manage potential socio-economic impacts.

Table 6.32 Mitigation measures - socio-economic

Impact	Mitigation measure	Responsibility	Timing
Consultation	Reasonable notice will be provided to nearby residents and Cowra Council prior to the start of the works. Notice will include the proposed start date, a description of the proposed works and activities, the estimated duration and timeframes, and the proposed complaints handling process.	Contractor	Construction

6.15 Cumulative impacts

Cumulative impacts have the potential to arise from the added effects of other external projects. This section describes the cumulative impacts and benefits likely to arise from the combination of the construction and operation of the proposal with other projects being carried out the area.

6.15.1 Potential cumulative projects

A search of the following was undertaken to determine the potential presence of any large-scale projects in the vicinity of the proposal:

- Transport for NSW projects website
- Department of Planning Industry and Environment Major Projects Register

- Cowra Council's development application tracker.

No projects were identified within the proximity to the proposal, with the exception of:

- Wyangala Dam Wall Raising Project (Critical SSI Project)
- Wyangala Waters Holiday Park Relocation Project (separate development application to Cowra Council).

These projects are identified in the vicinity of the proposal which could result in cumulative impacts.

6.15.2 Potential impacts

Construction cumulative impacts

Potential cumulative impacts may occur as a result of construction activities occurring simultaneously with the above-mentioned projects. The current timing of the above-mentioned projects means that the likelihood of all projects occurring at the same time would be limited. If the projects occur at the same time as the project the contribution of the proposal to the cumulative impacts is considered to be limited due to the small scale nature of the proposal. Potential cumulative impacts should projects occur simultaneously would potentially include:

- noise impacts from construction equipment and activities
- air quality impacts due to the generation of dust and emissions from construction equipment and vehicles
- traffic impacts due to increased vehicle numbers on the surrounding road network.

While the likelihood of the construction of the proposal and the above-mentioned projects would be unlikely, the potential construction of the proposal and then the other project in quick succession would result in a cumulative exposure to construction related impacts over a longer period of time. This duration based on currently available information could result in impacts on the Wyangala area for a period of up to five years due to the one year construction program for the proposal and the estimated four year program for the Wyangala Dam Wall Raising Project. The proposal would contribute to the extended period of potential construction however it would only contribute a relatively minimal level of impact during the first year of construction with the future projects likely to contribute more substantial impacts.

Overall the cumulative impacts resulting from construction while present are considered to be minimal and are only likely to occur in the event that the other projects in the Wyangala area go ahead as planned. Mitigation measures would be implemented to ensure that any potential cumulative impacts which may arise can be appropriately managed.

Cumulative vegetation impacts

The proposal includes the clearance of about 0.63 hectares of native vegetation. This removal of vegetation results in the cumulative impacts of the three projects which are occurring in the vicinity of Wyangala. This clearance of vegetation results in a reduction in the amount of native vegetation within the area. The clearance of vegetation for the proposal is not considered to contribute to the cumulative impacts in any substantial way due to the small percentage which the proposal contributes to the wider clearing required for the other projects.

The proposal would also not impact upon any threatened communities and therefore would not contribute to the cumulative impact on any threatened communities.

The impact of vegetation and other habitat within the proposal footprint would result in a cumulative decrease in habitat for threatened fauna. However as with the clearance of native vegetation the proposal is not considered to contribute significantly to the loss of habitat within the Wyangala area due to the small area to be impacted compared to the other projects.

6.15.3 Mitigation measures

No specific mitigation measures are proposed to manage potential cumulative impacts.

7. Environmental management

7.1 Construction Environmental Management Plan

The proposal will be delivered in accordance with environmental management measures and controls that will mitigate the potential environmental impacts. These measures will be documented in a Construction Environmental Management Plan (CEMP).

The CEMP will describe safeguards and management measures identified in section 7.3 of this document and any additional measures required by licences, permits or approvals that are required to construct the proposal. This will provide a framework for establishing how measures will be implemented and who will be responsible for their implementation. The CEMP would potentially include sub plans for specific environmental issues as required by the consent.

The CEMP will be prepared prior to commencement of construction and be reviewed and endorsed by WINSW. The CEMP would then be considered a working document, subject to ongoing change, updated and approval as necessary.

The CEMP will include the following information:

- details of all positions and contact details of all key personnel
- audit and reporting program to ensure all actions/measures are implemented
- training requirements, including site induction requirements to ensure that all personnel understand the principles of environmental management
- emergency and incident response procedures
- list of approvals to be obtained before work commences
- consultation requirements (government and community) and complaint handling procedures
- actions for meeting environmental objectives based on the management measures identified in this SEE and any statutory or regulatory obligations
- details of person responsible for the implementation of each action.

7.2 Operational environmental management

The proposal will be operated by Cowra Council once construction is complete and management and ownership of the asset has been transferred. Cowra Council would be responsible for the preparation of any operational environmental management requirements. It is expected that the plant would be operated in a similar manner to the existing WTP which Cowra Council currently operates on the site.

7.3 Summary of management measures

Environmental safeguards and management measures outlined in this SEE will be incorporated during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7.1.

Table 7.1 Summary of mitigation measures

ID	Impact	Mitigation measure	Responsibility	Timing
BIO1	Vegetation clearance	Prior to the commencement of any work in or adjoining areas of native vegetation, a survey will be carried out to mark the construction impact boundary. The perimeter of this area will be fenced using high visibility fencing and clearly marked as the limits of clearing. All vegetation outside this fence line will be clearly delineated as an exclusion zone to avoid vegetation and habitat removal. Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Contractor	Pre-construction
BIO2	Removal of fauna habitat	Prior to the commencement of any vegetation clearing the following will be undertaken: • Pre-clearance fauna surveys, undertaken by a suitably qualified ecologist(s) prior to the commencement of any clearing activities. • The presence of significant environmental or priority weed infestations will be identified and communicated to the contractor	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
		Surrounding vegetation (i.e. non-hollowing bearing trees and understory plants) will be inspected by the ecologist for the presence of fauna.		
BIO3	Removal of fauna habitat	Suitable bush rock habitat will be relocated to nearby adjacent areas outside of the construction footprint and checked by a qualified ecologist prior to construction commencing for any resident fauna.	Contractor	Construction
BIO4	Removal of fauna habitat	Staged vegetation clearing, commencing with the most disturbed vegetation and progressing towards higher quality vegetation to increase the opportunity for fauna to vacate the site and disperse into areas of adjoining habitat to evade injury.	Contractor	Construction
BIO5	Removal of fauna habitat	Where possible, clearance of hollow-bearing trees will occur outside of the breeding season of bats and birds with the potential to occur at the site (typically during September-December), and periods when some species (microbats) are in torpor (typically during June-August).	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
BIO6	Vegetation clearance	Stockpiles of fill or vegetation will be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Contractor	Construction
BIO7	Introduction of Weeds and Pathogens	All machinery will be appropriately cleaned prior to entry to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*) in accordance with the national best practice guidelines.	Contractor	Construction
ABH1	Unexpected finds	Should archaeological material be found during construction, the unexpected finds protocol (Appendix 2 of Appendix C) will be enacted.	Contractor	Construction
NAH1	Discovery of heritage items	If potential relics or archaeological items are uncovered during the works, all works in the vicinity of the find will cease and the advice from a qualified heritage specialist be sought. Water Infrastructure NSW project representatives will also be informed.	Contractor	Construction
NV1	Consultation	All sensitive receivers (e.g. schools, local residents) likely to be affected (within about two kilometres) will be notified prior to commencement of any work associated with the activity that may have an adverse noise or vibration impact.	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
NV2	Construction noise impacts	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • all project specific and relevant standard noise and vibration management measures • relevant licence and approval conditions • permissible hours of work • any limitations on high noise generating activities (ie restrictions on locations and times) • location of nearest sensitive receivers • construction employee parking areas • designated loading/unloading areas and procedures • site opening/closing times (including deliveries) • environmental incident procedures.	Contractor	Construction
NV3	Out of hours works	If works outside standard construction hours is required then the contractor's environmental representative would: • justify the need for the out of hours works • consider potential noise impacts and implement relevant safeguards	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
		• identify community notification requirements • seek an out of hours work approval.		
NV4	Consultation with highly noise affected receivers	The proponent should communicate in advance with the potentially impacted residents by clearly explaining the duration and noise level of the works, and inform of any respite periods.	Contractor	Construction
NV5	Operational noise	The buildings enclosing mechanical equipment should be designed to meet the project noise trigger levels at the nearest sensitive receivers in accordance with the requirements of the Noise Policy for Industry. Additional considerations include: • Internal areas of the main building should be designed to have an (average) internal noise level of 80 dBA or lower • Locating louvres on facades away from sensitive receivers • Designing exhaust ventilation systems with appropriate mitigation, if required. Testing after installation would be undertaken to confirm whether impacts are experience with further noise attenuation measure to be implemented into the building if required.	Contractor	Pre-Construction

ID	Impact	Mitigation measure	Responsibility	Timing
NV6	Operational noise	Any external noise sources should be selected and designed to meet the project noise trigger levels at the nearest sensitive receivers. i.e. have a maximum sound pressure level of 80 dBA at 1m.	Contractor	Pre-Construction
AQ1	Dust emissions	Stabilisation of disturbed surfaces will take place as soon as practicable.	Contractor	Construction
AQ2	Exhaust emissions	Construction plant and equipment will be maintained in a good working condition in order to limit impacts on air quality.	Contractor	Construction
AQ3	Exhaust emissions	Plant and machinery will be turned off when not in use.	Contractor	Construction
WQH1	Discharge of water during testing	Volumes of water to be discharged to land during testing phase are to be minimised where possible and is to occur to areas which are relatively flat to allow absorption into the ground and not allow run-off particularly towards Lake Wyangala.	Contractor	Construction
WQH2	Discharge of water during testing	Discharge location for water during testing phase will be confirmed in consultation with Cowra Council and the Wyangala Waters Holiday Park as to minimise any impacts.	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
WQH3	Discharge of water during testing	Erosion control devices are to be considered at discharge locations based on conditions located at the selected location.	Contractor	Construction
WQH4	Discharge of chlorinated water	A protocol which outlines the procedures for the discharge of any chlorinated water is to be developed and included in the CEMP. This will include any methods to dechlorinate water prior to discharge or outline locations where discharges of chlorinated water will occur to minimise impacts.	Contractor	Pre-construction
GSH1	Water quality	Dirty water will not be released into drainage lines and/or waterways and will be disposed of at an appropriately licensed facility.	Contractor	Construction
GSH2	Contamination of water	All fuels, chemicals, and liquids will be stored at least 40 m away from waterways (including existing stormwater drainage system) and will be stored in an impervious bunded area within the compound/laydown areas. Bunded areas will be check each day to ensure that are in working order.	Contractor	Construction
GSH3	Contamination of water	The refuelling of plant and maintenance of machinery will be undertaken in impervious bunded areas in the compound/laydown areas.	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
GSH4	Contamination of water	Vehicle wash downs and/or concrete truck washouts will be carried out within the designated bunded area on an impervious surface or carried out off-site.	Contractor	Construction
GSH5	Contamination of water	Visual monitoring of water quality of surface water leaving the proposal site will be carried out on a regular basis to identify potential spills or the effects of sediment-laden runoff.	Contractor	Construction
GSH6	Spills and leaks	A site specific emergency spill plan will be developed, and include spill management measures in accordance with all relevant guidelines including relevant EPA guidelines.	Contractor	Construction
GSH7	Unknown contamination	In the event that indicators of contamination are encountered during construction (such as odours or visually contaminated materials), work in the area will cease until an environmental consultant can advise on the need for remediation or other action.	Contractor	Construction
TT1	Impacts on road network	Vehicle movements along Reg Hailstone Way are to be limited to light vehicles only with heavy vehicles to access the site from Cowra via Darbys Falls Road.	Contractor	Construction

ID	Impact	Mitigation measure	Responsibility	Timing
TT2	Access to other land uses	Vehicular access is to be maintained to the existing WTP and the telecommunications tower located adjacent to the proposal site. Consultation with the asset owners will be undertaken to confirm the access requirements for these assets.	Contractor	Construction
BF1	General	A bushfire management procedure will be developed and incorporated into the CEMP.	Contractor	Construction
BF2	Hot works and ignition of fire	A hot works procedure will be developed and include in the CEMP.	Contractor	Construction
LU1	Impacts to utilities	The contractor will consult with relevant utility providers and the potentially impacted landholder (Council) to minimise impacts on access to existing assets where possible and to coordinate any loss of power to existing infrastructure include alternate supply.	Contractor	Pre-construction
VA1	Construction area impacts	All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the proposal site and will be removed from the site following the completion of construction.	Contractor	Construction
WM1	Waste minimisation	A resource and waste management plan will be prepared and implemented as part of the CEMP.	Contractor	Pre-construction and construction

ID	Impact	Mitigation measure	Responsibility	Timing
WM2	Demand on resources	Excavated material will be reused on-site for fill where feasible to reduce demand on resources.	Contractor	Construction
WM3	Waste management	Waste bins will be provided and recycling of materials encouraged. Waste will be transported to an appropriate waste disposal facility.	Contractor	Construction
SE1	Consultation	Reasonable notice will be provided to nearby residents and Cowra Council prior to the start of the works. Notice will include the proposed start date, a description of the proposed works and activities, the estimated duration and timeframes, and the proposed complaints handling process.	Contractor	Construction

8. Conclusion

8.1 Justification of the proposal

The existing WTP located at the proposal site is unable to treat water to a standard which is in accordance with current *Australian Drinking Water Guidelines* (2011) and *Health Based Targets for Drinking Water Safety* (2015) standards.

This water is currently provided to the village of Wyangala and the holiday park and is currently not considered potable. The proposal is therefore considered to be in the public interest as the proposed WTP would ensure that the Wyangala community will be supplied with potable drinking water which would also reduce the risk of potential health issues associated with partially treated water.

The proposal would also see the existing WTP infrastructure which is beyond its operational life, being replaced with more advanced infrastructure. Without this upgrade the ability of the existing WTP to treat water would further deteriorate and potentially result in a further inability to service the Wyangala village and holiday park.

The proposal site is suitable and justified for such a development as the land is current used for a similar use.

8.2 Conclusion

This SEE assesses the potential impact of the proposal in accordance with section 4.15 of the EP&A Act. This SEE the potential environmental impacts of the proposal, considering both the potential positive and negative impacts of the proposal. The document also recommends mitigation measures to protect the environment where required.

The following key impacts associated with the proposal have been identified:

- impacts to biodiversity as a result of vegetation removal (not considered significant in accordance with the BC and EPBC Acts)
- water quality due to erosion and sedimentation of disturbed areas
- construction noise due to the operation of machinery and equipment.

The operation of the WTP is not considered to result in any significant impacts with the plant operating in a similar manner to the existing plant.

Overall, potential negative impacts associated with the proposal can be adequately managed by implementing the management measures in section 7.3, and the beneficial impacts (outlined in section 8.1) are considered to outweigh the adverse impacts.

9. References

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Appendix A – Detailed design plans

REV	DATE	REVISION DESCRIPTION	BY	CHK	CIV/STR	MECH	E/I	PROCESS
01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

APPROVED

REFERENCE

DRAWING NUMBER	TITLE
DRG–MM–0038	METERING & SLUDGE HANDLING FLOOR PLANS & ELEVATIONS
DRG–MM–0037	WTP BUILDING FLOOR PLAN

ENVIROPACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

EPS DRG No.: 114005–L–001

PROJECT NO.	114005	
ENG. DESIGN BY	M.STARK	
DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

SITE ANALYSIS PLAN

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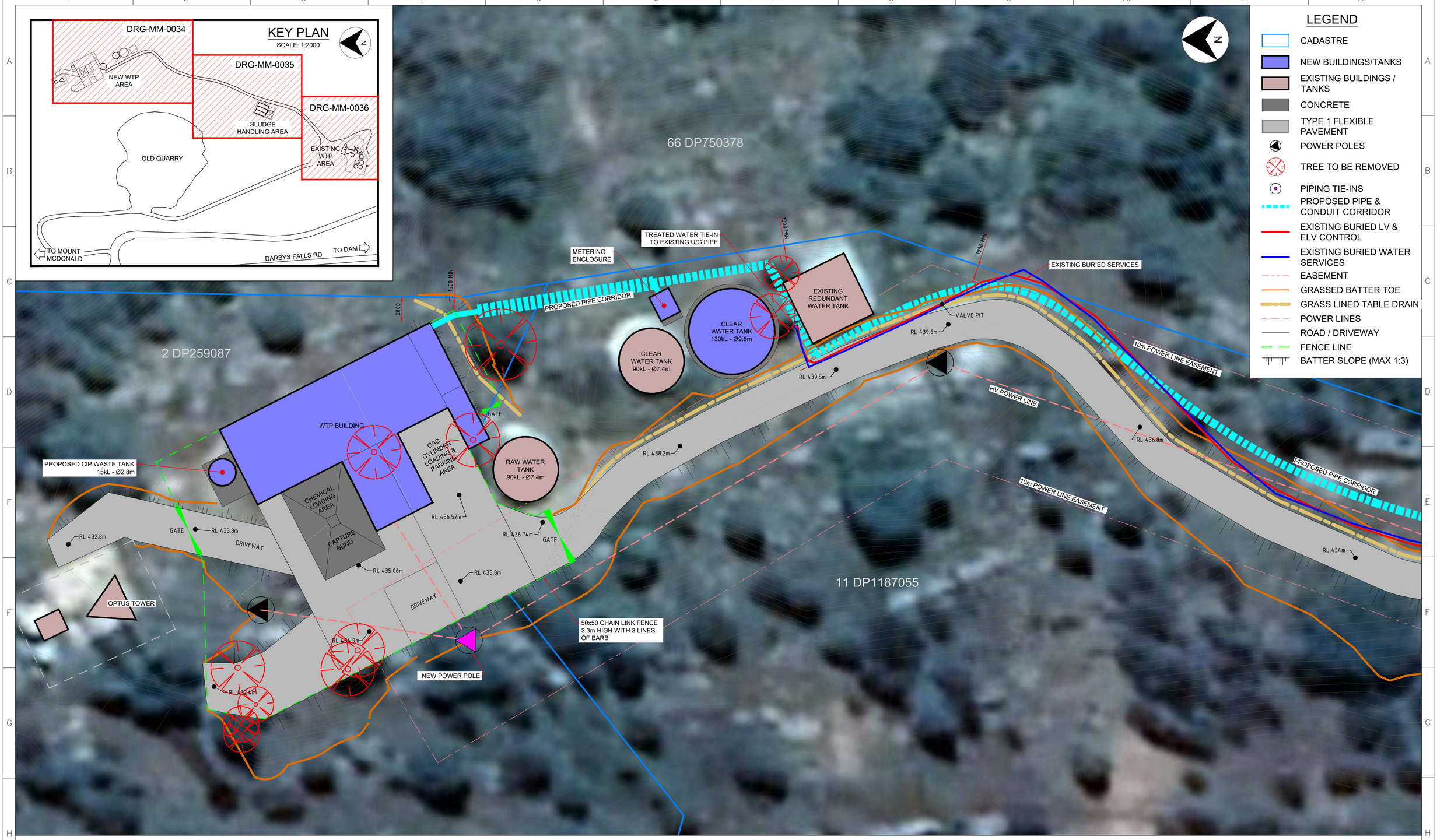

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NOTE

1. TREE CLEARING WITHIN EASEMENT SUBJECT TO ESSENTIAL ENERGY TERMS OF EASEMENT

REV	DATE	REVISION DESCRIPTION	BY	CHK	CIV/STR	MECH	E/I	PROCESS
01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

APPROVED

REFERENCE

DRAWING NUMBER

TITLE

ENVIROPACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

EPS DRG No.: 114005-L-002

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DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

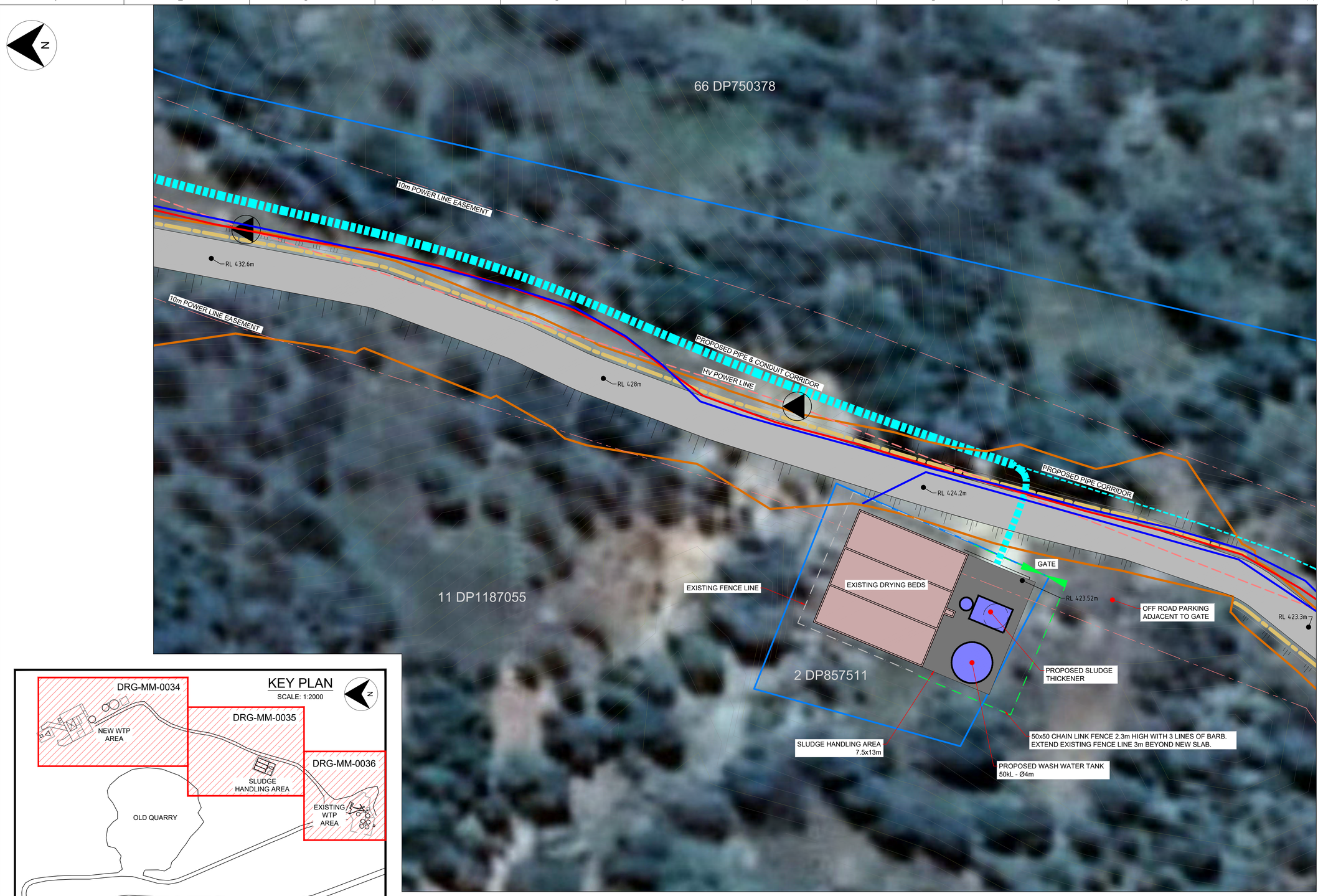
SITE PLAN
NEW WTP AREA

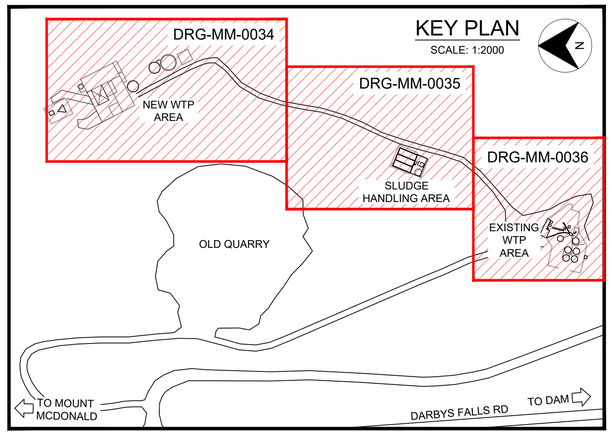
Scale A1 1:200

DRG NO. WDLWYAWTP0000-LA140013-ENVI-DRG-MM-00034

SHEET –

REV 01





NOTE

1. TREE CLEARING WITHIN EASEMENT SUBJECT TO ESSENTIAL ENERGY TERMS OF EASEMENT

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01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

APPROVED

REFERENCE

DRAWING NUMBER | TITLE

ENVIROPACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

EPS DRG No.: 114005-L-003

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DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

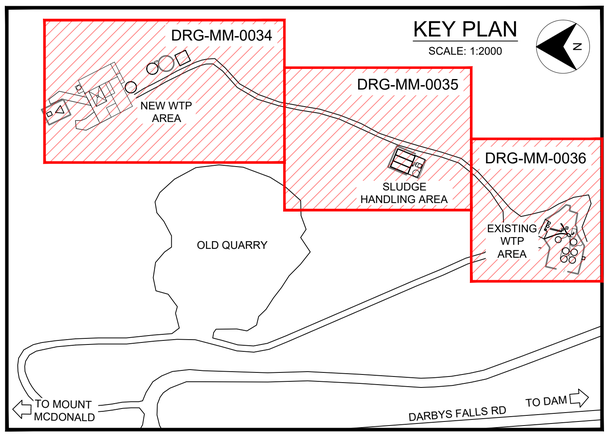
WYANGALA DAM WATER TREATMENT PLANT

SITE PLAN
SLUDGE HANDLING AREA

Scale 1:200 | A1 | DRG NO. WDLWYAWTP0000-LA140013-ENVI-DRG-MM-00035 | SHEET – | REV 01

LEGEND

- CADASTRE
- NEW BUILDINGS/TANKS
- EXISTING BUILDINGS / TANKS
- CONCRETE
- TYPE 1 FLEXIBLE PAVEMENT
- POWER POLES
- PIPING TIE-INS
- PROPOSED PIPE & CONDUIT CORRIDOR
- EXISTING BURIED LV & ELV CONTROL
- EXISTING BURIED WATER SERVICES
- EXISTING ABOVE GROUND WATER SERVICES
- EASEMENT
- GRASSED BATTER TOE
- GRASS LINED TABLE DRAIN
- POWER LINES
- ROAD / DRIVEWAY
- FENCE LINE
- BATTER SLOPE (MAX 1:3)



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NOTE

1. TREE CLEARING WITHIN EASEMENT SUBJECT TO ESSENTIAL ENERGY TERMS OF EASEMENT

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01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

REFERENCE | DRAWING NUMBER | TITLE

ENVIRO PACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

EPS DRG No.: 114005-L-004

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DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

SITE PLAN
EXISTING WTP AREA

Scale	A1	DRG NO.	SHEET	REV
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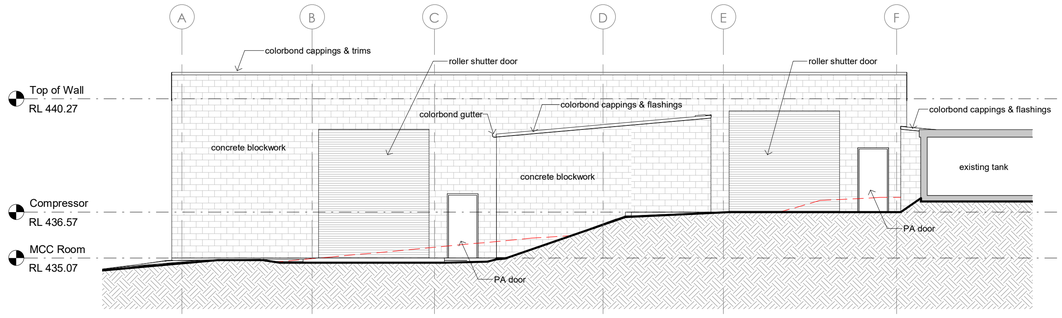
WATER TREATMENT BUILDING

WYANGALA DAM, NSW



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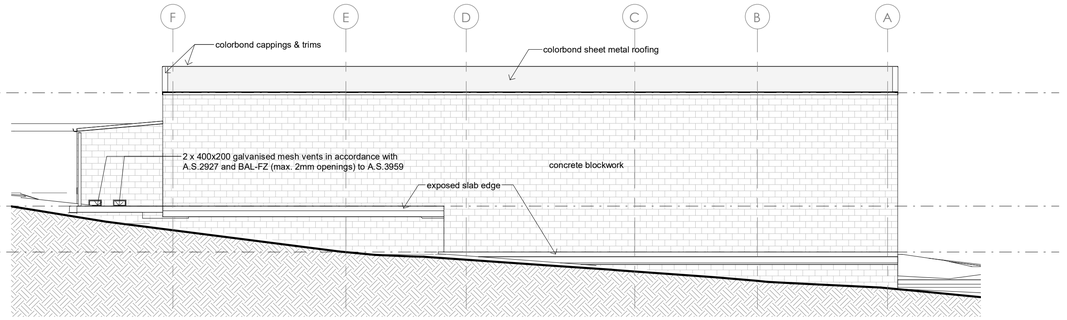

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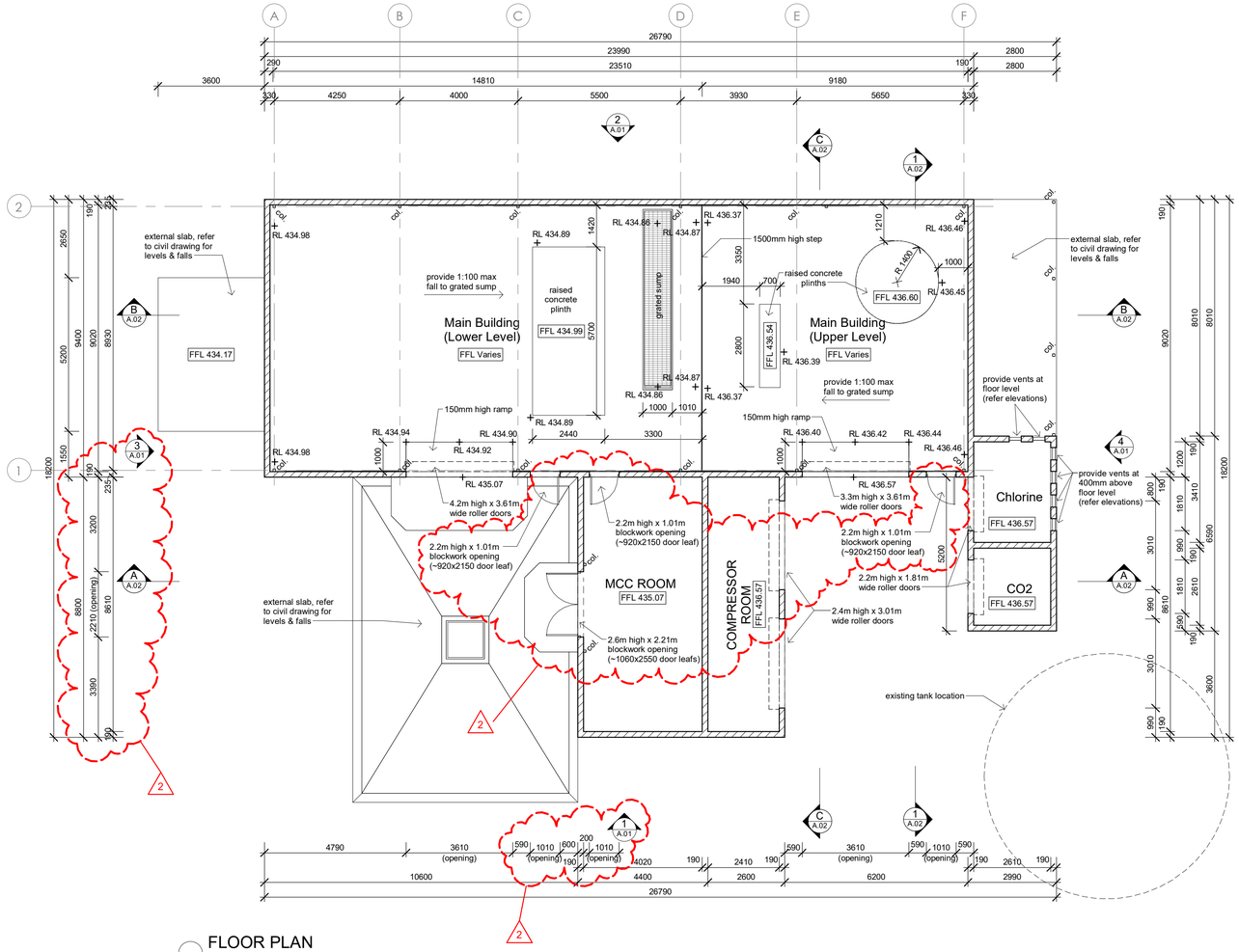

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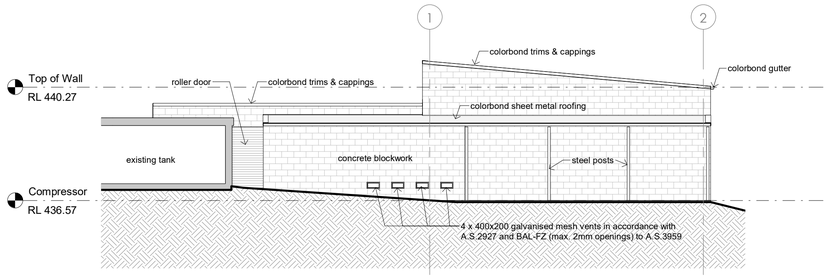

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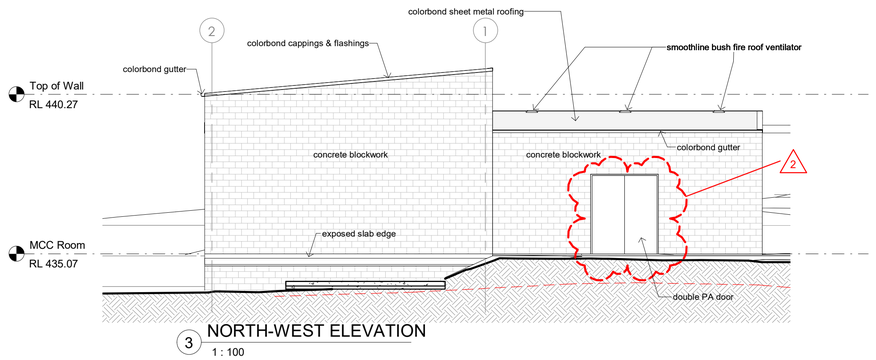

3 NORTH-WEST ELEVATION
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DRAWING SCHEDULE

ARCHITECTURAL

A.01	FLOOR PLAN & ELEVATIONS
A.02	SECTIONS

NOTE:
this drawing to be read in conjunction with engineers drawings, including Civil, Structural, Plant & Equipment.

WDLWYAWTP0000-LA140013-ENVI-DRG-CC-00041 Rev 2

DRAWING MUST BE PRINTED IN COLOUR

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1	30.06.21	ISSUED FOR CONSTRUCTION
2	16.07.21	PA DOOR DIMENSIONS ADDED

FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALING.

CHECK ALL DIMENSIONS ON SITE BEFORE FABRICATING ANY ITEM.

ENVIROPACIFIC
CELEBRATING 20 YEARS

HavenhandMather
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Architects Registration Board: 6799

PROJECT: WATER TREATMENT BUILDING
WYANGALA DAM, NSW

DRAWING: FLOOR PLAN & ELEVATIONS

JOB NO. 2111
SCALE: 1 : 100
DATE: 11.06.2021
DRAWN: CJG
CHECKED: DFM
SHEET No: A.01
REV. No: 2
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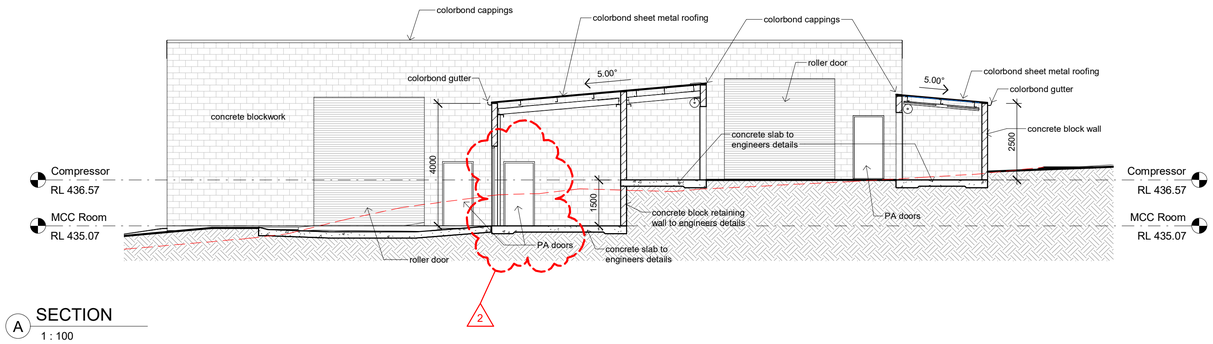

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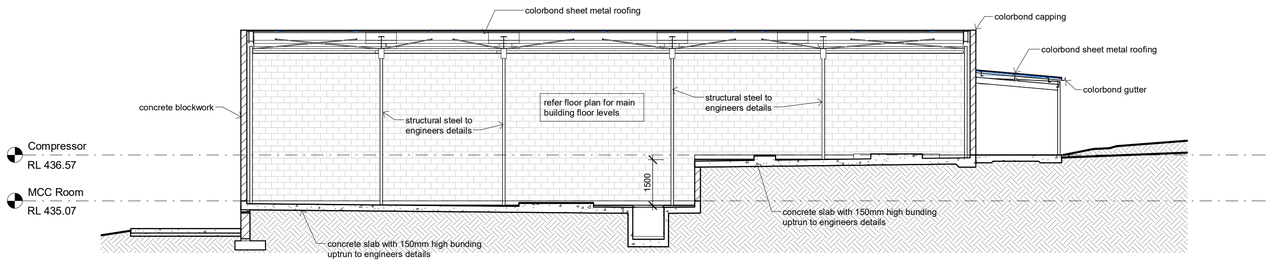

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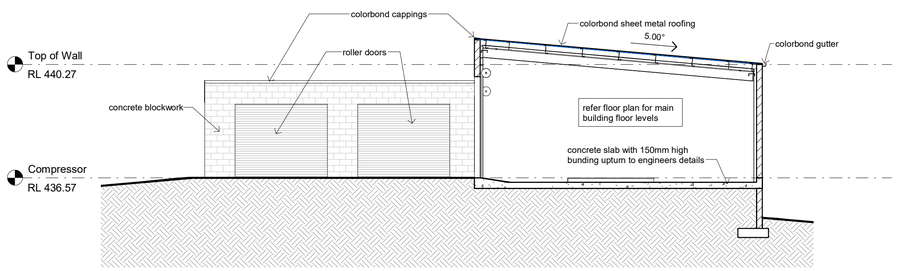

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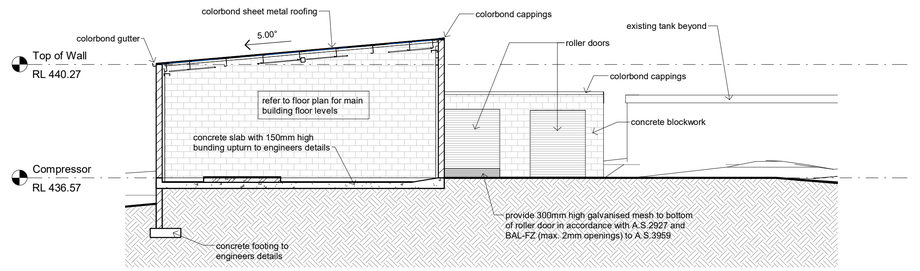

NOTE:
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WDLWYAWTP0000-LA140013-ENVI-DRG-CC-00042 Rev 2

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FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALING.

CHECK ALL DIMENSIONS ON SITE BEFORE FABRICATING ANY ITEM.

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HavenhandMather ARCHITECTS PLANNERS
Member Australian Institute of Architects
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02 6331 7155
PO Box 208, Bathurst 2795
mail@havenhandmather.com.au
Architects Registration Board: 6799

PROJECT:
WATER TREATMENT BUILDING
WYANGALA DAM, NSW

DRAWING:
SECTIONS

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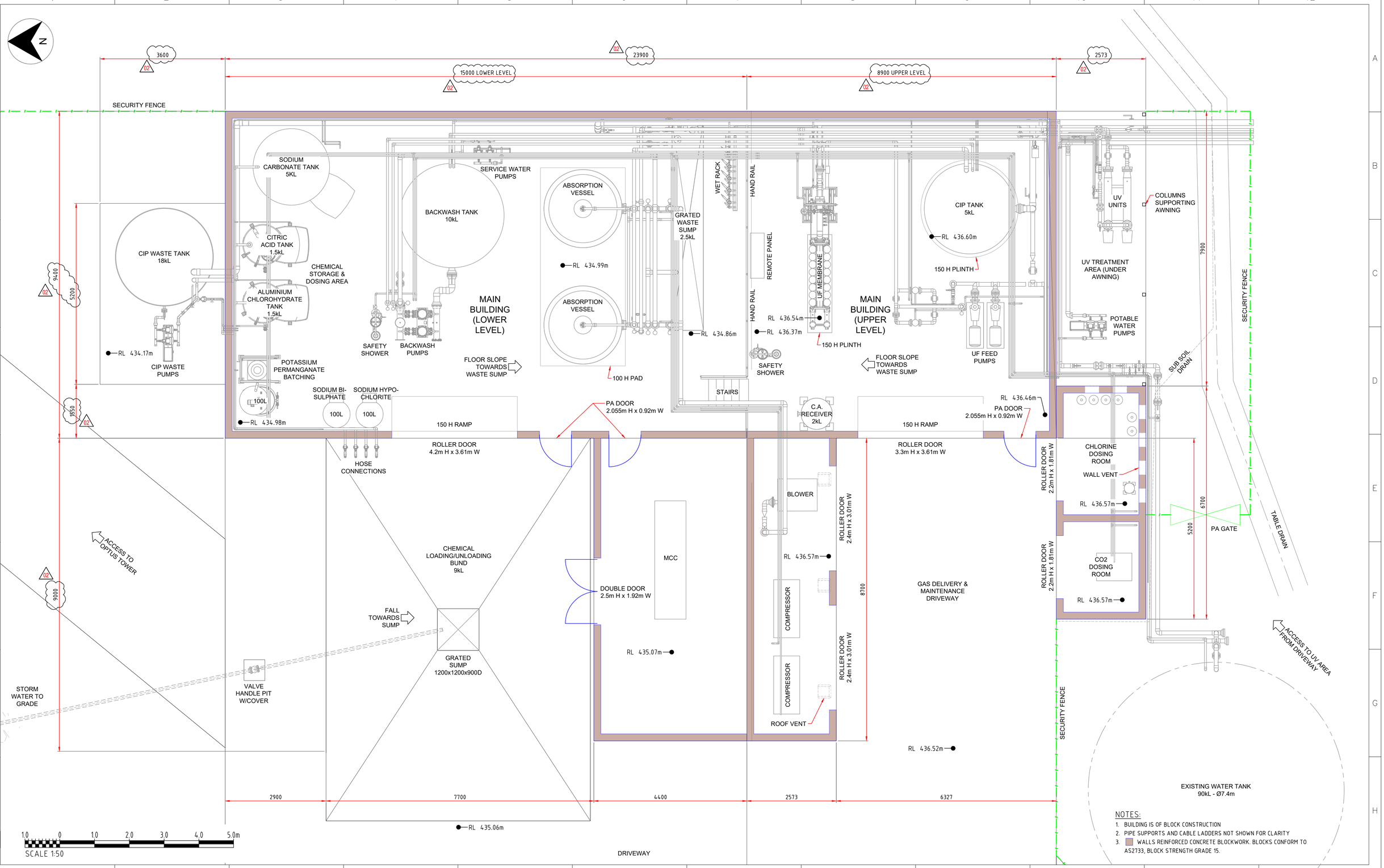


NOTES:

1. BUILDING IS OF BLOCK CONSTRUCTION
2. PIPE SUPPORTS AND CABLE LADDERS NOT SHOWN FOR CLARITY
3. WALLS REINFORCED CONCRETE BLOCKWORK. BLOCKS CONFORM TO AS2733, BLOCK STRENGTH GRADE 15.

REV	DATE	REVISION DESCRIPTION	BY	CHK	CIV/STR	MECH	E/I	PROCESS
02	06.08.21	RE-ISSUED FOR CONSTRUCTION	DJP	JP				
01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

APPROVED

REFERENCE

DRG–MM–0033 SITE ANALYSIS PLAN

DRAWING NUMBER TITLE

ENVIROPACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

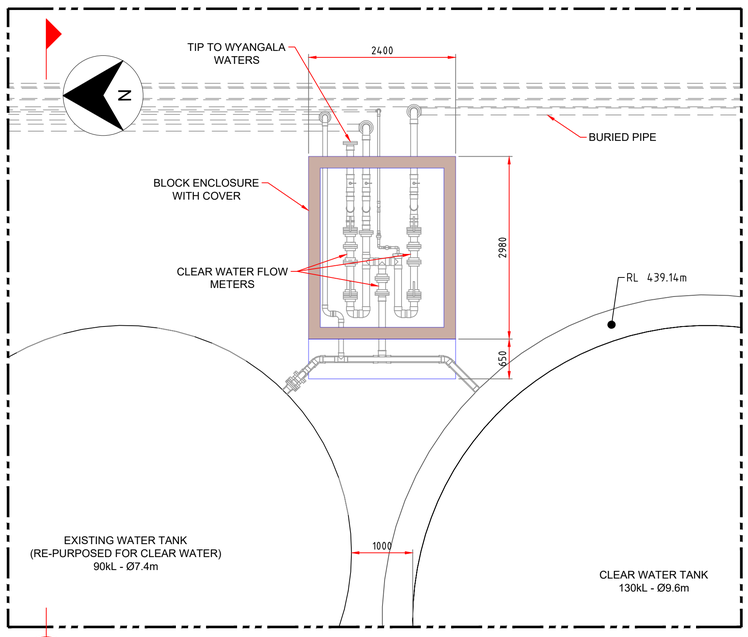
EPS DRG No.: 114005–L–005

PROJECT NO.	114005	
ENG. DESIGN BY	M.STARK	
DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

WTP BUILDING LAYOUT

Scale 1:50 | A1 | DRG NO. WDLWYAWTP0000–LA140013–ENVI–DRG–MM–00037 | SHEET 1 of 1 | REV 02



METERING AREA

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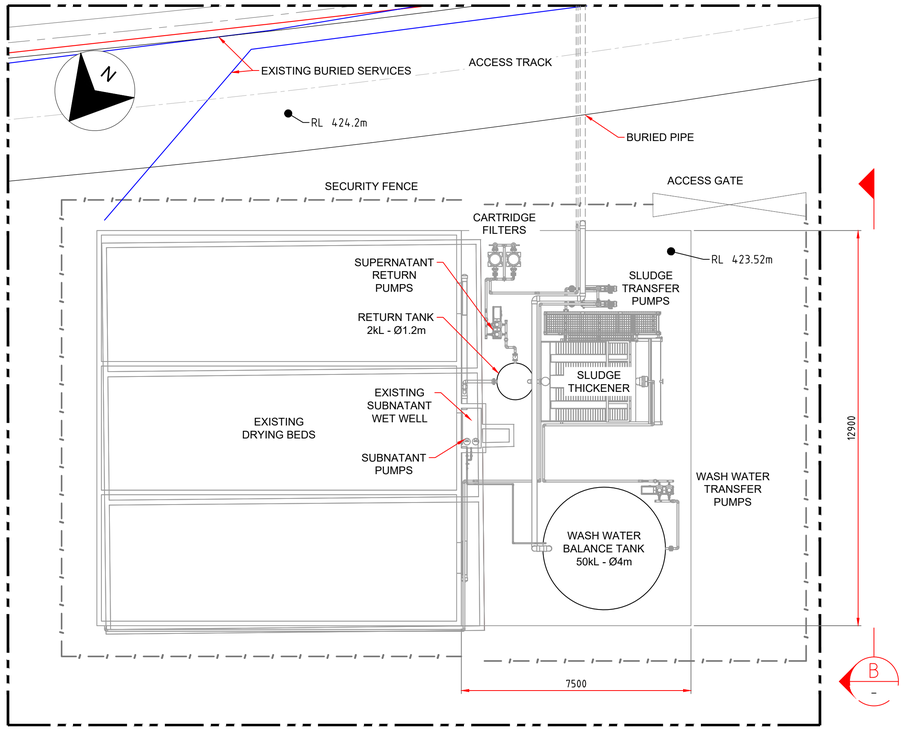
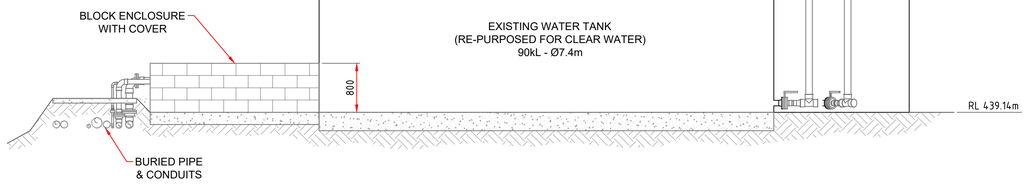


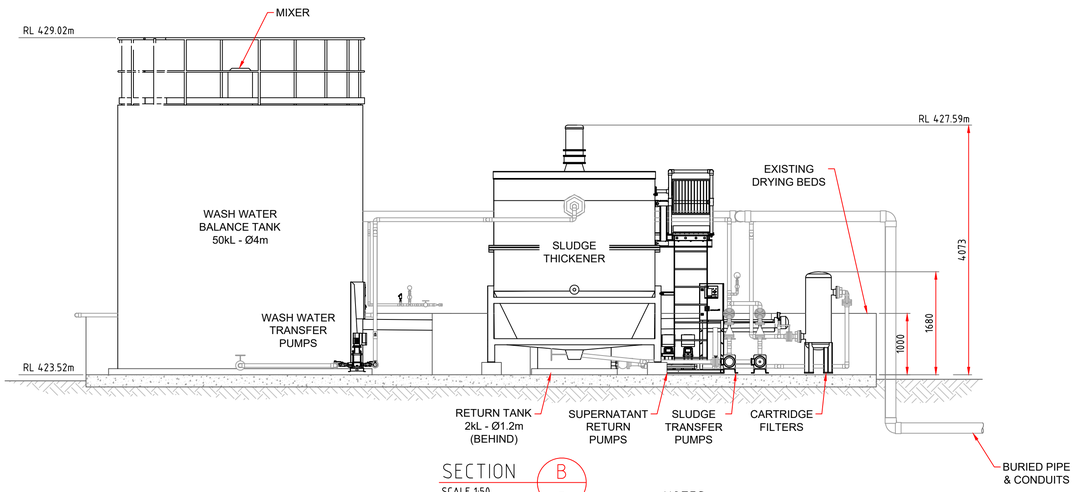
SLUDGE HANDLING AREA

SCALE: 1:100



SECTION A

SCALE 1:50



SECTION B

SCALE 1:50

NOTES:

1. BUILDING IS OF BLOCK CONSTRUCTION
2. PIPE SUPPORTS AND CABLE LADDERS NOT SHOWN FOR CLARITY
3. WALLS REINFORCED CONCRETE BLOCKWORK. BLOCKS CONFORM TO AS2733, BLOCK STRENGTH GRADE 15.

1.0 0 1.0 2.0 3.0 4.0 5.0m

SCALE 1:50

REV	DATE	REVISION DESCRIPTION	BY	CHK	CIV/STR	MECH	E/I	PROCESS
01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

APPROVED

REFERENCE

DRAWING NUMBER	TITLE
DRG–MM–0033	SITE ANALYSIS PLAN

ENVIROPACIFIC

A.B.N: 43111372064

ENVIROPACIFIC SERVICES PTY LIMITED

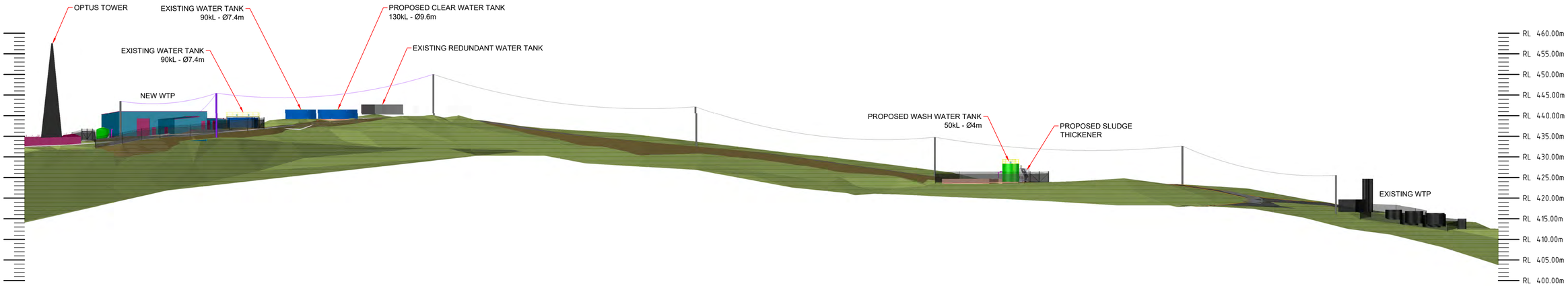
EPS DRG No.: 114005–L–006

PROJECT NO.	114005	
ENG. DESIGN BY	M.STARK	
DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

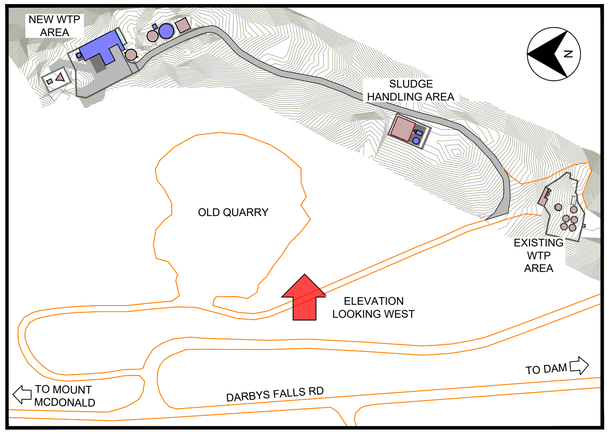
METERING & SLUDGE HANDLING FLOOR PLANS & ELEVATIONS

Scale	A1	DRG NO.	SHEET	REV
1:50		WDLWYAWTP0000–LA140013–ENVI–DRG–MM–00038	1 of 1	01



ELEVATION LOOKING WEST

SCALE: 1:500



KEY PLAN

SCALE: 1:2000

10 0 10 20 30 40 50m

SCALE 1:500

REV	DATE	REVISION DESCRIPTION	BY	CHK	CIV/STR	MECH	E/I	PROCESS
01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

APPROVED

REFERENCE

DRAWING NUMBER

TITLE

ENVIRO PACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

EPS DRG No.: 114005-L-007

PROJECT NO.	114005	
ENG. DESIGN BY	M.STARK	
DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

SITE ELEVATION

Scale A1: 1:500

DRG NO.: WDLWYAWTP0000-LA140013-ENVI-DRG-MM-00039

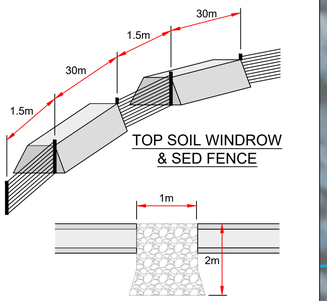
SHEET: –

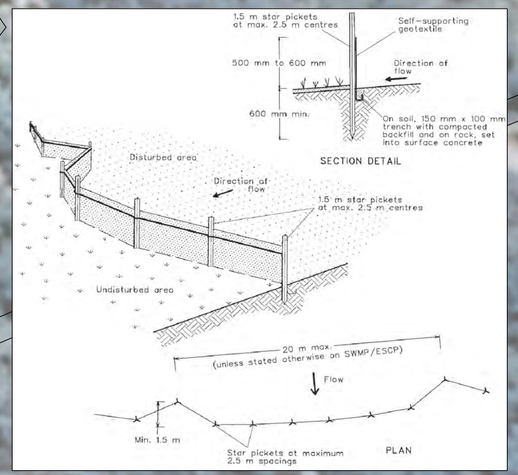
REV: 01

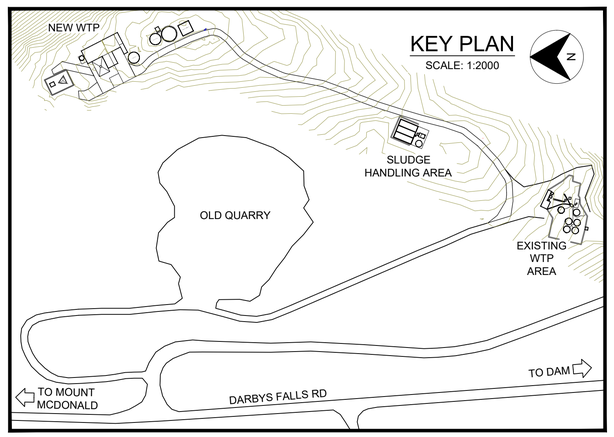
LEGEND

- PROPOSAL SITE
- COMPOUND LOCATIONS
- CADASTRE
- THREATENED VEGETATION COMMUNITIES
- NEW BUILDINGS/TANKS
- EXISTING BUILDINGS / TANKS
- CONCRETE
- TYPE 1 FLEXIBLE PAVEMENT
- PROPOSED PIPE & CONDUIT CORRIDOR
- EXISTING BURIED WATER SERVICES
- EXISTING BURIED LV & ELV CONTROL
- POWER LINE EASEMENT
- POWER LINES
- FENCE LINE
- ROAD / DRIVEWAY
- BATTER TOE
- GRASS LINED TABLE DRAIN
- TOP SOIL WINDROW
- SED FENCE @ 30m SPACINGS (SEE EXAMPLE SKETCHES)
- ROCK WRAP SPILLWAY 2m x 1m - 150mm CRUSHED ROCK (SEE EXAMPLE SKETCH)
- BATTER SLOPE (MAX 1:3)
- POWER POLES

PARKING 15x4m
PROPOSED WTP
DRIVEWAY
OPTUS TOWER
PROPOSED POWER POLE
PARKING / LAYDOWN AREA
UPPER REFUELING AREA 15x4m
PROPOSED PIPE CORRIDOR
ACCESS TRACK 4m WIDE
EXISTING DRYING BEDS
PROPOSED SLUDGE HANDLING AREA
O'HEAD POWER LINE
EXISTING WTP
POWER POLE WITH SUBSTATION
OLD QUARRY
LAYDOWN AREA 50x20m
SITE BUILDINGS
PARKING / REFUELING AREA 25x15m
LUNCH ROOM 6x3m
SITE OFFICE 6x3m
TOILET BLOCK 3.6x2.4m
QUARRY ENTRY
FROM DARBYS FALLS RD
ACCESS TRACK 4m WIDE
PROTECTED AREA ENCLOSED WITH CROWD CONTROL BARRIERS TO ENSURE PEDESTRIANS ARE SAFE WHEN EXITING BUILDINGS
CONCRETE WASHOUT AREA 10x4m







10 0 10 20 30 40 50m
SCALE 1:500

REV	DATE	REVISION DESCRIPTION	BY	CHK	APPROVED: CIV/STR	MECH	E/I	PROCESS
01	19.07.21	ISSUED FOR CONSTRUCTION	DJP	JP				

REFERENCE

DRAWING NUMBER

TITLE

ENVIRO PACIFIC

A.B.N: 43111372064
ENVIROPACIFIC SERVICES PTY LIMITED

EPS DRG No.: 114005-L-008

PROJECT NO.	114005	
ENG. DESIGN BY	M.STARK	
DRAWN	DJP	19.07.21
CHECKED	JP	19.07.21
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

WYANGALA DAM WATER TREATMENT PLANT

EROSION AND SEDIMENT CONTROL PLAN

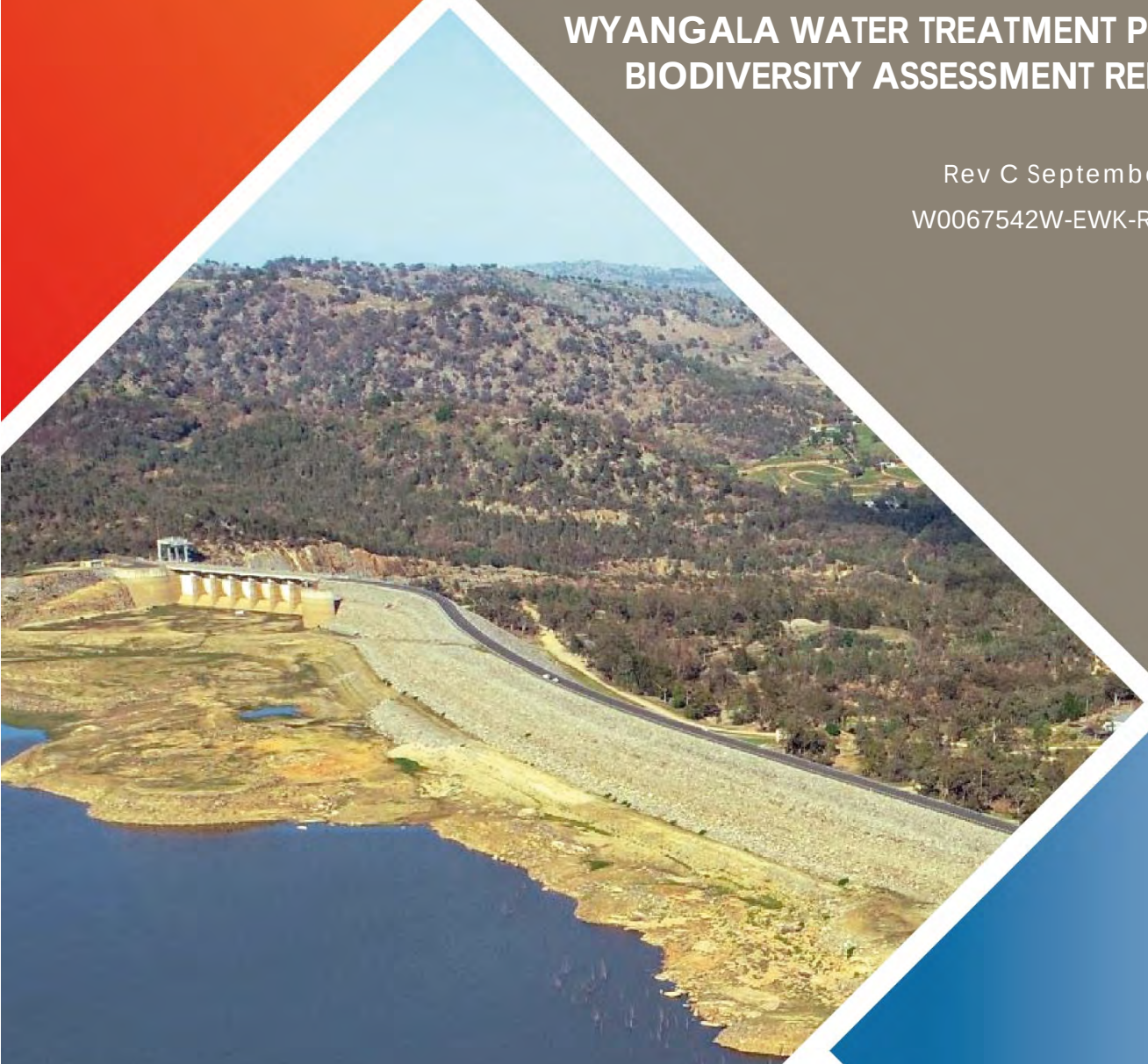
Scale 1:500 | A1 | DRG NO. WDLWYAWTP0000-LA140013-ENVI-DRG-MM-00040 | SHEET 1 of 1 | REV 01

Appendix B – Biodiversity Assessment Report

WYANGALA DAM WALL RAISING
PLANNING AND DEVELOPMENT CONSULTANCY
WYANGALA WATER TREATMENT PLANT BIODIVERSITY ASSESSMENT REPORT

Rev C September 2021

W0067542W-EWK-REP-055



Stantec

GHD

Wyangala Dam Wall Raising
Planning and Development Consultancy

Wyangala Water Treatment Plant
Biodiversity Assessment Report

This report is issued to Water Infrastructure NSW by the Stantec GHD Joint Venture:

Prepared By:	Recommended for Issue by:	Approved for Issue by:
Primary Author: Mal Weerakoon Responsible Joint Venturer: GHD	Jayne Tipping, SGJV Biodiversity Lead 02/09/21	Steve Fox, SGJV Project Director 02/09/21

Revision Status

Revision	Status	Issued by	Date
A	Draft	Ben James	06/08/21
B	Final Draft	Ben James	18/08/21
C	Final	Ben James	02/09/21

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Introduction

1.1 The proposal

Water Infrastructure NSW is proposing to replace the existing water treatment plant (WTP) at Wyangala, which includes construction of a new plant, and upgrades to the pipeline system (the proposal). The proposed works would provide potable water to the Wyangala village and Wyangala Waters Holiday Park.

The proposal requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). A Statement of Environmental Effects (SEE) is to be submitted to Council for assessment as part of a development application (DA) for the proposal.

The SEE has been prepared by Stantec GHD Joint Venture (SGJV) on behalf of Water Infrastructure NSW. The SEE examines the statutory context of the proposal and assesses the potential impact to the environment. Mitigation measures are proposed to minimise any identified impacts. This Biodiversity Assessment Report (BAR) has been prepared to support the SEE. It provides an assessment of the potential biodiversity impacts of the proposed works, with particular emphasis on threatened ecological communities, populations and species listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 Key features of the proposal

The proposal includes the following key features:

- new WTP building located north of the existing WTP adjacent to the existing raw water tanks
- new clear water tank adjacent to existing raw water tanks
- new sludge handling area adjacent to existing sludge drying beds, including wash water tank and sludge thickener
- new pipeline between existing raw water pipeline at existing WTP and new WTP
- new pipeline between new WTP and sludge handling area
- adjustment to pipework within existing WTP to ensure connections to raw water pipeline and supply to Wyangala village
- upgrade of existing road from existing WTP to new WTP
- upgrade of existing power supply including widening of associated easement.

An overview of the proposal is shown in Figure 2.

1.3 Purpose of this report

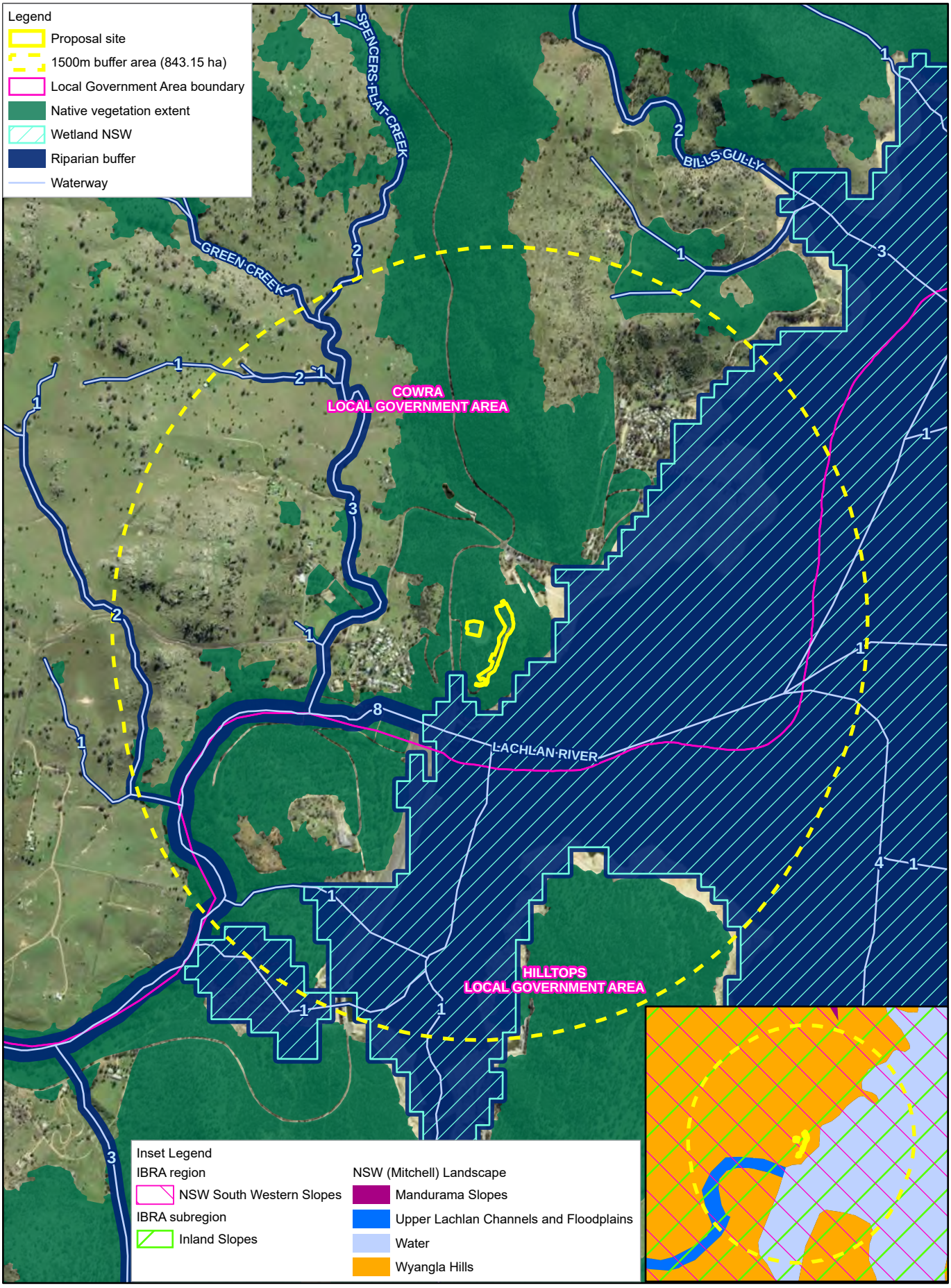
The purpose of this Biodiversity Assessment Report (BAR) is to:

- Describe the existing environment of the proposal site and surrounding study area, including flora species, vegetation zones, fauna species and habitats known or likely to occur, and a list of threatened biota previously recorded, or predicted to occur in the locality;
- Assess the value and conservation significance of native vegetation and habitats in the study area and the likelihood of occurrence of threatened biota based on the habitats present;
- Assess impacts of the proposal, addressing potential effects on native biodiversity values and particularly threatened biota and their habitats;
- Complete assessments of significance according to section 7.3 of the BC Act for threatened biota known or likely to occur in the study area and/or be affected by the proposal;
- Consider the significance of impacts on MNES listed under the EPBC Act that are known or likely to occur in the study area and/or be affected by the proposal;
- Recommend mitigation measures to reduce impacts on biodiversity values.

Provide concluding statements regarding the likely significance of impacts of the proposal on biodiversity values and on threatened biota or EPBC Act Matters of National Environmental Significance and the requirement or otherwise for further assessment or approvals at the State or Commonwealth level.

1.4 Definitions of assessment area

- The **'proposal'** or '**proposed works'** refers to the construction of the Water Treatment Plant described in section 1.2 and shown in Figure 2.
- The **'proposal site'** refers to those areas that may be directly impacted by the proposed works. This includes the area in which the roads and utilities would be constructed. The proposal site has a total area of about 1.51 hectares and is located within the Cowra Local Government Area (LGA).
- The **'study area'** refers to the proposal site and adjacent areas surveyed as part of previous designs for the proposed works. The study area also includes areas around Wyangala Dam surveyed as part of the early works and main works program for the raising of the Wyangala Dam Wall, including within the adjacent holiday park.
- The **'locality'** is defined as the area within a 20 kilometre radius of the proposal site.



Paper Size ISO A4

0 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Stantec GHD

WaterNSW
Wyangala Water Treatment Plant
Biodiversity Assessment

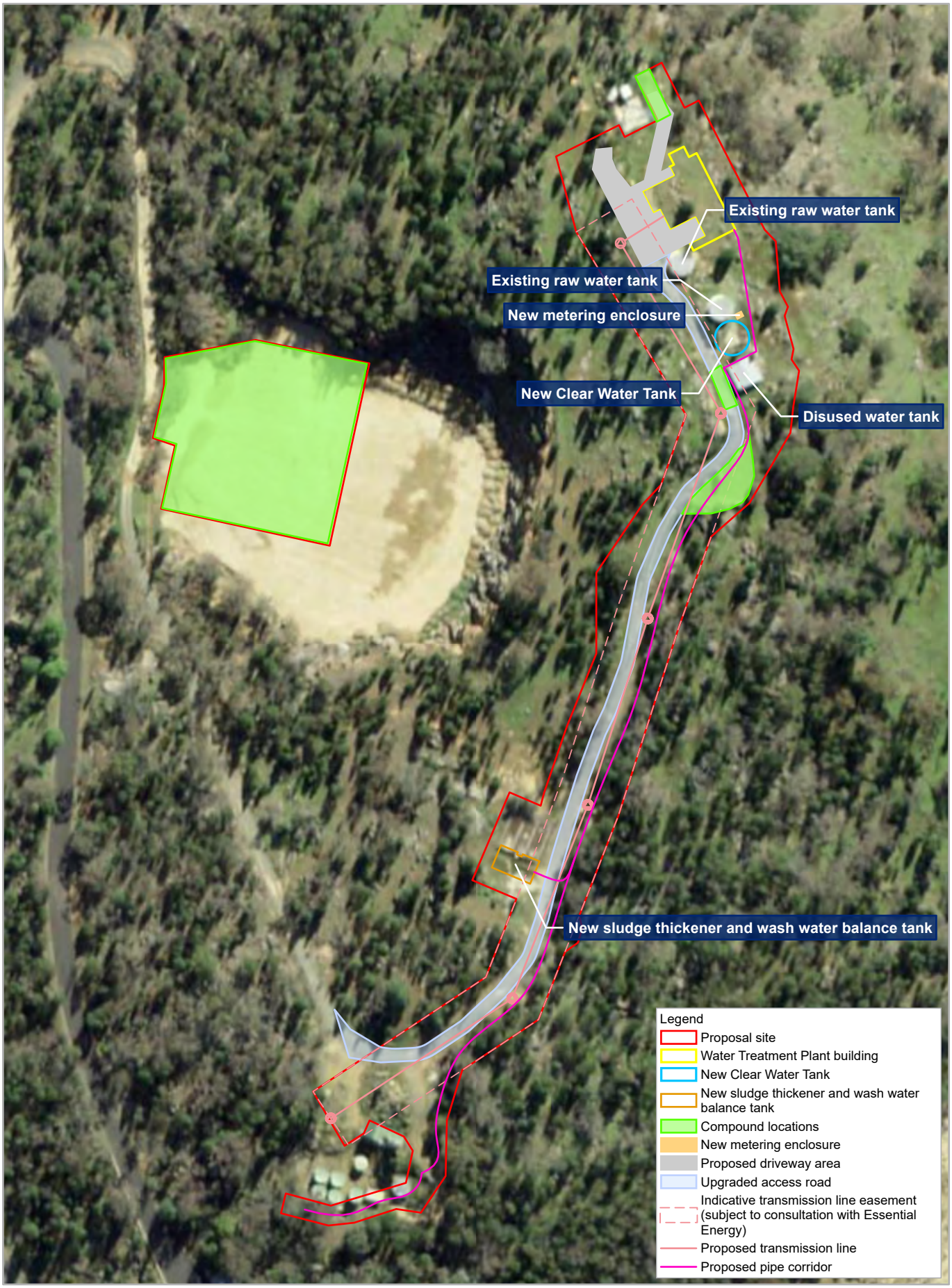
Location Map

Project No. 12528366
Revision No. **FINAL**
Date 03/ 08/ 2021

FIGURE 1

N:\AU\Sydney\Projects\21\12528366\GIS\Maps\Working\Biodiversity\BIO_WTP.aprx\12528366_BIOWTP002_LocationMap
Print date: 03 Aug 2021 - 07:28

Data source: General topo - NSW LPI DTDB; Native vegetation, wetlands NSW, IBRA regions and subregions, Mitchell Landscapes - OEH; LGAs - DPE; Aerial imagery - Sixmaps 2020 (public/NSW_Imagery: © Department of Customer Service 2020). Created by: jrprice



Paper Size ISO A4

0 25 50

Metres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Stantec GHD

Water Infrastructure NSW
Wyangala Water Treatment Plant
Statement of Environmental Effects

Project No. **12528366**
Revision No.
Date **18/08/2021**

Overview of the proposal

Figure 2

N:\AU\Sydney\Projects\21\12528366\GIS\Maps\WTP.aprx\12528366_WTP007_OverviewofProposal
Print date: 18 Aug 2021 - 13:07

Data source: Site, pipework - GHD 2020; roads - LPI DTDB 2017 ; public/NSW_Imagery: © Department of Customer Service 2020. Created by: lmanasan

1.5 Scope and limitations

This report has been prepared by SGJV for Water Infrastructure NSW and may only be used and relied on by Water Infrastructure NSW for the purpose agreed between SGJV and the Water Infrastructure NSW as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Water Infrastructure NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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

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

The opinions, conclusions and any recommendations in this report are based on assumptions made by SGJV described in this report (refer Section 9). SGJV disclaims liability arising from any of the assumptions being incorrect.

SGJV has prepared this report on the basis of information provided by Water Infrastructure NSW and others who provided information to SGJV (including Government authorities), which SGJV has not independently verified or checked beyond the agreed scope of work. SGJV does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.6 Abbreviations

Abbreviation	Definition
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCD	Biodiversity Conservation Division (formerly OEH)
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offsets Scheme
CEEC	Critically endangered ecological community
CEMP	Construction environmental management plan
DAWE	Department of Agriculture, Water and the Environment
DECCW	Department of Environment, Climate Change and Water (now BCD)
DotEE	Commonwealth Department of the Environment and Energy (now DAWE)
DPIE	Department of Planning, Industry and the Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
FM Act	*Fisheries Management Act 1994* (NSW)
GIS	Geographic information system
ha	Hectare
KTP	Key threatening process
LGA	Local Government Area
m	Metre
mm	Millimetre

Abbreviation	Definition
MNES	Matter of national environmental significance
NSW	New South Wales
OEH	Office of Environment and Heritage (now BCD)
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SIS	Species Impact Statement
TEC	Threatened ecological community
TSC Act	The former *NSW Threatened Species Conservation Act 1995*
VIS	NSW Vegetation Information System

2. Legislative context

2.1 NSW State legislation

2.1.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) forms the legal and policy platform for proposal assessment and approval in NSW and aims to, amongst other things, 'encourage the proper management, development and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and the Environmental Planning and Assessment Regulation 2000.

The proposal requires development consent under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The consent authority for the project is Cowra Council.

Under section 1.7 of the EP&A Act, the provisions of Part 7 of the *Biodiversity Conservation Act 2016* (BC Act) and Part 7A of the *Fisheries Management Act 1994* (FM Act) requires that the significance of the impact on threatened species, populations and endangered ecological communities is assessed using an assessment of significance. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Secretary's Environmental Assessment Requirements (FM Act), or a biodiversity development assessment report (BDAR) in accordance with the Biodiversity Offsets Scheme and Biodiversity Assessment Method must be prepared (BC Act).

Five-part tests have been prepared for threatened biota that would be impacted or are likely to be impacted by the proposal and are provided in Appendix D.

2.1.2 Biodiversity Conservation Act 2016

The BC Act provides legal status for biota of conservation significance in NSW. The BC Act aims to, amongst other things, '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'. It provides for the listing of threatened species and communities, establishes a framework to avoid, minimise and offset the impacts of proposed development (the Biodiversity Offsets Scheme, BOS), and establishes a scientific method for assessing the likely impacts on biodiversity values and calculating measures to offset those impacts (the Biodiversity Assessment Method, BAM).

Section 7.2 of the BC Act outlines how a development may be considered likely to significantly affect threatened species in the following ways:

a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or

b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or

c) it is carried out in a declared area of outstanding biodiversity value.

Section 7.3 of the BC Act lists five factors that must be taken into account when determining the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the BC Act. The 'five part test' or 'assessment of significance' is used to assist in the determination of whether a project is 'likely' to impose 'a significant effect' on threatened biota and thus whether a BDAR is required.

The proposal is not considered to result in significant impacts as determined by the significance assessment undertaken in accordance with Section 7.3 of the BC Act. Details of these significance assessment can be found in section 7.6 and Appendix C of this document. The proposal would also not exceed the biodiversity offset schemes threshold and would not result in any impacts on declared area of outstanding biodiversity value.

Based on the above the proposal is not considered to significant affect any threatened species in accordance with Section 7.2(1) of the BC Act.

The BC Act has been addressed in this assessment through:

- Desktop review to determine the threatened species, populations or ecological communities (referred to collectively as threatened biota) and migratory species that have been previously recorded within the locality and hence could occur in the study area subject to the habitats present
- Field surveys for threatened biota
- Identification, assessment and mapping of threatened biota (or their habitat)
- Assessment of potential impacts on listed threatened biota and migratory species,
- Identification of suitable impact mitigation and environmental management measures to minimise potential impacts on threatened biota and migratory species, where required.

Threatened biota and migratory species recorded or likely to occur in the study area are detailed further in Section 6.4 and Section 6.5 and potential impacts are identified in Section 7.

2.1.3 Biosecurity Act 2015

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Priority weeds recorded in the study area during site surveys are identified in Section 5.6.

2.2 Commonwealth legislation

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on Matters of National Environmental Significance (MNES) or the environment of Commonwealth land undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' or a significant impact to the environment of Commonwealth land is deemed to be a 'controlled action' and may not be conducted without prior approval from the Australian Minister for the Environment.

Potential MNES of relevance to this assessment include:

- Threatened species and ecological communities
- Migratory species.

The EPBC Act has been addressed in this assessment through:

- Desktop review to determine the listed biodiversity matters that are predicted to occur within the locality of the proposal and hence could occur, subject to the habitats present
- Field surveys to identify the presence of potential habitat for listed threatened biota and migratory species
- Assessment of potential impacts on threatened and migratory biota
- Identification of suitable impact mitigation and environmental management measures for threatened and migratory biota, where required.

3. Methodology

3.1 Desktop assessment

3.1.1 Database searches

A database was carried out to create a list of threatened flora and fauna species, populations and ecological communities (threatened biota) listed under the BC Act and FM Act, and MNES listed under the EPBC Act that could be expected to occur in the locality based on previous records, known distribution ranges, and habitats present. The database review assisted with focusing field survey techniques and effort. Biodiversity databases and existing literature and information pertaining to the study area and locality (i.e. within a 20 kilometres radius of the construction corridor) that were reviewed prior to conducting field investigations included:

- NSW Department of Planning, Industry and Environment (DPIE) BioNet Atlas for records of threatened biota previously recorded in the locality (website for the Atlas of NSW Wildlife) (OEH 2021a) and Threatened Biodiversity Data Collection (TBDC) profiles of threatened species listed under the BC Act (DPIE 2021a)
- DPIE Threatened biodiversity profile search online database for threatened ecological communities and species listed under the BC Act (OEH 2021b).
- NSW Government (2020) Biodiversity Values Map and Threshold Tool for biodiversity values that would require further assessment under the BOS
- Department of Agriculture, Water and the Environment (DAWE) EPBC Act Protected Matters Search Tool – for a 20 kilometre radius around the proposal site (DAWE 2021a).
- DAWE online Species profiles and threats database (SPRAT) (DAWE 2021b).
- NSW BioNet Vegetation Classification (OEH 2021c) to identify matching plant community types (PCTs) in the study area
- NSW Department of Primary Industries (DPI) priority weed declarations – Central Tablelands region (DPI 2020).
- Aerial photographs and satellite imagery of the study area
- Available regional-scale vegetation mapping of the Central West / Lachlan Region (OEH 2016).

Dependence (or interaction) of the vegetation communities identified within the proposal site on groundwater was determined by searching the Atlas of Groundwater Dependent Ecosystems (BOM 2021a). The Atlas predicts the occurrence of groundwater dependent ecosystems (GDEs) and ecosystems that potentially use groundwater. It shows ecosystems that interact with the subsurface expression of groundwater (including vegetation ecosystems) or the surface expression of groundwater (such as rivers and wetlands). The Atlas also shows the likelihood that landscapes are accessing water in addition to rainfall, such as soil water, surface water or groundwater.

3.1.2 Desktop review

A BDAR is under preparation on behalf of Water Infrastructure NSW to assess the potential ecological impacts of Wyangala Dam Wall Raising Project in accordance with the NSW Biodiversity Offsets Scheme (BOS) and responds to the Secretary's environmental assessment requirements (SEARs) for biodiversity for that project. The biodiversity impact assessment for the proposed WTP (the subject of this assessment) draws upon information presented in the BDAR currently under preparation, including:

- The results from targeted flora and fauna surveys undertaken by GHD ecologists around Wyangala Dam between April 2020 and March 2021 (GHD in prep).
- The results from targeted flora and fauna surveys undertaken by GHD ecologists within the Wyangala Waters Holiday Park (GHD 2020).

This report builds on the assessment of the broader study area with a more focussed survey within the specific vegetation removal footprint for the proposed WTP.

Following collation of database records, consideration of records from other studies and species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the broad habitats at the proposal site. This was further refined following field surveys and assessment of habitats present to inform the impact assessment. The results of this assessment are presented in Appendix A.

3.2 Site survey

3.2.1 Survey overview

Site surveys included:

- Initial site stratification and vegetation mapping.
- Sampling of vegetation integrity plot/transects.
- Habitat assessments.
- Targeted surveys for threatened flora.
- Targeted surveys for threatened fauna.

Survey effort was formally stratified across the proposal site in accordance with the BAM. Survey effort that has directly contributed to this BAR is summarised in Table 1 and is described in detail below.

Table 1 Survey techniques and timing

Stage	Date	Survey Technique
Biodiversity assessment survey within WTP footprint	17 September 2020	Habitat assessment Call playback Spotlighting Ultrasonic call recording targeting microbats
	19 September 2020	Vegetation mapping Vegetation integrity plot/transects Mapping of hollow-bearing trees Systematic traverses targeting candidate threatened flora Mapping of nest trees
Biodiversity assessment survey as part of the broader study area around Wyangala Dam	April 2020-current	Vegetation mapping Vegetation integrity plot/transects Systematic traverses targeting candidate threatened flora Spotlighting Call playback Ultrasonic call recording targeting microbats Active searches for scats and signs Diurnal bird surveys Habitat assessment Mapping of hollow-bearing trees Active reptile searches Tile array surveys Camera trapping Trapping- Elliot, cages, harp Mapping of nest trees Boat traverses Streamside searches Songmeters

3.2.2 Vegetation mapping

Existing vegetation mapping of the site (OEH 2016) was ground-truthed in the field via systematic walked transects across the proposal site and by walking the boundary of vegetation units. Necessary adjustments were made by hand on aerial photographs of the proposal site with reference to a handheld Global Positioning System (GPS) unit. Native vegetation in the study area was initially assigned a vegetation community name

based on observed floristic and structural characteristics. Intact native vegetation communities were defined into plant community types (PCTs) based on vegetation structure, species composition, soil type and landscape position with reference to the BioNet Vegetation Classification (OEH 2021c). PCTs were further split into vegetation zones according to the following broad condition classes:

- Good – featuring natural vegetation structure and predominantly native understorey
- Degraded understorey – featuring natural vegetation structure but predominantly exotic or cleared understorey

3.2.3 Vegetation integrity survey plot/transects

A plot/transect survey was conducted on site with reference to the BAM given its value as a consistent and prescribed method for survey. The site value was determined by assessing ten attributes used to assess function, composition and structure of vegetation within a 50 metre by 20 metre plot centred on a 50 metre transect. These attributes were then assessed against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECC, 2009). The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health.

All flora species within a 20 metre by 20 metre quadrat nestled within the 50 metre by 20 metre plot were identified according to the nomenclature of the Royal Botanic Gardens and Domain Trust (2018). Each species identified was allocated a growth form group and designated as either native, exotic or high threat exotic in accordance with lists provided by OEH.

The plots were stratified between vegetation zones across the proposal site (refer to Table 7 below). This approach enabled all PCTs present with varying composition and condition to be sampled. Additional plot/transects were sampled in the broader study area and helped design a proposal site layout that avoided impacts to threatened biota. The location of survey plots is shown on Figure 3.

3.2.4 Targeted threatened flora surveys

Targeted surveys were undertaken for threatened flora species with the potential to occur within the proposal site given known distributions, previous records in the locality and habitat requirements for each species (refer to the threatened species assessment in Section 7.6.2).

Targeted searches were completed by systematically walking parallel traverses spaced 10 metres apart across the entire proposal site, with reference to the DPIE (2020) threatened plant survey guidelines. Targeted threatened flora surveys were undertaken over two days in September 2020.

3.2.5 Terrestrial fauna survey

Targeted surveys

Fauna survey techniques and effort conducted in the proposal site are summarised in Table 2 and described below. Survey effort was stratified across wider area around the dam, noting that fauna species are mobile and may rely upon habitat resources in the proposal site even if not directly observed. All fauna observations were recorded on pro forma field data sheets.

Table 2 Targeted fauna survey techniques and effort within the proposal site

Survey technique	Survey effort
Spotlighting	One night of spotlighting on 17 September 2020 was conducted between the hours of 8 – 8:45 pm. Survey effort included walking transects. Total effort = 1.5 person hours
Active reptile/ amphibian searches Active searches for scats and signs	Dedicated searches for any signs of fauna occupation. Included searching for evidence of feeding, foraging and signs of bird presence (such as pellets, whitewash, nests etc.) and other biota (scats, scratchings, diggings, nests etc.). Active searches of woody debris, under rocks and other ground litter were conducted throughout the proposal site targeting frogs and reptiles. Total effort = 4 person hours
Ultrasonic call recording (microbats)	1 x Anabat positioned in different flyways over one night Total effort = 1 x recording night (12 hours)

Survey technique	Survey effort
Mapping of hollow-bearing trees	Opportunistic searches for hollow-bearing trees throughout the proposal site Total effort = 12 person hours.

Fauna habitat assessment

Fauna habitat assessments were undertaken throughout the study area, including observation of potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources such as water bodies, food trees, the density of understorey vegetation, the composition of ground cover, the soil type, presence of hollow-bearing trees, leaf litter and ground debris were noted.

Indicative habitat criteria for targeted threatened species (i.e. those determined as having the potential to occur within the proposal site following the desktop review) were identified prior to fieldwork. Habitat criteria were based on information provided in DPIE and DAWE threatened species profiles, field guides, and the knowledge and experience of GHD field ecologists.

Habitat assessments included searches for resources of potential value to threatened fauna including:

- Trees with bird nests, hollows or other potential fauna roosts with a particular focus on suitable habitat for threatened forest owls, parrots or cockatoo hollows and threatened raptor nest trees.
- Rock outcrops, caves or overhangs providing potential shelter sites for fauna.
- Burrows, dens and warrens.
- Distinctive scats or latrine sites, owl white wash and regurgitated pellets under roost sites.
- Tracks or animal remains.
- Evidence of activity such as feeding scars, scratches and diggings.
- Specific food trees and evidence of foraging (for example chewed *Allocasuarina* cones).

The locations and quantitative descriptions of habitat features were captured with a handheld GPS unit and photographed where appropriate.

Mapping of hollow bearing trees

Surveys for hollow-bearing trees were conducted in the vegetated sections of the study area and within the proposal site. Individual trees, with particular focus on large, mature trees, were inspected for hollows. Hollow-bearing trees were recorded using the GIS application – Collector for ArcGIS (Version 18.0.3). Tree species, approximate diameter at breast height (DBH), number of hollows and the diameter of the hollows were recorded for each specimen as a waypoint point in the application. The location of hollow-bearing trees is shown on Figure 3.

Spotlighting

Spotlighting for nocturnal birds including Powerful Owl, Masked Owl and Barking Owl was conducted for 1.5 person-hours on three nights and involved two ecologists conducting walking and driving transects through areas of suitable habitat. Nocturnal birds were targeted during the spotlight period by systematically scanning native vegetation.

Arboreal mammals

Spotlighting, for arboreal mammals including the Squirrel Glider was conducted in conjunction with nocturnal bird surveys. It involved two ecologists conducting walking transects through areas of suitable habitat. Nocturnal mammals were targeted during the spotlight period by systematically scanning native vegetation. The field survey effort included dawn and dusk observations of hollows for evidence of occupancy.

Active searches

Active searches targeting reptile and amphibian species were conducted in areas of potential habitat, including patches of woody debris, rocky outcrops and rocky habitat in woodland and other ground litter within the proposal site. These searches included active hand searches by flipping partially embedded rocks and were conducted during flora surveys and daytime traverses throughout the proposal site and study area immediately surrounding the proposal site.

Microchiropteran bat surveys

Microbat ultrasonic echolocation call recordings (Anabat surveys) were undertaken using one Anabat unit over one night in potential bat fly-ways in the proposal site (see Figure 3). Bat calls were recorded during field surveys using Anabat Express Zero Crossing detectors (Titley Scientific).

The full night zero crossing analysis file (zca file) recorded using the detector was converted to zc sequence files using Anabat Insight (version 1.9.3) for analysis and in order to add metadata (e.g. species label etc.).

During the conversion process a filter was applied to identify bat sequences and remove noise files. Noise files were moved to a separate folder for later checking.

The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay *et al*. 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for potential species (Pennay *et al*. 2011; Churchill 2008; Van Dyck *et al*. 2013) and records from BioNet (May 2020). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills *et al*. 1996 & Duffy *et al*. 2000 for similar process) as summarised in Table 3. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Table 3 Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species for e.g. *Chalinolobus gouldii /Mormopterus ozimops* sp. *Nyctophilus* sp. The calls of *Nyctophilus geoffroyi / gouldi* cannot be distinguished during the analysis process and are therefore lumped together. *Nyctophilus* sp./*Myotis macropus*. The calls of these species can be easily confused during the analysis process and are therefore often lumped together.

Opportunistic observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. This included a conscious focus on suitable areas of habitat during flora surveys, for instance fallen timber was scanned and/or turned for reptiles and mature trees and stags were scanned for roosting birds.

3.3 Survey conditions

The field surveys within the proposal site were undertaken in September 2020. Conditions were mild during morning surveys, with mild to warm temperatures during daytime surveys. Survey conditions were warm during nocturnal surveys with little to no wind. No rainfall was experienced during surveys.

Weather conditions were generally suitable for the detection of most species. Weather observations during the survey period (refer Table 4) were taken from Cowra Airport, the nearest weather station about 30 kilometres west of the proposal site.

Table 4 Daily weather observations during the survey period (BOM 2020b).

Date	Minimum temp (Deg Celsius)	Max temp (Deg Celsius)	Rainfall (mm)
17/09/2020	6.6	25.8	0
19/09/2020	14.3	20.9	0

3.4 Geographical Information System (GIS) analysis

GIS was used to:

- Plot the proposal site on a high resolution aerial photo base and to map PCTs, survey effort, habitat resources and biodiversity values across the proposal site and areas investigated in the study area.
- Calculate the extent of native vegetation to be impacted.
- Confirm the relevant IBRA bioregion, IBRA subregion and Mitchell Landscape for the site.

Native vegetation cover, extent and connectivity were assessed using aerial photography. Air photo interpretation was used to identify and record distinct vegetation patches, determine the broad condition state of vegetation types and the location and extent of vegetated habitat corridors.

3.5 Likelihood of occurrence of threatened and migratory birds

Following collation of database records, consideration of records from other studies and review of species and community profiles, a 'likelihood of occurrence' assessment was prepared with reference to the habitats contained within the proposal site. Identification of potential habitat for threatened and migratory species was based on information provided in the species profiles (DAWE 2021b, DPIE 2021b), recovery plans, journal articles, and the field staffs' knowledge of species habitat requirements. The likelihood of occurrence assessment was further refined following field surveys. The likelihood of threatened and migratory biota occurring in the proposal site was assessed based on presence of records from the locality for the last 20 years (since 2000), species distribution and habitat preferences, and the suitability of potential habitat present in the proposal site. The results of this assessment are provided in Appendix A.

Table 5 provides a key to the likelihood of occurrence in the proposal site of threatened biota known or likely to occur in the locality. Following completion of a likelihood of occurrence assessment, the likely impact of the proposal on those species with a 'high', 'moderate', 'low' or 'recorded' likelihood of occurrence were considered (refer to Appendix A). Species and communities that were considered to have a 'high' or 'moderate' likelihood of occurrence in the proposal site, and a 'likely' impact as a result of the proposal were the focus of assessments of significance, as outlined in Section 7.6.

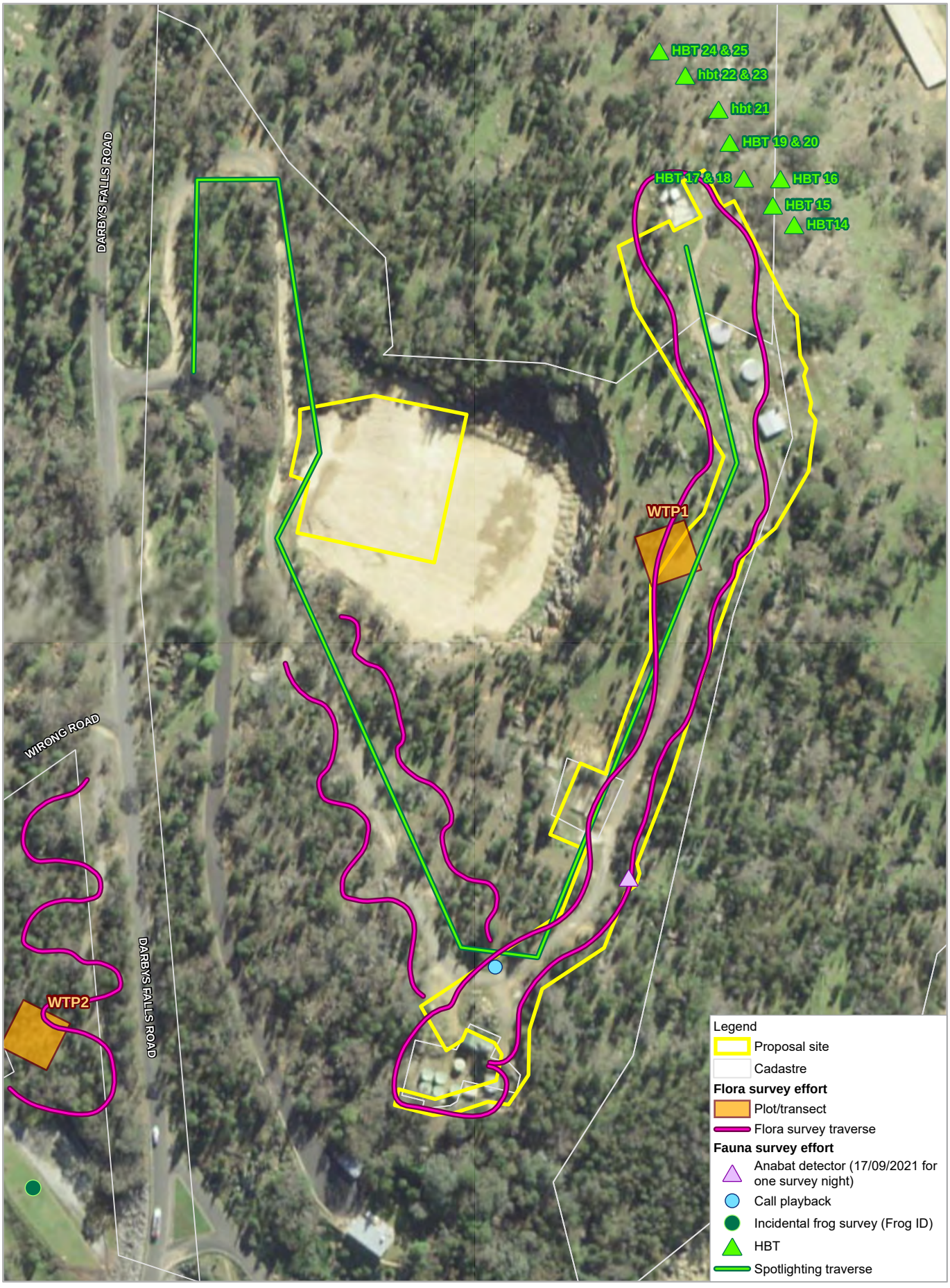
Table 5 Key to likelihood of occurrence of threatened species

Likelihood	Definition
Recorded	The species was observed in the proposal site during the current survey.
High	It is highly likely that a species inhabits the proposal site and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (within 20 kilometres) and is known or likely to maintain resident populations in the proposal site. Also includes species known or likely to visit the proposal site during regular seasonal movements or migration.
Moderate	Potential habitat is present in the proposal site. Species unlikely to maintain sedentary populations, however may seasonally use resources within the proposal site opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the proposal site, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the proposal site and has not been recorded recently in the locality (within 20 kilometres). It may be an occasional visitor, but habitat similar to the proposal site is widely distributed in the local area, meaning that the species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the proposal site or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
Nil	Suitable habitat is absent from the proposal site

3.6 Survey effort considerations and limitations

It is likely that some species that occur in the study area either permanently, seasonally or transiently were not identified during this one-off survey. These species may include annual, ephemeral or cryptic flora species; nocturnal fauna; birds and frogs that call at other times of year and mobile or transient fauna in general. The habitat assessment conducted allows for identification of habitat resources for such species, to make an assessment of their likelihood of occurring within the study area. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values and constraints within the study area. This information was used to predict potential impacts of the proposal on biodiversity values and to assist with the development of a design that specifically avoids and/or reduces impacts on threatened ecological communities and known and potential habitat for threatened species as far as possible.

There is generally a low cover of groundcover species across the proposal site, with the density of species not high enough as to prevent or inhibit identification of species of conservation significance. There was minimal flowering of flora species observed across the proposal site and surrounding study area.



Paper Size ISO A4

0 25 50

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

WaterNSW

Wyangala Water Treatment Plant
Biodiversity Assessment

Survey Effort

Project No. 12528366
Revision No. **FINAL**
Date 2021-07-26

FIGURE 4

N:\AU\Sydney\Projects\21\12528366\GIS\Maps\Working\Biodiversity\BIO_WTP.aprx\12528366_BIOWTP004_SurveyEffort
Print date: 26 Jul 2021 - 12:22

Data source: Footprints - GHD 2020; Cadastre - Sixmaps 2020; Road - LPI DTDB 2017;public/NSW_Imagery: © Department of Customer Service 2020public/NSW_Imagery: © Department of Customer Service 2020. Created by: jrprice

4. Existing environment

4.1 Site context

4.1.1 Location and land uses

The site is located in Wyangala, about 30 kilometres south east of Cowra in Central Western NSW. The site is about 200 metres south of the Wyangala Waters Holiday Park and is situated on the western boundary of Lake Wyangala/Lachlan River, directly north of the Wyangala Dam wall. The closest town is the Wyangala Village, which is about 300 metres west of the site.

The land within the proposal site is owned by Water Infrastructure NSW and operated by Cowra Council. The site contains an existing water treatment plant which services the Wyangala village and the Holiday Park. Currently, the plant is not operational and there is no potable water available in the Wyangala area (including the Holiday Park). Further to the south is Water Infrastructure NSW's Wyangala Dam office and the dam wall.

Land to the west of the proposal site consists of a vegetated ridgeline, along which Reg Hailstone Way is situated. Further west the landscape comprises agricultural land with scattered rural dwellings.

Native vegetation within the proposal site and study area extends to the south, west and north onto Mount McDonald and the catchment surrounding Wyangala Dam within the Wyangala Waters State Park. Vegetation in the proposal site and wider study area is part of the Kanangra-Boyd to Wyangala (K2W) wildlife link.

The location of the proposal within the region is shown in Figure 1.

4.2 Bioregion and IBRA subregion

The study area occurs within the Inland Slopes IBRA (Interim Biogeographic Regionalisation for Australia) subregion of the NSW South Western Slopes IBRA bioregion.

The NSW South Western Slopes IBRA bioregion comprises the lower inland slopes of the Great Dividing Range and covers an area of 8,657,426 hectares and 10.1 per cent of NSW. This bioregion extends from Albury in the south to Dunedoo in the northeast. Griffith lies just outside the western boundary and Crookwell lies just outside the eastern boundary of the bioregion. The bioregion includes parts of the Murray, Murrumbidgee, Lachlan and Macquarie River catchments.

4.3 NSW landscape region (Mitchell Landscapes)

The study area is located within the Wyangala Hills Mitchell Landscape (DECC 2008a). This landscape is characterised by rounded hills, steep slopes and partly dissected plateaus and tors with massive outcrops. General elevation is 400 to 750 metres and local relief occurs at 200 metres. The soil is characterised by thin loamy sand between outcrops, red texture-contrast soils on upper slopes that grade into yellow texture –contrast soils on lower slopes, and siliceous coarse sand along streams (DECC 2008b).

The landscape commonly features open woodland of mostly cleared and grazed Yellow Box (*Eucalyptus melliodora*), Red Stringybark (*Eucalyptus macrorhyncha*), Broad-leaved Peppermint (*Eucalyptus dives*) and Blakely's Red Gum (*Eucalyptus blakelyii*) with an understory of kangaroo grass (*Themeda triandra*) and Poa sp. On rocky peaks, patches of Black Cypress Pine (*Callitris endlicheri*) often occur (DECC 2008b).

Based on the vegetation, landforms and soils observed during the field survey the Wyangala Hills Mitchell landscape is a good fit for the biophysical environment at the proposal site.

4.4 Soils and geology

4.4.1 Soil landscapes

The study area falls within the Wyangala soil landscape. The Wyangala soil landscape occurs on rolling low hills to rolling hills with prominent granite outcrops. Red podzolic soils occur on non-calcic brown soils on upper slopes, yellow podzolic soils on midslopes, siliceous sands on mid to lower slopes and yellow soloths in drainage lines. It has a local relief between 40-140m with slopes between 10-20% (OEH, 2020d).

4.4.2 Soil hazards

Soil landscapes reports pertaining to the proposal site indicate that soils associated with the Wyangala soil landscape can have a moderate to very high potential for erosion with soil profiles that contain siliceous soils and yellow soloths.

There is minimal risk of acid sulphate soils as the site is not in a coastal location and has an elevation ranging from about 34-60 m AHD. Acid sulphate soil risk mapping indicates that there are no known occurrences at the proposal site (OEH 2020d).

4.4.3 Areas of geological significance

There are no karst, caves, cliffs or other areas of geological significance located within the proposal site or area immediately surrounding the site. There are crevices within the areas of rocky habitat within the site and surrounding area where larger rocks occur, particularly on the surrounding hill slopes.

4.5 Climate

The site has a temperate climate. Based on data from the Cowra Airport weather station (65111) located approximately 40 kilometres from the proposal site, the site has a mean annual rainfall of 509 mm, falling predominantly in summer and spring. The site can reach mean daily maximum temperatures of 34.0 degrees Celsius and mean daily minimum temperature of 2.2 degrees Celsius (BOM, 2021b).

4.6 Hydrology

No watercourses are located on the proposal site.

Surface runoff is expected to follow localised topography but is likely to ultimately result in an overall easterly flow direction towards Wyangala Dam.

Wyangala Dam is an impoundment above a dam wall across the Lachlan River and is directly fed by the Lachlan and Abercrombie Rivers. Water from Wyangala Dam is piped through the dam wall into the Lachlan River, approximately 400m south-west of proposal site, and then continues to flow in a westerly direction past Cowra and Forbes.

The proposal site is not identified by Cowra LEP mapping as being subject to flooding, due largely to the steep elevated rise of the proposal site above Wyangala Dam.

5. Native vegetation

5.1 Native vegetation extent and connectivity

The proposal site occurs around a track leading to the existing WTP and its associated ancillary infrastructure. The proposal site comprises native vegetation with a degraded understorey, mixed with introduced groundcover in areas that have undergone a higher level of clearing and development disturbance and occurring around existing infrastructure. The site contains 0.63 hectares of native vegetation, confined to the edges of the existing track.

Native vegetation in the proposal site is part of an extensive patch of near-continuous native vegetation forming a habitat corridor that extends to the north and south. Native vegetation in the proposal site is restricted by Wyangala Dam to the east and partially cleared lands to the west.

Native vegetation within the proposal site and study area extends to the south, west and north onto Mount McDonald and the catchment surrounding Wyangala Dam within the Wyangala Waters State Park. Native vegetation in the proposal site and wider study area is part of the Kanangra-Boyd to Wyangala (K2W) wildlife link.

5.2 Flora species

A total of 69 flora species from 34 families were recorded on the proposal site and comprises 37 native species and 32 exotic species. The Asteraceae (13 species, 6 native), Poaceae (grasses, 7 species, 1 native), and Fabaceae (shrubs and scramblers, 7 species, 2 native) were the most diverse families recorded.

The site contained a small subset of the 479 flora species recorded within the study area around Wyangala Dam (GHD 2020 in prep). A full list of flora species recorded within the broader study area around Wyangala Dam is provided in Appendix B. Characteristic plant species are discussed below in relation to the vegetation zones occurring in and adjacent to the proposal site.

5.3 Plant community types

Plant community types (PCTs) within and adjacent to the proposal site were identified according to section 5.2 of the BAM as described below.

Existing regional vegetation mapping encompassing the study area was reviewed with the highest resolution vegetation mapping available being the Central West / Lachlan Region vegetation map (OEH 2016). The following PCTs and non-native vegetation were mapped within the proposal site:

- White Box grassy woodland (PCT 266) on upper, mid and lower slopes in the east of the study area.
- Blakelys Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland (PCT 282) on the lower slopes and flats in the south of the study area.
- 0_Not native (non-native vegetation) associated with existing sealed and unsealed tracks from Darby Falls Road to existing Water Infrastructure NSW infrastructure.

The vegetation within the proposal site was ground-truthed, using observations of vegetation structure, dominant plant species, soil type, geomorphology and landscape position with reference to the BioNet Vegetation Classification (VIS) (OEH 2021b). The following vegetation types were confirmed in the proposal site and immediately adjoining land:

- Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments (PCT 339), based on observed:
  - Shrubby woodland vegetation structure.
  - Landscape position on rocky hillslopes and ridges on hill landforms on granite substrates.
  - Presence of the characteristic tree species Tumbledown Red Gum (*E. dealbata*) and Long-leaved Box (*E. goniocalyx*) as well as species listed in the mid stratum and ground stratum that are listed in the VIS for this PCT and recorded within plots. These include Back Cypress Pine, Hickory Wattle (*Acacia implexa*) and scattered patches of Drooping Sheoak (*Allocasuarina verticillata*) in the mid stratum, and Purple Wiregrass (*Aristida ramosa*), Nodding Blue Lily (*Stypandra glauca*), Rock Fern and Barbed Wire Grass (*Cymbopogon refractus*) in the ground stratum.
- 0_Not native (non-native vegetation) based on the presence of infrastructure, bare earth or exotic plants. In grassland and other vegetated areas, at least 50 per cent of the ground cover present was exotic weed species such as Paterson's Curse (*Echium plantagineum*), Common Crowfoot (*Erodium cicutarium*), Hop Clover (*Trifolium campestre*) and Capeweed (*Arctotheca calendula*)

Vegetation types within the proposal site and surrounding study area are shown on Figure 3.

The following PCTs were confirmed within the wider study area (Figure 3) but do not occur in the proposal site or on immediately adjoining land:

- Blakelys Red Gum - White Box 0 Yellow Box – Black Cypress Pine box grass/shrub woodland (PCT 282)
- Dwyers Red Gum - White Cypress Pine – Currawang shrubby woodland (PCT 185)
- White Box grassy woodland (PCT 266)

5.4 Vegetation types

Key attributes of the vegetation types within the proposal site, including condition, conservation status and extent are summarised in Table 6. Tables 7 and 8 provide a detailed description of the native and non-native vegetation within the proposal site. Plant species lists and plot data are provided in Appendix B.

Table 6 Key attributes of the vegetation types within the proposal site

Plant community type	PCT ID	Condition	BC Act Status	EPBC Act Status	Area in proposal site (ha)
Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments (PCT 339)	339	Degraded understorey	Not listed	Not listed	0.63
Non-native vegetation	-	Poor	Not applicable	Not applicable	0.27
Cleared areas	-	-	Not applicable	Not applicable	0.61
Total area of vegetation					**0.90**
Total site area					**1.51**

Table 7 Tumbledown Red Gum - Black Cypress Pine - Red Stringybark Currawang shrubby low woodland on Wyangala granite and metasediments

Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments		
PCT (OEH, 2021c)	Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments of the Wyangala Dam region, NSW South Western Slopes Bioregion	
PCT ID	339	
NSW Veg Type ID	LA268	
Survey effort	Plot/transect WTP1 within the proposal site. Plot WTP2 adjacent to proposal site (within proposal site of previous design).	
Conservation significance	Native vegetation. Not listed as a Threatened Ecological Community (TEC) under the BC Act or EPBC Act	
Condition	Degraded. Semi-intact over storey is present. • Native species richness below benchmark for all growth forms except forbs which was well above benchmark • Canopy and shrub cover below benchmark • Native groundcover above benchmark (38.3 %) compared to benchmark (31 %) • No large trees recorded • No hollow-bearing trees in plot sampled • Low leaf litter cover 3.2% compared to benchmark of 59% • Fallen logs at up to 24 m compared to benchmark of 82 m • Exotic cover was high up to 14.9% • High threat exotic weed cover at 0.1% This vegetation zone has lower ecological and habitat value in comparison to other vegetation patches recorded in the wider study area, with limited fauna habitat resources such as hollow-bearing trees and fallen timber.	
Landscape position	Occurs on the lower to mid hillslopes in the proposal site where disturbance is higher, and the community has been altered.	
Structure	Open woodland to shrubby regrowth form of the plant community with a degraded understorey dominated by introduced species.	
Over storey	Tumbledown Red Gum occurs on occasion.	
Mid storey	Kurrajong, White Cypress Pine and Hickory Wattle, with a cover of 0.1 to 15.1%. One sampled plot contained over storey with no mid storey, and the other sampled plot contained shrubby regrowth with no canopy.	
Groundcover	Low cover and low native species richness. Native groundcover species include: • Grasses: Red Grass and Speargrass (*Austrostipa scabra*). • Forbs: Flannel Cudweed (*Actinobole uliginosum*), Common Sunray (*Triptilodiscus pygmaeus*), Dense Stonecrop (*Crassula colorata*), Grass Cushion (*Isoetopsis graminifolia*) • Ferns: Rock Fern (*Cheilanthes sieberi*), Bristly Cloak Fern (*Cheilanthes distans*) • Shrubs: Narrawa Burr (*Solanum cinereum*)	
Exotic species	There is high exotic plant cover, mainly consisting of herbaceous weeds in the groundcover layer. Dominant exotic species: Haresfoot Clover (*Trifolium arvense*), Paterson's Curse (*Echium plantagineum*), Capeweed (*Arctotheca calendula*), Narrow-leaved Clover (*Trifolium angustifolium*) and Catsear (*Hypochaeris radicata*).	

Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland on Wyangala granite and metasediments	
	High threat weeds: St John's Wort (*Hypericum perforatum*), Onion Grass (*Romulea rosea* var. *australis*) and Bridal Creeper (*Asparagus asparagoides*).

Table 8 Non-native vegetation

9Non-native vegetation		
PCT (OEH, 2020c)	n/a	
PCT ID	n/a	
NSW Veg Type ID	n/a	
Equivalent Map Units	0_Not native (OEH 2016)	
Survey effort	Opportunistic observations	
Conservation significance	Non-native vegetation. Not listed as a Threatened Ecological Community (TEC) under the BC Act or EPBC Act	
Condition	Non-native vegetation. • Very low native groundcover • Trees and native shrubs are absent from this vegetation zone • Leaf litter and fallen logs not recorded. This vegetation zone has lower ecological and habitat value in comparison to other vegetation patches recorded in the study area due to high introduced species cover and lack of habitat resources present.	
Landscape position	This vegetation occurs in the highly disturbed areas close to development and easily accessible sites, generally on the more flat and undulating areas of the landscape.	
Structure	Occurs as groundcover dominated by introduced species with no shrub or canopy cover present.	
Over storey	Absent.	
Mid storey	Absent.	
Groundcover	Moderately dense, very low native species richness. Native groundcover species include Kangaroo Grass (*Themeda triandra*), Wallaby Grass (*Rytidosperma* spp.) and Snowgrass (*Poa sieberiana*).	
Exotic species	There is very high exotic plant cover, mainly consisting of herbaceous weeds in the groundcover layer. Dominant exotic species: Hop Clover (*Trifolium campestre*), Paterson's Curse (*Echium plantagineum*) and Capeweed (*Arctotheca calendula*) High threat weeds: St John's Wort (*Hypericum perforatum*), Onion Grass (*Allium canadense*) and Sheep Sorrel (*Rumex acetosella*)	

5.5 Groundwater dependent ecosystems

The *NSW State Groundwater Dependent Ecosystems Policy* defines groundwater dependent ecosystems (GDEs) as ecosystems which have their species composition, and their natural ecological processes determined by groundwater (DLWC 2002). Ecosystems vary dramatically in the degree of dependency of groundwater, from having no apparent dependence through to being entirely dependent on it (DLWC 2002).

The Atlas of GDEs (BOM 2021a) predicts the vegetation in the proposal site and study area as 'Low potential Groundwater Dependent Ecosystem (GDE)'.

5.6 Priority weeds

Three plant species identified as priority weeds for the Central Tablelands region were recorded in the proposal site. These weeds and their management requirements as per the *Biosecurity Act 2015* are presented in Table 9 below.

Table 9 Priority weeds recorded in the proposal site and management measures

Scientific name	Common name	Requirements
Asparagus asparagoides	Bridal Creeper	*Prohibition on dealings* Must not be imported into the State or sold
Hypericum perforatum	St. John's Wort	*Regional recommended measure* Protect grazing land that is free of St. John's Wort
Rubus fruticosus species aggregate	Blackberry	*Prohibition on dealings* Must not be imported into the State or sold *Regional recommended measure* Protect conservation areas, natural environments and primary production lands that are free of Blackberry

Blackberry and Bridal Creeper are also listed as weeds of national significance (WONS) under the National Weeds Strategy. WONS are prioritised weeds based on their invasiveness, potential for spread and environmental, social and economic impacts.

5.7 Fauna habitat resources

A moderate diversity of native fauna species was recorded in the study area, including around Wyangala Dam (refer to Table 10). Given the limited habitat present, a subset of these species are likely to use the proposal site on a regular basis.

The proposal site contains the following broad habitat types for fauna:

- Rocky woodlands.
- Non native vegetation, including areas of exotic grassland, and developed areas.

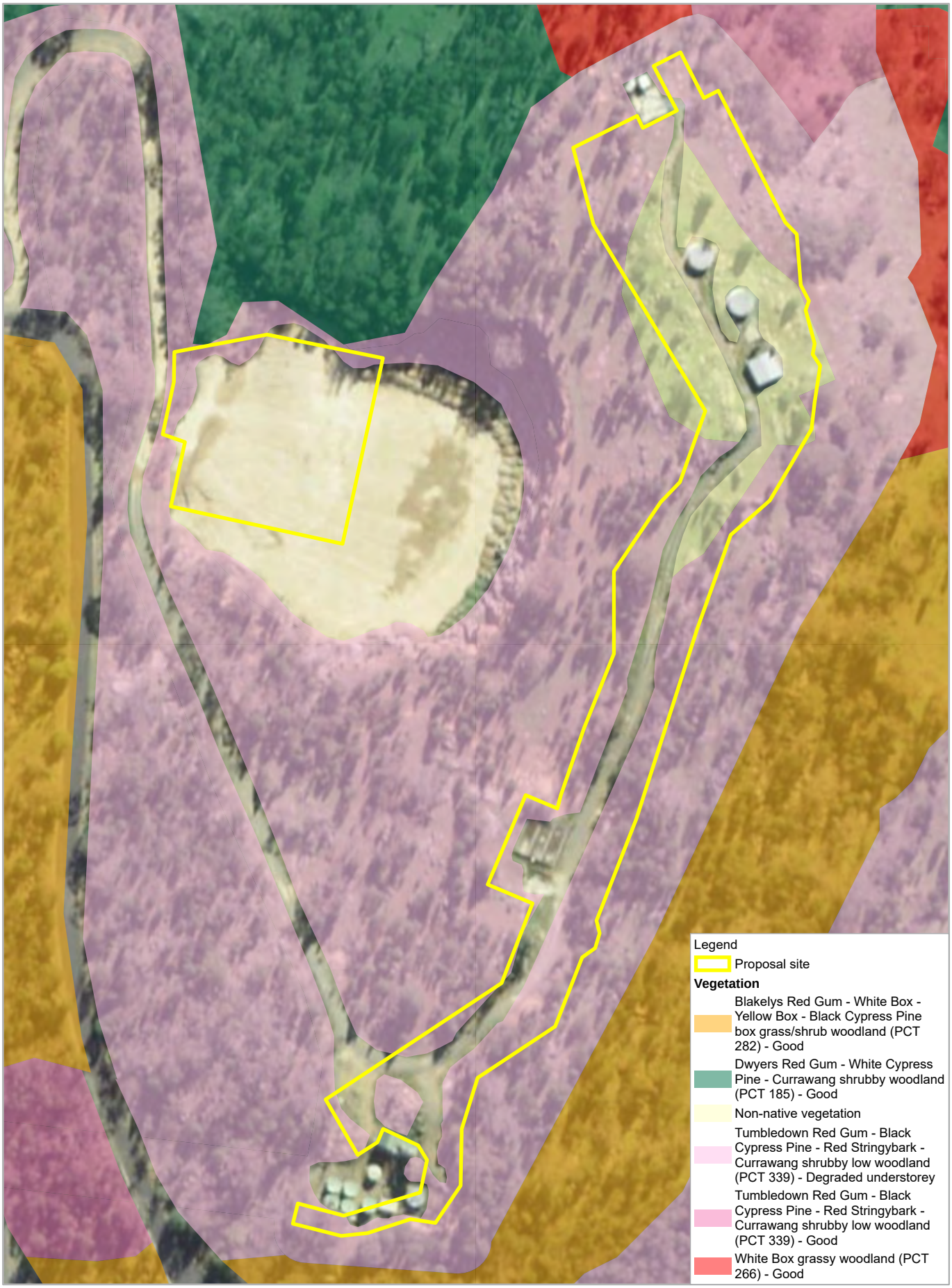
The various habitats and their biodiversity value in the proposal site are discussed in the following tables. Species likely to occur in the proposal site have been extrapolated from species recorded in similar habitats in the broader study area throughout Wyangala Dam.

Table 10 Fauna habitat descriptions

Rocky woodlands	
Description	Woodland habitat is present throughout the study area with degraded habitat present on the edge of existing trails. This habitat type within the proposal site provides moderate quality habitat for fauna species due to its lack of complex age structure and density however, connects to higher quality woodland that extends through the study area to the west and north and into the surrounding locality (Wyangala State Park). It is likely that native species recorded in the proposal site have home ranges that extend into these larger tracts of vegetation throughout the study area and locality. Better quality woodland containing intact canopy occurs mainly in the southern and central portions of the proposal site, where Tumbledown Red Gum are present along the edge of the existing track. The understorey in these areas is dominated by a higher diversity and cover of native species. Patches of woodland in the northern portion of the proposal site are in poorer condition due to a dominance of introduced species in the understorey and a modified canopy that is either sparse or absent due to land clearing. Mature eucalypts occur throughout the proposal site, namely Tumbledown Red Gum. In most woodland areas, the canopy lacks structural complexity due to the age of the canopy species being predominantly young throughout the site, and the nutrient poor rocky soils on hillsides. The midstorey within rocky woodland is variable, but generally has low native species diversity and structural complexity. Black Cypress Pine, White Cypress Pine and Hickory Wattle are the most commonly occurring native species. Dense areas of shrubby Cypress Pine regrowth are present in the study area. No hollow-bearing trees were recorded within the proposal site. The absence of hollow-bearing trees is likely attributed to the historic removal of larger trees from the site. At least 12 hollow-bearing trees occur directly to the north of the proposal and would not be impacted by this proposal (Figure x). No large stick nests suitable for nesting by the White-bellied Sea-eagle (*Haliaeetus leucogaster*) or Little Eagle (*Hieraaetus morphnoides*) were recorded in the proposal site.

Rocky woodlands	
	Rocky boulders, fallen timber and leaf litter provides broadly suitable shelter habitat for small reptiles, snakes and small mammals, with fallen timber relatively sparse in the proposal site. Rocky boulders are present in both cleared areas and in on the edge of the existing track in woodland. Habitat resources within the woodlands in the study area include canopy trees, nectar, fruits (including mistletoes) and leaves as well as foraging substrate and fruiting and flowering small trees and shrubs.
Typical fauna species recorded or likely to occur	Rocky woodland within the proposal site provides foraging, movement and potential breeding habitat for a variety of woodland bird species. The most commonly occurring bird species in the broader study area include Grey Fantail (*Rhipidura albiscapa)*, Pied Currawong (*Strepera graculina*) and Yellow-rumped Thornbill (*Acanthiza chrysorrhoa*). The Eastern Grey Kangaroo (*Macropus giganteus*), Common Brushtail Possum (*Trichosurus vulpecula*) and Common Wombat (*Vombatus ursinus*) are likely to occur. Common species of snakes, geckos and skinks such as the Red-bellied Black Snake (*Pseudechis porphyriacus*), Thick-tailed Gecko (*Underwoodisaurus millii*) and Bearded Dragon (*Pogona barbata*) are likely to forage in areas with leaf litter, woody debris and rocky habitat. There were no streams or creeks in the proposal site suitable for frogs.
Threatened and migratory fauna species recorded or likely to occur	One threatened fauna species, the Little Eagle was identified in close proximity to the proposal site. Records of other threatened raptors, including the White-bellied Sea-eagle also occur nearby (GHD 2020 in prep). Threatened woodland birds, including the Speckled Warbler, Dusky Woodswallow, Brown Treecreeper and Grey-crowned Babbler are known to occur in the study area and may forage in rocky woodland within the proposal site at times. The Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) may forage on occasion where there are gaps in canopy vegetation that form a natural flyway. Other threatened biota not recorded during surveys but identified during database searches as previously occurring within the locality, or that are considered likely to occur in habitat similar to that which was recorded on site are identified in Table 11, and discussed further in section 7.6.2.
Introduced species recorded	Red Fox (*Vulpes vulpes*), Cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*) and Goat (*Capra hircus*).
Photo	
Non-native vegetation	
Description	Non-native vegetation includes areas of exotic grassland, occurring within road-side edges and areas cleared for existing structures. In the wider study area, non-native vegetation includes exotic grassland used for agricultural purposes. Developed areas including ancillary infrastructure for the existing Water Treatment Plant do not comprise non-native vegetation. Non- native vegetation has a low habitat value for most native fauna given its low structural complexity and floristic diversity.
Typical fauna species	Exotic grassland provides foraging habitat for ground-foraging birds, including Grey Fantail and Willie-wagtail (*Rhipidura leucophrys*) and common mammal species such as the Wombat (*Vombatus ursinus*) and Eastern Grey Kangaroos (*Macropus giganteus*).

Rocky woodlands	
recorded or likely to occur	Areas with taller groundcover are likely to provide habitat for snakes and lizards, including the Red-bellied Black Snake (*Pseudechis porphyriacus*) and Eastern Bearded Dragon (*Pogona barbata*) recorded in similar habitats in the locality. The Thick-tailed Gecko (*Underwoodisaurus millii*) may occur in patches of rocky habitat where proximate to native vegetation. Woody debris and logs is sparse in non-native vegetation.
Threatened and migratory fauna species recorded or likely to occur	This habitat is unlikely to provide frequently occupied or important resources for any threatened fauna species known from the locality. Some microbat species may forage over areas of non-native vegetation during local foraging movements and species such as the Superb Parrot (*Polytelis swainsonii*) and Turquoise Parrot (*Neophema pulchella*) may forage for seeds in patches of introduced grasses on occasion.
Introduced species recorded	Goat (*Capra hircus*), European Rabbit (Oryctolagus cuniculus) and the Common Starling (*Sturnus vulgaris*)
Photo	



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Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Stantec GHD

WaterNSW

Wyangala Water Treatment Plant
Biodiversity Assessment

Vegetation

Project No. 12528366
Revision No. **FINAL**
Date 2021-07-23

FIGURE 3

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Print date: 23 Jul 2021 - 09:31

Data source: Footprints - GHD 2020; Cadastre - Sixmaps 2020; Road - LPI DTDB 2017;public/NSW_Imagery: © Department of Customer Service 2020public/NSW_Imagery: © Department of Customer Service 2020. Created by: jrprice

6. Conservation significance

6.1 Overview

Threatened biota and migratory species that are known or predicted to occur in the locality are presented in Appendix A.

The habitat resources present at the site and in the broader study area around Wyangala Dam (determined during the site survey) were compared with the known habitat associations/requirements of the threatened and migratory biota identified through the desktop review. This was used to determine the likelihood of each threatened ecological community, endangered population and threatened or migratory species occurring within the study area. The results of this assessment are presented in Appendix A.

The threatened biota and migratory species which were recorded in the study area or that are considered likely to occur and to be affected by the proposal are discussed below.

6.2 Threatened ecological communities

No threatened ecological communities were recorded within or immediately adjoining the proposal site.

Vegetation in the broader study area contains characteristic plant species, structure and geomorphic position listed in the Final Determination for the White Box Yellow Box Blakely's Red Gum Woodland (NSW Scientific Committee 2020) (Box-Gum Woodland). Box-Gum Woodland is listed as a CEEC under the BC Act. The following PCTs mapped in the broader study area comprise part of a local occurrence of Box-Gum Woodland (see Figure 5):

- PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion.
- PCT 267 – White Box - White Cypress Pine - Western Grey Box shrub/grass/forb woodland in the NSW South Western Slopes Bioregion
- PCT 268 – White Box – Blakely's Red Gum – Long-leaved Box – Norton's Box – Red Stringybark grass-shrub woodland on shallow soils on hills in the NSW South Western Slopes Bioregion.
- PCT 277 – Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion
- PCT 282 – Blakely's Red Gum – White Box – Yellow Box – Black Cypress Pine box grass/shrub woodland on clay loam soils on undulating hills of central NSW South Western Slopes Bioregion.

6.3 Threatened flora

No threatened flora species were identified within the proposal site.

Threated flora species previously recorded or that have the potential to occur in the locality are presented in Appendix A. Of these, three are considered to have potential to occur in the proposal site based on the presence of suitable habitat.

Potential habitat is present for the following threatened flora species:

- Yass Daisy (*Ammobium craspedioides*) – listed as a 'vulnerable species' under the BC Act and EPBC Act.
- Small Purple-pea (*Swainsona recta*) – listed as a 'endangered species' under the BC Act and EPBC Act.
- Woolly Ragwort (*Senecio garlandii*) – listed as a 'vulnerable species' under the BC Act.

The Yass Daisy and Small Purple-pea, have previously been recorded in the locality and were also recorded within the Lachlan River mid-section of the reservoir on the western side (GHD in prep). The Woolly Ragwort has not been recorded in the locality.

These species were not recorded during targeted surveys in the proposal site at a suitable time of year to detect specimens if present. As such, these species are unlikely to be impacted by the proposal.

The remaining species previously recorded or predicted to occur in the locality are unlikely to occur in the proposal site or to be affected by the proposal given the site is outside their known geographic range, there is an absence of suitable habitat within the proposal site, and/or they are not cryptic species and were not detected during targeted surveys.

Targeted threatened flora transects occurred within the proposal site and within the suitable survey period for these species to be detectable if present. As such, these species are considered unlikely to be impacted by the proposal.

6.4 Threatened fauna

Fauna species previously recorded or predicted to occur within the locality are presented in Appendix A. The proposal site contains habitat resources for a range of threatened woodland fauna species. Given the limited extent and the edge-affected nature of woodland habitat present within the proposal site, is unlikely to used regularly by these species.

The Little Eagle was recorded soaring above the study area, during the field surveys and the proposal site would comprise part of the species foraging range (see Figure 5). The Little Eagle was sighted on a number of occasions during recent surveys in the Wyangala Waters Holliday Park to the north, and a large stick nest was observed in this area may comprise potential breeding habitat for this species (see Figure 5). No raptor nests were observed in the proposal site.

A further 19 threatened fauna species have been recorded in the broader study area around the edges of Wyangala Dam (GHD in prep). The proposal site contains broadly suitable habitat for 14 of these. The remaining species identified in the desktop review have a low likelihood of occurrence or are unlikely to occur in the proposal site given habitat in the proposal site is unlikely to constitute preferred or important habitat for the species or does not contain suitable habitat (refer Table A1 of Appendix ATable 10).

Table 11 provides a summary of the threatened fauna that have been recorded in the broader study area around Wyangala Dam (GHD in prep) and/or that have a moderate or high likelihood of occurrence in the proposal site and hence may be affected by the proposal.

Table 11 Listed fauna species and their likelihood of occurrence in the proposal site

Scientific name	Common name	Status		Recorded in the study area (GHD in prep)	Likelihood of occurrence in proposal site
		BC Act	EPBC Act		
Ninox connivens	Barking Owl	V	-	Yes	Moderate (foraging only)
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Yes	High
Stagonopleura guttata	Diamond Firetail	V	-	Yes	Moderate
Artamus cyanopterus	Dusky Woodswallow	V	-	Yes	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Yes	Moderate (foraging only)
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Yes	Moderate
Melanodryas cucullata	Hooded Robin (south-eastern form)	V	-	Yes	Moderate
Hieraaetus morphnoides	Little Eagle	V		Yes	High
Grantiella picta	Painted Honeyeater	V	V	No	Moderate
Petroica boodang	Scarlet Robin	V	-	Yes	Moderate
Chthonicola sagittata	Speckled Warbler	V	-	Yes	High
Lophoictinia isura	Square-tailed Kite	V	-	Yes	Moderate
Polytelis swainsonii	Superb Parrot	V	V	Yes	Moderate
Neophema pulchella	Turquoise Parrot	V	-	Yes	High (foraging only)
Daphoenositta chrysoptera	Varied Sittella	V	-	Yes	High
Haliaeetus leucogaster	White-bellied Sea-eagle	V	V	Yes	Moderate
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Yes	Moderate (foraging only)
Myotis macropus	Southern Myotis	V	-	Yes	Moderate (roosting only)

Scientific name	Common name	Status		Recorded in the study area (GHD in prep)	Likelihood of occurrence in proposal site
		BC Act	EPBC Act		
Saccolaimus flaviventris	Yellow-bellied Sheath-tail Bat	V	-	Yes	Moderate
Petaurus norfolcensis	Squirrel Glider	V	-	No	Moderate (foraging only)

V – Vulnerable, E – Endangered, CE – Critically Endangered

No habitat for threatened biota listed under the FM Act is present within the proposal site, and no impacts to threatened aquatic biota are expected.

6.5 Migratory fauna species

No migratory species were recorded during field surveys. There is no habitat for migratory waders or wetland birds within the proposal site, however habitat is present for these species in the locality. This includes shallow water habitat around the foreshore of Wyangala Dam to the east of the proposal site. As a managed impoundment, Wyangala Dam features steep banks and minimal fringing wetland vegetation and would have lower value for migratory waders or wetland birds than a natural geomorphic feature of a similar size.

A full list of migratory fauna species recorded in the locality or predicted to occur is provided in Appendix A, together with species' habitat requirements and likelihood of occurrence.

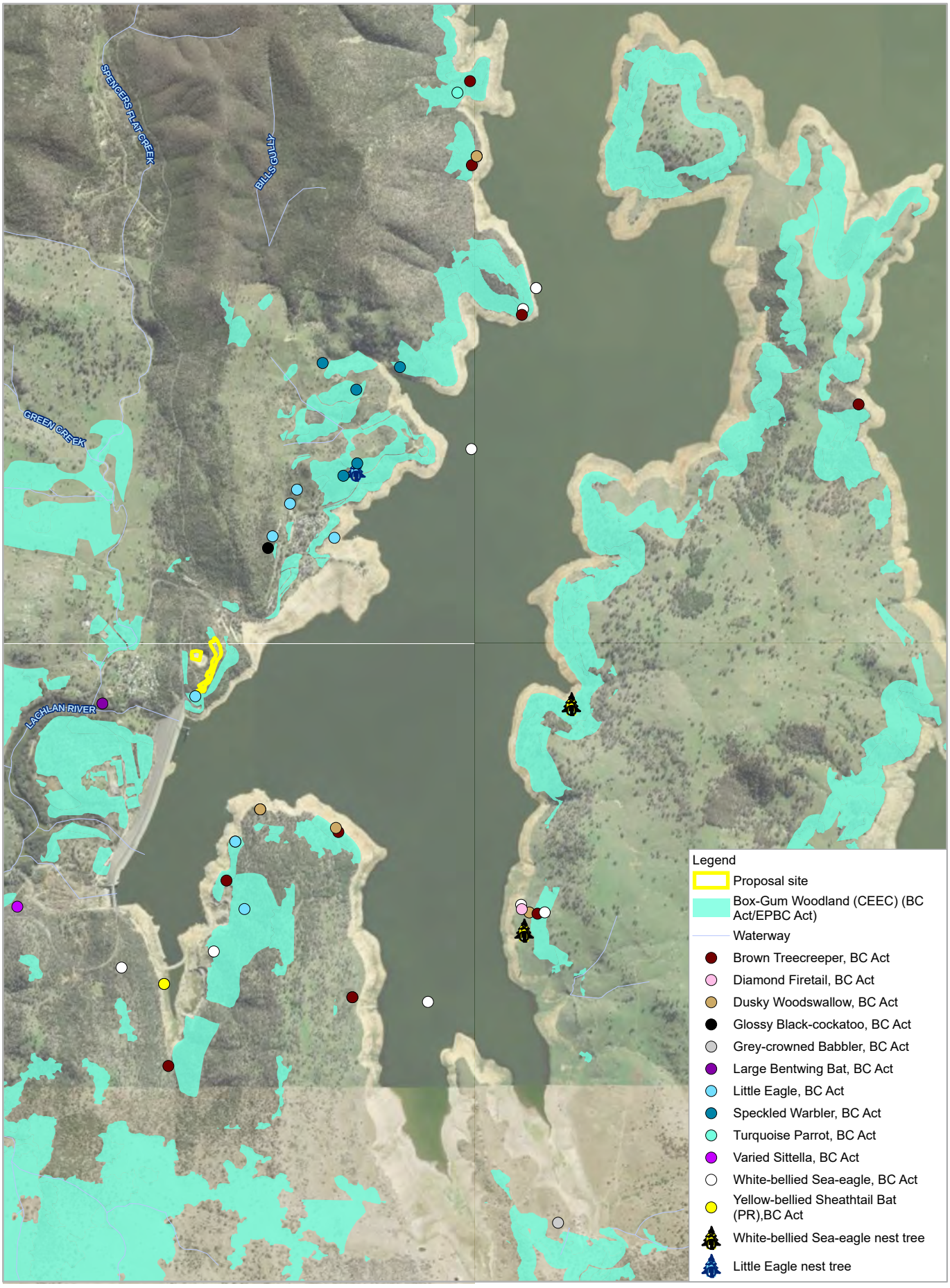
There is some potential for the following migratory woodland species to forage on occasion within the proposal site:

- White-throated Needletail (*Hirundapus caudacutus*)
- Yellow Wagtail (*Motacilla flava*)
- Satin Flycatcher (*Myiagra cyanoleuca*)
- Rufous Fantail (*Rhipidura rufifrons*)

Important habitat for these migratory birds is defined in the significance criteria for listed migratory species (DoE 2013) as follows:

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

Habitat in the proposal site is unlikely to be important for these species as defined in the significance criteria (DoE 2013) given the extent of fragmentation and previous and ongoing disturbance within a narrow strip of non-native vegetation and disturbed woodland along the edges of the road. Habitat in the proposal site would not support an ecologically significant proportion of the population, is not critical to the lifecycle of these species and is not at the limit of these species' range. While these species may occur on occasion, they would not rely on the habitats present for their persistence in the locality.



Paper Size ISO A4

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

WaterNSW

Wyangala Water Treatment Plant
Biodiversity Assessment

Project No. 12528366
Revision No. **FINAL**
Date 2021-07-27

Threatened biota

FIGURE 5

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Print date: 27 Jul 2021 - 10:52

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7. Impact assessment

7.1 Introduction

The proposal would result in direct impacts on native biota and their habitats within the proposal site. There is also the potential for indirect impacts on retained areas of native vegetation adjacent to the proposal site, both during construction and from the resulting ongoing operation and maintenance of the roads and WTP infrastructure. Impacts to native vegetation have been minimised where possible through proposal design and the location of proposed infrastructure and utilities in previously disturbed areas in order to minimise impacts where possible.

The proposal site and proposal site layout is shown on Figure 1. The proposal would include the removal of up to 0.63 hectares of native vegetation and 0.27 hectares of non-native vegetation comprising the construction footprint for the proposed roads and utilities and associated easements required for ongoing maintenance and operation. This area also includes a buffer of about 15 metres from the top of batters to incorporate erosion and sediment controls and all other requirements during construction.

Specific mitigation measures are recommended to minimise likely impacts on biodiversity values. These measures are presented according to the hierarchy of avoidance and mitigation of impacts in section 8.2 of this report.

7.2 Construction impacts

7.2.1 Direct impacts

7.2.1.1 Clearing of vegetation

The proposal would result in direct impacts on 0.63 hectares of native vegetation within a narrow strip on either side of an access road. Up to 0,27 hectares of non-native vegetation comprising exotic grassland would also be removed on the edge of the road. The majority of this vegetation is in moderate condition with a degraded understorey and has a moderate biodiversity value given its landscape context and habitat value for threatened species. The impacts on this vegetation are associated with clearing for proposed upgrades to existing roads, installation of new pipelines and construction of a new WTP. The construction of roads and existing WTP infrastructure and cleared areas have created gaps in the canopy vegetation on site and contributed to degradation of woodlands via the introduction and spread of weeds into the area. Despite the initial clearing, woodland in the proposal site remains connected to a large, continuous patch of native vegetation that extends to the west and north throughout the locality (Wyangala State Park). It is unlikely the clearing of native vegetation for the proposal would significantly fragment or reduce the overall connectivity of this patch, which would remain connected largely via the vegetation in the western portion of the study area.

The proposal would remove a small proportion of individual plant species, PCTs and associated habitats comparative to that in the surrounding area and locality. The clearing of native vegetation would involve the removal of a moderate diversity of non-threatened native plants, including mature trees.

It is assumed that the proposal would result in the total clearing of the proposal site. In practice it is likely that direct impacts associated with construction of the WTP would be smaller. A conservative approach has been adopted for the purpose of this assessment in that it has been assumed that the entirety of the proposal site would be subject to direct impacts during construction and that all biodiversity values would be lost. The measures to minimise impacts summarised in section 8 would help restrict both direct and indirect impacts to the proposal site.

Table 12 Clearing of native vegetation and habitat at the proposal site

Vegetation type	Listing under the BC Act and EPBC Act	Area of clearing in proposal site (ha)
Tumbledown Red Gum – Black Cypress Pine – Red Stringybark – Currawang shrubby low woodland on Wyangala granite and metasediments (PCT 339) – Degraded understorey	Not listed	0.63
Non-native vegetation	Not listed	0.27
Total vegetation removal		**0.90**
Total native vegetation removal		**0.63**

7.2.1.2 Removal of habitat and habitat resources

The vegetation to be impacted provides potential habitat resources for native fauna species, including threatened species of fauna recorded and likely to occur in the proposal site and surrounds (refer to section 6.6 and Appendix A). The proposal will result in impacts to 0.63 hectares of native vegetation and would include the removal of mature trees. The vegetation is a small area of disturbed edge habitat along an existing road and non-native vegetation surrounding existing infrastructure (Figure 2). The native vegetation to be removed has moderate habitat value for woodland fauna

species, including birds, bats and mammals. The removal of woodland will have a minor impact on the availability of foraging, roosting, nesting and movement habitat for a variety of woodland dependent fauna. Mature trees have value for fauna populations as sources of foraging resources such as leaves, nectar, sap or seed and substrate for invertebrate prey. Woodlands also provide important foraging habitat such as leaf-litter and woody debris for ground-foraging species. No known hollow-bearing trees would be removed as part of the proposal, but small inconspicuous hollows not recorded during survey may be present. No stick nests suitable for threatened raptors were observed during surveys.

Areas of rocky outcrop and scattered rocks occur in the proposal site and occur throughout both woodland and exotic grassland vegetation. These areas are likely to provide habitat for a variety of common reptile species, which would potentially be impacted by the proposal. The loss of leaf litter would remove habitat for a wide variety of vertebrates and invertebrates.

No areas of ephemeral aquatic habitat were recorded during site surveys. . Indirect impacts to aquatic habitat in the study area (i.e. Wyangala Dam) via sedimentation and wash in times of high-rainfall are possible however, and should be minimised via the implementation of safeguards outlined in section 7.1.

In the context of the areas of remaining native vegetation surrounding the proposal site, the proposal would remove a small proportion of available foraging resources for local populations of native fauna with a large continuous patch of native vegetation located to the north, south and west of the proposal site. It has been assumed that all vegetation and associated habitat within the impact footprint will be removed, however the total area impacted may be reduced during the detailed design phase.

7.2.1.3 Fauna injury and mortality

Clearing activities are likely to result in the injury or mortality of some individuals of less mobile fauna species and other small terrestrial fauna that may shelter in vegetation within the proposal site during clearing activities. Areas with taller groundcover are likely to provide habitat for snakes and lizards, including the Red-bellied Black Snake (*Pseudechis porphyriacus*), Eastern Bearded Dragon (*Pogona barbata*) and Thick-tailed Gecko (*Underwoodisaurus millii*).While no obvious hollows were recorded in the proposal site, there is a potential risk of injury or mortality to species which may be using inconspicuous crevices and fissures under bark not detected during surveys. More mobile native fauna such as birds, bats, terrestrial and arboreal mammals that may be sheltering in vegetation in the proposal site are likely to move into adjoining woodland areas during clearing.

Recommendations have been made in Section 8 below to minimise the risk of vegetation clearing activities resulting in the injury or mortality of resident fauna.

7.2.1.4 Fragmentation and isolation of habitat

Vegetation on site is already fragmented by clearing and existing infrastructure (Figure 2). Additional clearing will cause some further fragmentation and widen the existing gap but not likely to create a barrier to movement or isolate any areas of habitat for the species known or likely to occur. Habitat fragmentation can create barriers to the movement of pollinator vectors, such as insects, and consequently affect the life cycle of both common and threatened flora. Given the small extent of vegetation clearing proposed, it is unlikely that the proposal would create any significant or new barriers to the movement of pollinator and seed dispersal vectors, such as insects and birds.

7.2.2 Indirect impacts

7.2.2.1 Weed invasion and edge effects

‘Edge effects’ can include increased noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects would result from clearing and construction activities and then continue to affect vegetation and habitats adjoining the proposal site.

Altered environmental conditions along new edges can allow invasion by pest animals specialising in edge habitats and/or change the behaviour of resident animals. Edge zones can be subject to higher levels of predation by introduced mammalian predators and native avian predators.

Vegetation within and adjoining the proposal site is in moderate to low condition, comprising remnant native vegetation with weeds more abundant around disturbed edges and tracks, and in cleared areas. Weeds are in relatively low abundance in the areas of better quality vegetation, further away from the track. There are priority weed species present throughout the proposal site, including Blackberry, St John’s Wort and Bridal Creeper. Given the current use of the site, there is a low risk of construction activities spreading these priority weeds and new weeds further into adjoining vegetation. Management measures including the development of a weed management sub-plan as part of the project CEMP would be implemented to mitigate these potential impacts (refer to Section 8).

Other relevant mitigation measures to reduce the impacts of edge effects including dust suppression, erosion and sediment measures during construction are discussed in section 8.

7.2.2.2 Introduction and spread of weeds, pests and pathogens

Disturbance associated with vegetation clearing, vehicle traffic and general day to day operations of the proposal during construction increase the potential for the spread, introduction and establishment of weed and pest species, and diseases and pathogens.

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.

Construction activities within the proposal site may, in general, have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) into adjacent native vegetation through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats.

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 existing development presence and extent of human visitation across the proposal site and surrounding study area. To help mitigate the risk of pathogens being brought onto and/or spread through the site all machinery brought to site will be washed down and inspected to be free of soils, seeds and other organic material in accordance with Section 8.2.

7.2.2.3 Noise, vibration and light impacts on fauna

The majority of the proposed construction works would be undertaken during standard, daytime construction hours. Exemptions and approval for works outside of the above standard construction hours may be required during certain circumstances.

Noise levels during the construction period would result in an increase above existing background levels for the duration of construction. Noise levels would vary during the construction period, with some activities being louder and producing higher levels of vibration than others. Noise, vibration and light have been shown to have a variety of impacts on fauna, including changing foraging behaviour, impacting breeding success and changing species occurrences. Fauna most at risk would be those residing in close proximity to the works area, and in particular any species that may be nesting, roosting or denning in the area. Some fauna may vacate areas in proximity to the proposal site during construction. No nests of threatened raptors were observed in the proposal site. Hollow-bearing trees in adjacent areas may provide nesting habitat for species, including the threatened Turquoise Parrot, Squirrel Glider and a variety of threatened microbat species. Disturbance has the potential to interrupt breeding activities for some individuals. Other more resilient fauna species are likely to become accustomed to the noise, and this increased or novel impact is unlikely to result in a decrease in population numbers or diversity of these species. Given the temporary nature of the works, and the availability of alternate habitat in surrounding areas, it is unlikely the temporary increase in noise during construction of the proposal would significantly impact on fauna that occur in the proposal site or adjoining areas.

7.2.2.4 Erosion and sedimentation

Construction of the proposal has the potential to result in sedimentation, pollution, contaminated runoff or erosion within the proposal site and adjoining native vegetation, through soil disturbance and construction activities. Potential sources of soil and water pollution include:

- Soil disturbance during excavation and construction works.
- Inappropriate management of soil and material stockpiles.
- Hydrocarbon leaks or spills from vehicles or equipment used in construction.
- Increased sediment transfer and erosion potential in areas cleared of vegetation.

Mitigation measures to reduce the potential for such pollution are described in Section 7.2, and include minimising the disturbance area, construction staging, erosion and sediment control devices and rehabilitation or landscaping of disturbed areas.

7.3 Operational impacts

Impacts on biodiversity values would be largely restricted to the construction phase of the proposal. There are however a number of potential impacts that may occur as a result of the operation of the proposal. These include:

- Erosion and sedimentation as a result of runoff from hard stand areas.
- Introduction of weed propagules by vehicle and/or residents/visitors.
- Fauna mortality as a result of collision with vehicles.
- Noise and lights associated with the operation of the WTP

Given current land uses in the study area, the proposal would not result in a substantial increase in the operation of any of these potential impacts. The potential impacts are linked to human occupation of the site and are likely to

persist indefinitely. Mitigation measures to be implemented to minimise these potential impacts are discussed in Section 8.2.2.

7.4 Key threatening processes

A key threatening process (KTP) is a process that threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community. A process can be listed as a KTP if it could:

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

KTPs are listed under the BC Act, FM Act and EPBC Act. Some KTPs are listed under more than one Act. KTPs of relevance to the proposal are discussed in Table 13. Mitigation measures to limit the impacts of these KTPs are discussed in Section 8.2.1.

Table 13 Key threatening processes of relevance to the proposal

KTP	Status	Comment
Clearing of native vegetation	BC Act; EPBC Act	Clearing of native vegetation refers to the removal of one or more strata within a stand of native vegetation. There are numerous impacts as a result of clearing native vegetation, including: destruction of habitat causing a loss of biological diversity; fragmentation of populations; disturbed habitat which may permit the establishment and spread of exotic species; and loss of leaf litter, removing habitat for a wide variety of vertebrates and invertebrates (OEH, 2020d). Clearing of native vegetation has occurred historically within and around the proposal site. The construction footprint has been located in previously disturbed areas so as to avoid impacts on native vegetation where possible. The proposal would result in the clearing of up to 0.63 hectares of native vegetation. Implementation of vegetation management measures would minimise impacts on native vegetation where possible (see Section 8.2.1)
Invasion of plant communities by perennial exotic grasses	BC Act	Exotic perennial grasses of concern include Coolatai Grass (*Hyparrhenia hirta*), Pampas (*Cortaderia* spp.), Giant Parramatta Grass (*Sporobolus fertilis*), Chilean Needlegrass (*Nassella neesiana*), Serrated Tussock (*Nassella trichotoma*) and African Lovegrass (*Eragrostis curvula*). There is evidence that these perennial grass species have significant adverse impacts on biodiversity, including increases to fuel loads that result in changes to fire regimes that can alter the structure of native vegetation communities and lead to local extinctions of some native species. Construction activities have the potential to introduce and facilitate the establishment of perennial exotic grasses in the proposal site. Serrated Tussock is prevalent in the landscape surrounding Wyangala Dam, although not recorded in the proposal site. Weed management procedures would be implemented to limit any further spread of weeds as a result of the proposal (see Section 8.2.1).
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Construction activities have the potential to introduce Myrtle Rust to the proposal site and study area. The fungus infects leaves of susceptible plants producing spore-filled lesions on young actively growing leaves, shoots, flower buds and fruits. Leaves may become buckled or twisted and may die as a result of infection. Infection on highly susceptible plants may result in plant death. Implementation of hygiene protocols would minimise the risk of introduction or spread of this pathogen (see Section 8.2.1).
Infection of native plants by *Phytophthora cinnamomi*	BC Act; EPBC Act	*Phytophthora cinnamomi* is a soil borne pathogen that occurs in warm, moist conditions. Infected species may show a range of symptoms, and some plants may be killed and lead to areas of dieback. The proposal has the potential to introduce the pathogen to the proposal site and study area, through the transport and movement of plant, machinery and vehicles. Implementation of hygiene protocols would minimise the risk of introduction or spread of this pathogen (see Section 8.2.1).

7.5 Cumulative impacts

The proposed raising of Wyangala Dam wall will have impacts to large areas of native vegetation and habitat for threatened biota. The project site contains large areas of native vegetation interspersed with agricultural grazing land and a small amount of cereal cropping in the upper reaches of the Lachlan River, as well as cleared land. Eighteen

PCTs have been identified in the project site. Native grasslands in the project site occur as derived grasslands that are continuous with the understories of the remnant woodland patches in the study area and are considered to be derived from the clearing of the original woodland parent community PCT. The project would directly impact 1275 hectares of native vegetation in the inundation project site and 532 hectares in the construction project site that are habitat for several threatened flora and fauna species. The project would impact two threatened flora species and habitat for at least 21 threatened fauna species recorded during the field surveys.

The proposed raising of the Wyangala Dam wall would inundate portions of the existing Reflections Holiday Park. As a result, the Reflections Holiday Park is currently seeking environmental approval to relocate to higher ground. The final design of the park is yet to be confirmed, however previous iterations of the relocated holiday park included the removal of approximately 39 hectares of native vegetation for the construction of a new road network and utilities, administrative buildings, accommodation, recreational infrastructure, a water treatment plant, services and associated asset protect zones. As effort has been made to avoid impacts to native vegetation, the final design is likely to impact less than 39 ha of native vegetation. This project would result in cumulative impacts on biodiversity values in the catchment surrounding Wyangala Dam.

The construction of construction of a new WTP and associated infrastructure to replace the existing Wyangala WTP would result in direct impacts to 0.63 hectares of native vegetation. The majority of this vegetation is in moderate condition and has moderate biodiversity value given its landscape context and habitat value for threatened species. It is unlikely the clearing of native vegetation for the proposal would significantly fragment or reduce the overall connectivity of this patch, given the small amount of vegetation removal anticipated. The proposal would remove a negligible proportion of individual plant species, fauna populations, PCTs and associated habitats comparative to that in the surrounding area and locality.

The direct removal of around 532 ha of vegetation for construction and adverse inundation of at least 1,275 ha of native vegetation associated with the dam raising project and the relocation of the Holiday Park would contribute to significant negative impacts to biodiversity values in the catchment. Impacts associated with the construction of the WTP as part of this proposal make a minor contribution to the total quantum of cumulative impacts.

The construction of the WTP would not contribute to impacts of altered hydrology of downstream floodplain environments or impacts to aquatic ecosystems arising from the dam raising project.

7.6 Impacts on threatened biota and migratory species

The proposal would result in direct impacts on threatened species and their habitats within the proposal site. Impacts to native vegetation, and therefore threatened biota, has been minimised as far as practicable through refinement of proposal design and the location of proposed infrastructure into areas with existing disturbance as far as possible. The potential impacts on threatened biota are described below with assessments of the significance of impacts included in Appendix C.

7.6.1 Threatened ecological communities

There would be no impacts to any TECs listed under the BC Act and EPBC Act.

7.6.2 Threatened species

7.6.2.1 Threatened flora species

There is broadly suitable habitat for three threatened flora species within the proposal site. No threatened flora species were identified during targeted field surveys during the appropriate seasonal survey period.

Given this, the lack of previous records from the study area, and the relatively small area of potential habitat that would be removed, the proposal has a low likelihood of having an adverse impact on these species. As such, assessments of significance have not been completed for these species.

7.6.2.2 Threatened fauna species

Assessments of significance pursuant to Section 7.3 of the BC Act (5-part test) 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. These include:

- Hollow-dependent mammals that may forage in the proposal site and den/roost in nearby habitat - Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat
- Hollow-dependent woodland birds that are likely to forage in the proposal site and may breed/nest in nearby habitat - Turquoise Parrot and Brown Treecreeper
- Woodland birds that are likely to forage in the proposal site and may breed/nest in the study area - Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin

Assessments for significance are described in Appendix C their findings summarised below.

The proposal is unlikely to have a significant effect on a local population of the Squirrel Glider, Yellow-bellied Sheathtail Bat and Southern Myotis as:

- The Squirrel Glider has not been previously recorded on the proposal site or in the locality and the proposal will remove only a small area of low-quality foraging habitat that does not appear to contain hollows suitable for breeding
- Removal of a small amount (0.63 hectares) of potential foraging and roosting/breeding habitat in native woodland and an additional 0.27 hectares of foraging habitat in non-native vegetation for Yellow-bellied Sheathail Bat, if small hollows are present
- Removal of a small amount (0.63 hectares) of potential roosting habitat in native woodlands for Southern Myotis, if small hollows are present
- The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these species through the study area or locality or to isolate patches of habitat
- There are areas of higher habitat quality within the study area that is connected with suitable habitat in the locality, and the habitat to be removed in the proposal site is unlikely to be important for the persistence of a viable local population of these species.

Consequently, a species impact statement would not be required for the Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat. Mitigation measures to minimise impacts on hollow-dependant mammals (if present) would be implemented (see Section 7.2).

- The proposal is unlikely to have a significant effect on a local population of the Turquoise Parrot and Brown Treecreeper as:
- The removal of a small area (0.90 hectares) of foraging habitat for the Turquoise Parrot in roadside woodland and non-native vegetation
- The removal of a small area (0.63 hectares) of foraging habitat for the Brown Treecreeper in roadside woodland
- Impacts to the proposal site are small in extent, are not unlike impacts that have previously been experienced at the site due to its current use as an existing WTP, and as such, are unlikely to deter the species from utilising the site if they presently occur
- The vegetation to be removed is unlikely to comprise important breeding habitat being located along disturbed edges and given the apparent lack of tree-hollows
- The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these species through the study area or locality or to isolate patches of habitat
- There are areas of higher habitat quality within the study area that is connected with suitable habitat in the locality, and the habitat to be removed in the proposal site is unlikely to be important for the persistence of a viable local population of these species Consequently, a species impact statement would not be required for these bird species. Mitigation measures to minimise impacts on these species and areas of potential habitat would be implemented (see Section 7.2).

The proposal is unlikely to have a significant effect on a local population of the Speckled Warbler, Grey-crowned Babbler, Diamond Firetail, Dusky Woodswallow and Hooded Robin as:

- The removal of a small area of foraging habitat (0.90 hectares) in roadside woodland and non-native vegetation
- The removal of a small area of foraging habitat (0.63 hectares) for the Varied Sittella in roadside woodland
- No known breeding habitat would be removed by the proposal and the vegetation to be removed along the roadside edge is unlikely to comprise important breeding habitat
- Impacts to the proposal site are small in extent, are not unlike impacts that have previously been experienced at the site due to its current use as an existing WTP, and as such, are unlikely to deter the species from utilising the site if they presently occur
- The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these species through the study area or locality or to isolate patches of habitat

Consequently, a species impact statement would not be required for the threatened woodland bird species assessed. Mitigation measures to minimise impacts on these bird species (if present) and areas of potential habitat would be included in the CEMP (see Section 8.2).

No habitat for threatened biota listed under the FM Act is present within the proposal site, and no impacts to threatened aquatic biota are expected.

A small number of highly mobile, wide ranging species such as the Little Eagle and Barking Owl that have a moderate likelihood of occurring in the proposal site but are unlikely to be impacted by the proposal given the absence of breeding

habitat and the very small area of potential foraging habitat that would be removed. Assessments of significance have not been prepared for these species. No assessments of significance are considered necessary for species considered to have a low likelihood of occurrence in the study area (see Appendix A) as any potential impact resulting from the proposal is likely to be minimal.

7.6.3 Migratory fauna species

There is potential foraging habitat for up to four migratory woodland bird species within the proposal site. None of these species would be reliant upon habitats within the proposal site for any part of their life cycle, and habitat within the proposal site does not comprise important habitat for these species as defined in the significance criteria for listed migratory species (DoE 2013) (see section 6.5).

Given the lack of likely impacts on important habitat for migratory species, no assessments of significance for these species have been prepared.

8. Mitigation

8.1 Avoiding and minimising impacts

Effort has been made through the proposal planning and design process to avoid impacts to areas of high biodiversity value. Multiple iterations of the project boundary have been considered during the planning process. The total area of native vegetation impacted by the proposed works has been reduced from over 2 ha to 0.63 ha. The final iteration of the proposal boundary has avoided impacts to areas of higher biodiversity value by locating the WTP footprint in previously disturbed and fragmented patches of vegetation. Habitat resources with high conservation value such as hollow bearing trees have been avoided.

A conservative approach has been adopted for the purpose of this assessment in that it has been assumed that the entirety of the proposal site would be subject to direct impacts during construction and that all biodiversity values would be lost. Opportunities to retain some vegetation within the construction footprint may be identified during the detailed design phase of the project.

8.2 Mitigating impacts

8.2.1 Construction phase

8.2.1.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) (or equivalent) would be required for the construction phase of the proposal and would be prepared prior to commencement of construction. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures, including the procedures outlined below. The proposed mitigation measures would include environmental safeguards for protection of neighbouring properties and waterways in accordance with relevant policy documentation and Government guidelines.

In order to address the potential impacts of the proposal on biodiversity as discussed in Section 7, the mitigation and management measures outlined in Table 14 would be implemented as part of the CEMP for the site.

Table 14 Mitigation measures (construction)

Impact	Mitigation	Timing	Responsibility
General	All workers are to be provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches.	Prior to clearing/construction works.	Construction contractor
	Prepare a flora and fauna management sub-plan as part of the CEMP, incorporating recommendations below, and expanding on specific details where necessary.	Prior to clearing/construction works.	Construction contractor
	Measures to suppress dust, prevent erosion and sedimentation must be implemented during clearing and construction.	Throughout clearing and construction phases	Construction contractor
	Appropriate speeds are to be enforced to limit dust generation and minimise chances of fauna mortality through vehicle strike.	Throughout clearing and construction phases	Construction contractor
Vegetation clearing	Limit disturbance of vegetation to the minimum necessary to undertake the proposal.	Prior to works commencing	Construction contractor
	Prior to the commencement of any work in or adjoining areas of native vegetation: • a survey would be carried out to mark the construction impact boundary • The perimeter of this area will be fenced using high visibility fencing, clearly marked as the limits of clearing. • Vegetation outside this fence line will be clearly delineated as an exclusion zone to avoid unnecessary vegetation and habitat removal/disturbance. • Fencing and signage must be maintained for the duration of the construction period. Fencing should be designed to allow fauna to exit the site during clearing activities.	Prior to clearing / Daily inspections of exclusion zones during works in area.	Construction contractor and qualified ecologist
	Stockpiles of fill or cleared vegetation should be placed within existing cleared areas (and not within areas of adjoining native vegetation).	Prior to clearing/ construction works	Construction contractor
	Sediment fences should be installed to prevent transfer of sediments into adjacent vegetation.	Prior to clearing/ construction works	Construction contractor
Introduction of Weeds and Pathogens	Prepare a weed and pest species management sub-plan as part of project CEMP to manage weeds and pathogens during the construction and operational phase of the proposal.	Prior to clearing/ construction works	Construction contractor
	The introduction and spread of weed species will be minimised by restricting access to areas of native vegetation and communicating the responsibilities of all proposal personnel at site inductions and during regular toolbox meetings. All priority weeds identified on the site will be controlled and removed in accordance with the requirements of the *Biosecurity Act 2015*.	Prior to clearing/ construction works	Construction contractor and qualified ecologist

Impact	Mitigation	Timing	Responsibility
	All priority and environmental weeds will be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material. Disposal must be documented, and evidence of appropriate disposal must be kept.		
	All machinery entering the site must be appropriately washed down and disinfected prior to work on site to prevent the potential spread of weeds, Cinnamon Fungus (*Phytophthora cinnamomi*) and Myrtle Rust (*Pucciniales fungi*) in accordance with the national best practice guidelines for Phytophthora (O'Gara *et al*. 2005) and the Myrtle Rust factsheet (DPI 2015b) for hygiene control.	Prior to any plant or machinery being brought onto the site	Construction contractor
	Incorporate control measures in the design of the proposal to limit the spread of weed propagules downstream of the proposal site. Sediment control devices, such as silt fences, would assist in reducing the potential for spreading weeds.	Prior to clearing/ throughout construction works	Construction contractor
Removal of fauna habitat	Pre-clearance surveys Prior to the commencement of any clearing the following will be undertaken: • Pre-clearance fauna surveys, undertaken by a suitably qualified ecologist(s) prior to the commencement of any clearing activities. This will include identification of habitat trees, including trees that contain obvious nests or potential roost sites (peeling bark, small hollows), rocky habitat, fallen logs with an "H" in high visibility spray paint. • Surrounding vegetation will be inspected by the ecologist for the presence of fauna.	Prior to and during clearing works	Construction contractor and qualified ecologist
	Clearing surveys • Clearance surveys are to be undertaken during clearing by a suitably qualified and appropriately licenced ecologist to inspect identified habitat features prior to removal, ensure appropriate implementation of clearing protocols (see below), and the appropriate management of any fauna encountered. • If animals are encountered, procedures outlined in the protocol for capture and relocation (below) will be followed. Surrounding vegetation can then be cleared. • If no fauna are found, then surrounding non-hollow-bearing vegetation can be cleared. This process will be monitored by the ecologist in case fauna are found to be at risk. • The ecologist will document the outcomes of this process (e.g. number and species encountered/rescued). • A wildlife rescue organisation (e.g. WIRES) should be made aware of operations in case any injured fauna are found. All animals encountered will be treated	During clearing phase	Construction contractor and qualified ecologist

Impact	Mitigation	Timing	Responsibility
	humanely, ethically, and in accordance with relevant codes under the NSW Prevention of Cruelty to Animals Act 1979. All trees marked with an “H” are to be felled in accordance with the procedure detailed below: • A suitably qualified and experienced ecologist will be present, with appropriate animal-handling equipment and holding containers. • Prior to felling or removal, clearing machinery will be used to gently shake or ‘bang’ the habitat tree for a period of 2-3 minutes (dependant on tree health and structural integrity) to encourage any resident fauna to vacate hollows. Sticks, poles or other similar hand-held objects will also be used to hit the trunk of the tree or log at various points, to encourage animals to vacate the tree. The tree will be observed for at least 5 minutes prior to completing this action. • After the observation period, trees will be gently lowered/felled using an excavator bucket or dozer blade for support if possible. The ecologist will observe the tree felling and ensure that any hollows are not blocked by being placed against the ground. • Once deemed safe by the plant operator, the ecologist will inspect each tree and hollows for fauna that may be present (uninjured, injured or deceased). Use of fibre-optic cameras to assist this process is recommended. The ecologist will document this process using the tree hollow inspection register. • Felled habitat trees with any occupied hollows will be left on the ground overnight or up to 24 hours to allow the animal to exit the hollow. Habitat trees can then be cut into appropriate sections according to the protocol for habitat salvage and relocation (described below). For any hollow logs: • Gently knock the log with an excavator for a short time while the log is observed by the ecologists. • Any fauna leaving the log will be rescued by the ecologists according to the protocol for fauna capture and relocation (described below); and • If no fauna emerge after an appropriate time (>5 min), the ecologists will inspect the hollow and instruct the plant operator to salvage hollows or translocate the log in accordance with the protocol for habitat salvage and relocation (described below). • Felled habitat trees and logs can be cut into sections after at least 24 hours on the ground/post clearing to permit the recovery of hollow resources. The project ecologist is to direct an appropriately accredited chainsaw operator in these works. • Following clearing operations, salvaged hollows are to be relocated in the adjacent woodland area, under direction from the project ecologist.		

Impact	Mitigation	Timing	Responsibility
	• Any stockpiled hollow sections of trunks or branches should be placed on their ends (with the hollow opening against the ground) to minimise the chance of fauna entering hollows while they are stockpiled. • Vegetation in the adjacent woodland area is not to be damaged during relocation habitat features. Appropriately, sized machinery should be used to relocate hollow trunks and limbs and will use existing tracks or disturbed areas only. A suitably qualified and appropriately licenced ecologist will be present during the clearance of all native vegetation and/or fauna habitats. Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. WIRES or Sydney Wildlife) should be made aware of operations in case any injured fauna are found. All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the NSW Prevention of Cruelty to Animals Act 1979, including: • Australian code of practice for the care of animals for scientific purposes (NHMRC 2004). • Code of practice for the welfare of wildlife during rehabilitation (DPI 2001). • Animal ethics considerations and protocols outlined in this document. If the project ecologist considers an animal is at risk of injury or undue stress, it is to be gently directed into secure adjoining habitat. Where deemed necessary by the project ecologist, the animal may be required to be captured and released. Capture and release operations will proceed via the following protocols: • All construction activities that are considered by the project ecologist be likely to increase the risk of injury, mortality or stress to the animal will be halted until the animal has been removed, which will be enforced with the co-operation of the Contractor. Construction activities that do not contribute to the risk of injury, mortality or stress to the animal can continue (as determined by the project ecologist). • Only qualified ecologists or wildlife carers are authorised to handle animals. • Animals will be captured (if required) by the project ecologist using a safe and ethical technique, as is appropriate for the particular species (see below). Native animals that are unable to depart of their own accord will be captured and held in a receptacle appropriate for that species until release. All captive-held animals will be provided with food, water and warmth as is appropriate for the species. Each receptacle will only hold one animal at a time and will be cleaned and disinfected between use to avoid the spread of disease.		

Impact	Mitigation	Timing	Responsibility
	Details of any fauna relocated from hollows would be recorded on the tree hollow inspection register. Any other fauna relocated from trees, shrubs or other areas would also be recorded.		
	Bush rock within the construction footprint would be inspected for fauna prior to removal and relocated to adjacent areas outside of the proposal site under the direction of the project ecologist.	Prior to and during clearing works	Construction contractor and qualified ecologist
Water Quality and aquatic habitats	Erosion and sediment control plans should be prepared and established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase.	Prior to construction commencing	Construction contractor
	Erosion and sediment controls would be regularly inspected, particularly following rainfall events, to ensure their ongoing functionality.	Weekly during construction phase or after any significant rainfall event	Construction contractor
	Stabilised surfaces should be reinstated as quickly as practicable after construction.	Immediately following clearing	Construction contractor
	Spill kits would be made available to construction vehicles. A management protocol for accidental spills would be put in place.	During construction	Construction contractor

8.2.2 Operation phase

The biodiversity assessment has been prepared on the basis that the proposed road upgrade and construction of a new WTP would require the complete clearing of vegetation from within the proposal site, however further refinement of the proposed design will likely reduce these impacts.

Operation of the proposal is unlikely to result in additional impacts to those present from the existing WTP and associated roads and infrastructure to any significant degree. Operational mitigation measures would help to minimise impacts of the proposal.

9. Conclusion

The proposal involves the construction of a new WTP and associated infrastructure to replace the existing Wyangala WTP. The proposal would allow for the transfer of potable water to the Wyangala township, south west of the proposal, and the Reflections Holiday Park located north of the proposal.

The proposal site has been modified by the construction and operation of the existing WTP, power lines and access roads and contains patches of cleared land, non-native vegetation and degraded native woodland. Woodland in the proposal site connects to a large, continuous patch of native vegetation that extends to the south, west and north throughout the locality (Wyangala State Park).

The proposal would remove up to 0.63 hectares of native vegetation, comprising Tumbledown Red Gum - Black Cypress Pine - Red Stringybark - Currawang shrubby low woodland with a degraded understorey and 0.27 ha of non-native vegetation comprising exotic grassland and occurring along an existing access track. Multiple iterations to the design of the proposal have avoided and minimised impacts on biodiversity values and located infrastructure previously modified areas of lower biodiversity value as far as possible.

The vegetation to be removed is not a threatened ecological community and does not contain habitat for threatened plants. There would be no removal or disturbance of threatened ecological communities in the broader study area. The narrow strips of native vegetation that will be removed along the existing access track may contribute to foraging habitat for threatened and migratory woodland fauna species that occur in the broader study area but are unlikely to comprise nesting or breeding habitat or be important for the persistence of any local populations of these species.

Assessments of significance completed with reference to section 1.7 of the EP&A Act and section 7.3 of the BC Act have concluded the proposal is unlikely to have a significant impact on threatened biota listed under the BC Act and therefore a BDAR is not required. The proposal would also not be considered likely to significantly impact threatened species in accordance with section 7.2(1)(a) and 7.2(1)(b) of the BC Act. Similarly, the proposal is unlikely to have a significant impact on any biota listed under the EPBC Act.

A number of safeguards and mitigation measures are proposed, including the implementation of a CEMP, to minimise the impacts of the proposal on native flora and fauna, including threatened species known, and likely to occur in the proposal site.

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Appendix A Affected Threatened Biota Assessment

Table A1 Threatened ecological communities and species records and likelihood of occurrence

An evaluation of the likelihood and extent of impact to threatened and migratory fauna (BC Act threatened species); and within a 20 kilometre radius of the proposal site (EPBC Act threatened and migratory species). Records are from the EPBC Protected Matters Search Tool available from the Department of Agriculture, Water and the Environment (DAWE) website and the NSW BioNet Wildlife Atlas. Ecology information has been obtained from the Threatened Species Profiles on the NSW BCD website (http://www.environment.nsw.gov.au/threatenedspecies/) and from the Species Profiles and Threats Database on the Commonwealth DAWEE website (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl).

Status

- National - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.
- NSW - Biodiversity Conservation Act 2016
- E - Endangered
- CE - Critically Endangered
- EP - Endangered population
- V - Vulnerable
- Mi - Migratory

Likelihood of occurrence in proposal site

Recorded – The species was observed in the proposal site during the current survey.

High – It is highly likely that a species inhabits the proposal site and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (within 20 kilometres) and is known or likely to maintain resident populations in the proposal site. Also includes species known or likely to visit the proposal site during regular seasonal movements or migration.

Moderate – Potential habitat is present in the proposal site. Species unlikely to maintain sedentary populations, however may seasonally use resources within the proposal site opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the proposal site, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.

Low – It is unlikely that the species inhabits the proposal site and has not been recorded recently in the locality (within 20 kilometres). It may be an occasional visitor, but habitat similar to the proposal site is widely distributed in the local area, meaning that the species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the proposal site or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

Nil – Suitable habitat is absent from the proposal site.

Likelihood of impact

- Nil chance of impact – The proposal site does not contain suitable habitat for this species and will not have an adverse impact on any other areas containing suitable habitat.
- Unlikely impact - The project would have a low potential to impact this species or its habitats. An assessment of the likely significance of impact (five-part test) has not been prepared for this species
- Likely impact - The project could impact on this species and its habitat. An assessment of the likely significance of impact (five-part test) has been prepared for this species (see Appendix C).

Threatened biota known to occur in the locality

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
Amphibians	*Litoria booroolongensis*	Booroolong Frog	E	E	DAWE 2021a	Restricted to western slopes and tablelands, mainly in western-flowing streams and their headwaters on the Great Dividing Range. Has disappeared from the Northern Tablelands and rare throughout the rest of its range. Occurs along permanent streams with some fringing vegetation cover, ranging from slow-flowing creeks to large rivers, in both forested/ open pasture areas. Found on or near cobble banks and other rock structures within stream margins and shelter under rocks or amongst vegetation near the ground on the stream edge.	Nil	Nil	No suitable habitat (permanent streams) occurs in the proposal site.
Birds	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	OEH 2021a (5 records)	In inland areas this species inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes. In NSW, confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region.	Low	Unlikely	Not recorded during recent surveys in the study area. Absence of preferred foraging habitat (Box-ironbark woodland or riparian forests of River Sheoak) in the study area. The study area is located outside of the species known breeding distribution
Birds	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V	-	OEH 2021a (5 records) GHD (in prep)	Widespread from the coast to inland, including the western slopes of the Great Dividing Range and farther west. Often recorded in woodlands and dry open sclerophyll forests, but has also been recorded in shrublands, heathlands regenerating forests and very occasionally in moist forests or rainforests. The understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, often with coarse woody debris. Also recorded in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber. The nest is an open shallow untidy cup frequently built in an open hollow, crevice or stump. Although Dusky Woodswallows have large home	Moderate	Likely	Recorded in woodland around Wyangala dam during recent surveys. Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in suitable habitat in the locality.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						ranges, individuals may spend most of their time in about a 2 ha range and defend an area about 50 m around the nest. Prefer larger remnants over smaller remnants. Competitive exclusion by Noisy Miners (*Manorina melanocephala*) is a significant threat to this species.			
Birds	*Botaurus poiciloptilus*	Australasian Bittern	E	E	DAWE 2021a	Widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Nil	Nil	No suitable habitat in the proposal site.
Birds	*Calidris ferruginea*	Curlew Sandpiper		CE, Mi	DAWE 2021a	Distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. Breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. Generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. Also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Nil	Nil	No suitable habitat in the proposal site.
Birds	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V		OEH 2021a (34 records) GHD (in prep)	Restricted to the south-eastern coast and highlands, from the lower Hunter and northern Blue Mountains to the Southwestern Slopes, south to and contiguous with the Victorian population.	Moderate	Likely	Recorded in woodland around Wyangala dam during recent surveys and could forage in the proposal site.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						Inhabits eucalypt open forests and woodlands with an acacia understorey. In summer it lives in moist highland forest types, and in winter it moves to more open types at lower elevations. The Gang-gang Cockatoo feeds on seeds obtained in trees and shrubs, mostly from eucalypts and wattles. The Gang-Gang Cockatoo nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially eucalypts, often near water. They are known to breed in eucalypt tree species with hollows greater than 9 cm diameter.			Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in foraging habitat in the locality. No obvious tree-hollows were recorded within the proposal site and the narrow strips of woodland habitat to be removed are unlikely to comprise breeding habitat.
Birds	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	GHD (in prep)	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. 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. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. Nests in the hollows of old eucalypt trees (alive or dead standing). Typically, the nesting site occurs 3 to 30 metres above the ground. Birds tend to nest in the same area as other breeding pairs. Breeding takes place from March to August. Glossy-black Cockatoos are through to breed throughout their range, which is widespread. This	Low	Unlikely	Recorded in woodland around Wyangala dam during recent surveys in areas containing an abundance of *Allocasuarina* species. The proposal site does not contain food resources for this species. *Allocasuarina* species were recorded downslope of the proposal site to the east but would not be impacted by the proposal. There are no suitable tree-hollows for nesting in the proposal site and breeding habitat for the species will not be impacted by the proposal.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						includes Goonoo and Bidden State Forests, the Narrandera Range and Rankin Springs			
Birds	*Chthonicola sagittata*	Speckled Warbler	V	-	OEH 2021a (5 records) GHD (in prep)	Within NSW most frequently reported from the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits a wide range of Eucalyptus-dominated communities with a grassy understorey, a sparse shrub layer, often on rocky ridges or in gullies. Sedentary and requires large, relatively undisturbed remnants to persist in an area. Forages on the ground for seeds and insects, and nests in a slight hollow in the ground or at the base of a low dense plant.	High	Likely	Recorded in woodland around Wyangala dam during recent surveys and likely to occur in the proposal site at least on occasion. Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in potential foraging habitat in the locality. The narrow, disturbed strips of woodland along existing roads in the proposal site are unlikely to comprise breeding habitat.
Birds	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	OEH 2021a (19 records) GHD (in prep)	Occurs from Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell to the east coast, in areas such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys. Most common on the inland slopes and plains. Inhabits eucalypt woodlands and dry open forest, usually dominated by stringybarks or rough-barked species with open grassy understorey. Fallen timber is important foraging habitat. Nests in hollows in standing trees or stumps.	High	Likely	This species was recorded in woodland around Wyangala dam during recent surveys and is likely to forage at the proposal site on occasion. Important habitat resources including fallen timber was recorded within the broader study area. Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in potential foraging habitat in the locality. While no obvious hollows were recorded, suitable breeding habitat may still be present in inconspicuous smaller hollows.
Birds	*Daphoenositta chrysoptera*	Varied Sittella	V	-	GHD (in prep)	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is	High	Likely	This species was recorded in woodland around Wyangala dam during recent surveys. Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in habitat in the locality.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.			
Birds	*Grantiella picta*	Painted Honeyeater	V	V	DAWE 2021a	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	Moderate	Unlikely	May occur in the study area during nomadic foraging movements Mistletoe was recorded during site surveys on woodland trees in the broader study area. The removal of 0.63 hectares of woodland from the site, including trees containing mistletoe will reduce foraging resources in the locality.
Birds	*Haliaeetus leucogaster*	White-bellied Sea Eagle	V	Mi	GHD (in prep)	Primarily coastal but may extend inland over major river systems. Breeds close to water, mainly in tall open forest/woodland but also in dense forest, rainforest, closed scrub or remnant trees. Usually forages over large expanses of open water, but also over open terrestrial habitats (e.g. grasslands).	Low	Unlikely	Recorded around Wyangala dam during recent surveys. No suitable nesting trees or raptor nests were recorded in the proposal site or surrounding study area. No suitable foraging habitat occurs in the proposal site.
Birds	*Hieraaetus morphnoides*	Little Eagle	V		GHD (in prep)	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. The species occurs as a single population throughout NSW. It occupies open eucalypt forest, woodland or open woodland. Allocasuarina or Acacia woodlands and riparian woodlands of interior NSW are also used. Pairs build a large stick nest in winter in tall living trees within a remnant patch.	Moderate	Likely	Recorded around Wyangala dam during recent surveys. No suitable nesting trees or raptor nests were recorded in the proposal site or surrounding study area. The removal of 0.63 hectares of native woodland and 0.27 hectares of non-native vegetation would comprise a negligible reduction in the available foraging habitat for this highly mobile species in the study area.
Birds	*Hirundapus caudacutus*	White-throated Needletail	-	V, Mi	DAWE 2021a	Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and	Low	Unlikely	May occur in the study area on occasion but would not roost in the proposal site and the removal

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						NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. A large proportion of the White-throated Needletails of the nominate subspecies would occur in Australia as non-breeding visitors. A predominantly aerial species most White-throated Needletails spend the non-breeding season in Australasia, mainly in Australia, and occasionally in New Guinea and New Zealand, though it has been suggested that some may overwinter in parts of South-East Asia. As the Needletails that occur in Australia migrate from breeding areas in the Northern Hemisphere, they would be affected by global threats.			of 0.63 ha of woodland vegetation is unlikely to have an adverse impact on this wide-ranging and generally aerial species.
Birds	*Lathamus discolor*	Swift Parrot	E	CE	OEH 2021a (1 record)	Migratory, travelling to the mainland from March to October. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. *Eucalyptus robusta, Corymbia maculata* and *C. gummifera* dominated coastal forests are also important habitat. Breeds in Tasmania from September to January.	Low	Unlikely	Not recorded during recent surveys around Wyangala Dam. Absence of preferred foraging habitat (Box-ironbark woodland) in the proposal site. The proposal footprint occurs outside of the species known breeding distribution
Birds	*Leipoa ocellata*	Malleefowl	E	V	DAWE 2021	The stronghold for this species in NSW is the mallee in the south west centered on Mallee Cliffs NP and extending east to near Balranald and scattered records as far north as Mungo NP. West of the Darling River a population also occurs in the Scotia mallee including Tarawi NR and Scotia Sanctuary. The population in central NSW now occurs chiefly in Yathong, Nombinnie and Round Hill NRs and surrounding areas. To the south of this area the species is probably locally extinct in such reserves as Pulletop	Low	Unlikely	Not recorded during recent surveys around Wyangala Dam. Proposal site occurs at the eastern edge of its known distribution. Less frequently found in woodlands dominated by Cypress Pine such as at the proposal site. Breeding mounds were not recorded in the proposal site or wider study area.

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						NR (last recorded 1989), Ingalba NR (1982) and Buddigower NR (1990) and the intensely studied population at Yalgogrin. Further east, a population continues to persist in the Goonoo forest near Dubbo. Outside these areas, occasional records have been made in the Pilliga forests (most recently 1999), around Cobar (1991) and Goulburn River NP (1989). The species utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species.			
Birds	*Lophoictinia isura*	Square-tailed Kite	V		GHD (in prep)	In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses	Moderate	Likely	Recorded around Wyangala dam during recent surveys. No suitable nesting trees or raptor nests were recorded in the proposal site or surrounding study area. The removal of 0.63 hectares of native woodland and 0.27 hectares of non-native vegetation would comprise a negligible reduction in the available foraging habitat for this highly mobile species in the study area.
Birds	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V	-	OEH 2021a (6 records) GHD (in prep)	Considered a sedentary species, but local seasonal movements are possible. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches	Moderate	Likely	This species was recorded in woodland around Wyangala dam during recent surveys. Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in habitat in the locality.

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						and litter. Nests on low, live or dead forks or branches of trees or stumps, or occasionally on fallen trees or limbs.			
Birds	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	-	OEH 2021a (3 records)	Widespread in NSW, but rarely recorded east of Great Dividing Range except in Richmond and Clarence River areas and scattered sites in the Hunter, Central Coast and Illawarra regions. Mostly in upper levels of drier open forests /woodlands dominated by box and ironbark eucalypts, or less commonly Smooth-barked Gums, Stringybarks and Tea-treas. Forage over home range of >5 ha. Tend to occur within largest woodland patches in the landscape. They forage for insects, nectar and honeydew. The nest is hidden by foliage high in the crown of a tree.	Low	Unlikely	The species may occur in the locality and appear as an occasional visitor to the broader study area. The species is unlikely to be reliant on habitat in the proposal site given the availability of extensive suitable habitat in the surrounding locality. The species is suitably mobile and able to traverse the proposal footprint to other areas of habitat. The removal of 0.63 hectares of woodland from the site, including trees containing mistletoe will reduce foraging resources in the locality.
Birds	*Motacilla flava*	Yellow Wagtail		Mi	DAWE 2021a	The Yellow Wagtail breeds in temperate Europe and Asia. They occur within Australia in open country habitat with disturbed ground and some water. Recorded in short grass and bare ground, swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land and town lawns.	Low	Unlikely	The species may occur in the locality and appear as an occasional visitor to the broader study area. The species is unlikely to be reliant on habitat in the proposal site given the availability of extensive suitable habitat in the surrounding locality. The species is suitably mobile and able to traverse the proposal footprint to other areas of habitat.
Birds	*Myiagra cyanoleuca*	Satin Flycatcher	-	Mi	DAWE 2021a	In NSW, widespread on and east of the Great Divide, sparsely scattered on the western slopes, very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, often near wetlands and watercourses. On migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Generally not in rainforests. Prefer to nest in a fork of outer	Low	Unlikely	The species may occur in the locality and occasionally visit the proposal site, however is unlikely to reliably occur due to its preference for heavily vegetated gullies in eucalypt-dominated forests. Due to the wider availability of good quality habitat in the locality, and the mobility of

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						branches of trees, such as paperbarks, eucalypts, and banksia. Where they breed at elevations of more than 600 m above sea level in south-eastern Australia, they breed from November to early January (Frith 1969). Mainly insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and subcanopy of trees.			the species, it is unlikely that they will be impacted by the project
Birds	*Neophema pulchella*	Turquoise Parrot	V	-	OEH 2021a (2 records) GHD (in prep)	Occurs from coast to inland slopes. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in hollow-bearing trees, either dead or alive and in hollows in tree-stumps Preferred breeding habitat is the ecotone between farmland and forests. Open grassy forests and woodlands; in gullies and on low slopes of foothills that are moist and seasonally waterlogged are used; occasionally they breed on ridges (Quin 1990; Quin and Baker-Gabb 1993).	High	Likely	This species was recorded in the locality around Wyangala dam during recent surveys, including within the adjacent Holiday Park. As the species feeds on the seeds of native and introduced grasses and herbs, the removal of 0.63 hectares of woodland and 0.27 hectares of introduced grassland will reduce the available foraging habitat for this species in the study area. While no obvious hollows were recorded, suitable breeding habitat may still be present in inconspicuous smaller hollows.
Birds	*Ninox connivens*	Barking Owl	V	-	OEH 2021a (1 record)	Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in *Acacia* and *Casuarina*), or dense eucalypt canopy. Nests in hollows of large, old	Low	Unlikely	The species may occasionally occur within the broader study area and hunt in open grasslands and woodlands. This species is unlikely to be reliant on habitat in the proposal site or be impacted by its loss. There is substantial higher quality habitat available in the locality. No suitable breeding habitat for the species will be impacted by the proposal. No

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						eucalypts, including *Eucalyptus camaldulensis, Eucalyptus albens, Eucalyptus polyanthemos* and *Eucalyptus blakelyi*. Prefer to breed in tree hollows with diameter >20 cm). Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.			obvious hollows were recorded within the proposal site.
Birds	*Numenius madagascariensis*	Eastern Curlew	-	Mi	DAWE 2021a	The Curlew is a migratory bird that travels from Australia to Russia. In Australia it is primarily coastal, residing in estuaries, bays, harbours, inlets and coastal lagoons. Forages on crabs and molluscs on mudflats (Marchant and Higgins, 1993).	Low	Unlikely	No suitable habitat occurs in the proposal site or would be impacted by the project.
Birds	*Petroica boodang*	Scarlet Robin	V	-	OEH 2021a (3 records) GHD (in prep)	In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	Moderate	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. Would not occur in proposal site during winter as it migrates to grassy woodland on river-flats. This species is unlikely to be reliant on habitat in the proposal site, or be impacted by its loss. Removal of 0.63 hectares of disturbed woodland from the proposal site will result in a small reduction in habitat in the locality.
Birds	*Polytelis swainsonii*	Superb Parrot	V	V	OEH 2021a (30 records) GHD (in prep) DAWE 2021a	Occurs as a single population in the South-west Slopes and Riverina bioregions. Inhabits Box Gum, Box – Cypress Pine and Boree woodlands and River Red Gum Forest. Mainly forages in grassy box woodlands, up to 10km from breeding sites. Two core breeding areas: between Cowra and Yass – Grenfell, Cootamundra and Coolac in the SW Slopes, and along the Murray, Edward and Murrumbidgee Rivers in the Riverina. Birds breeding in the SW slopes migrate north to the Namoi/Gwydir Rivers for winter. Nest in hollow trees, in tall	Moderate	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. The removal of 0.63 hectares of woodland will remove potential foraging habitat for the species. The species is known to breed in the surrounding locality (Corowa region) however no breeding habitat will be removed in the proposal site.

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						riparian River Red Gum communities (Riverina area) or open Box Gum woodland or isolated paddock trees (SW Slopes).			
Birds	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V	-	OEH 2021a (5 records) GJD (in prep)	Occurs on western slopes and plains, as well as in the Hunter Valley and several locations on the north coast. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Family groups have territories between 1-50 (generally around 10) hectares. Nests typically built in shrubs or sapling eucalypts.	Moderate	Likely	This species was recorded in the locality around Wyangala dam during recent surveys. The removal of 0.63 hectares of woodland will reduce the availability of foraging and nesting habitat for the species
Birds	*Rhipidura rufifrons*	Rufous Fantail		Mi	DAWE 2021a	The Rufous Fantail is found along NSW coast and ranges. Inhabits rainforest, dense wet forests, swamp woodlands and mangroves. During migration, it may be found in more open habitats or urban areas.	Low	Unlikely	The species may occur in the locality and occasionally visit the proposal site, however is unlikely to reliably occur due to its migration from more open habitats. Due to the wider availability of good quality habitat in the locality, and the mobility of the species, it is unlikely that they will be impacted by the project.
Birds	*Rostratula australis*	Australian Painted Snipe	E	E	DAWE 2021a	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Nil	Nil	No suitable habitat occurs in the proposal site, or would be impacted by the project.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
Birds	*Stagonopleura guttata*	Diamond Firetail	V	-	OEH 2021a (11 records) GHD (in prep)	Typically found west of the Great Dividing Range, but populations also occur in drier coastal areas including W Sydney, Hunter, Clarence and Snowy River valleys. Occurs in grassy eucalypt woodlands, including Box Gum and Snow Gum communities, as well as open forest, mallee and natural and derived grasslands. Often found in riparian areas and occasionally in lightly wooded farmland. Nests in shrubby understorey or higher up under nests of other species.	Moderate	Likely	This species was recorded in the locality around Wyangala dam during recent surveys. The removal of 0.63 hectares of woodland and grasslands may reduce available nesting and foraging habitat for the species.
Mammals	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	DAWE 2021a	Found mainly in areas with extensive cliffs and caves, from Queensland south to the NSW Southern Highlands. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (20-40 females) from November through to January in roof domes in sandstone caves and overhangs. Found in well-timbered areas containing gullies. Feeds on insects in the forest canopy or over water. Breeding occurs in winter or spring. Likely to hibernate through the coolest months.	Low	Unlikely	Not previously recorded in the locality. Given this species preference for well-timbered areas containing gullies and in close proximity to caves, it is unlikely that the species would forage or breed in the proposal site or will likely to be impacted by the proposal.
Mammals	*Dasyurus maculatus*	Spot-tailed Quoll	V	E	DAWE 2021a	It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. Inhabits a range of environments including rainforest, open forest, woodland, coastal health and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up	Low	Unlikely	This species may occur within suitable habitat in the wider locality and visit the proposal site on occasion. The removal of a negligible amount of foraging habitat within modified woodland and introduced grassland is unlikely to reduce the availability of habitat likely to support the species. No suitable den sites recorded during surveys.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						to 3,500 ha, which are usually traversed along densely vegetated creek lines. Inhabits a range of environments including rainforest, open forest, woodland, coastal health and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.			
Mammals	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V	-	OEH 2021a (1 record) GHD (in prep)	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave-roosting bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	Moderate	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. Proposal site would provide a negligible proportion of foraging habitat available in the locality. Likely to roost in caves in the surrounding slopes. No breeding habitat is known to occur in the broader study area.
Mammals	*Myotis macropus*	Southern Myotis	V	-	OEH 2021a (1 record) GHD (in prep)	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).	Moderate	Likely	This species was recorded in the locality around Wyangala dam during recent surveys and could breed and roost at the site. While no obvious hollows were recorded, suitable breeding habitat may still be present in inconspicuous smaller hollows. The project will remove 0.63 hectares of potential roosting habitat. No foraging habitat would be impacted.
Mammals	*Nyctophilus corbeni*	South-eastern	V	V	DAWE 2021a	Overall, the distribution of the south eastern form coincides approximately with central western NSW, with the Murray Darling Basin	Low	Unlikely	No records for this species occur in the locality. This species is typically distributed in central

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
		Long-eared Bat				and the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke, *Allocasuarina leuhmanni* and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland.			western Australia and is unlikely to occur in the proposal site.
Mammals	*Petauroides volans*	Greater Glider	-	V	DAWE 2021a	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level. It prefers taller montane, moist eucalypt forest with relatively old trees and abundant hollows.	Low	Unlikely	Suitable tall, montane eucalypt forest containing abundant hollows does not occur in the proposal site or immediate surrounds. This species is unlikely to occur.
Mammals	*Petaurus norfolcensis*	Squirrel Glider	V		-	Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin *et al.* 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10 ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004).	Moderate	Likely	Suitable habitat for the species occurs in the wider study area. The removal of 0.63 hectares of woodland may reduce available foraging habitat for the species. While no obvious hollows were recorded, suitable breeding habitat may still be present in inconspicuous smaller hollows. The project will remove 0.63 hectares of potential breeding and foraging habitat available for the species.
Mammals	*Petrogale penicillata*	Brush-tailed Rock Wallaby	E	V	DAWE 2021a	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However the distribution of the species across its original range has	Low	Unlikely	No suitable habitat occurs within the proposal site.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.			
Mammals	*Phascolarctos cinereus*	Koala	V	V	DAWE 2021a	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	Low	Unlikely	Vegetation within the proposal footprint is not mapped as important habitat for the species based on the SEPP (Koala Habitat Protection) 2012. Only one feed tree species; Tumbledowm Red Gum occurs in the proposal site. The proposal site would provide potential low quality foraging habitat and represents a very small area for this wide ranging and foraging species.
Mammals	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	OEH 2021a (1 record)	Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops. Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy.	Low	Unlikely	This species may occur within suitable habitat in the wider locality and visit the proposal site on occasion. The removal of a negligible amount of foraging habitat within modified woodland is unlikely to reduce the availability of foraging habitat likely to support the species. No roost camps detected during surveys.
Mammals	*Saccolaimus fliventris*	Yellow-bellied Sheathtail Bat	V		GHD (in prep)	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a	Moderate	Likely	This species was recorded in the locality around Wyangala dam during recent surveys and could breed, roost and forage at the site. While no obvious hollows

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. It forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.			were recorded, suitable breeding habitat may still be present in inconspicuous smaller hollows. The project will remove 0.63 hectares of potential roosting, breeding and foraging habitat available for the species.
Reptiles	*Aprasia parapulchella*	Pink-tailed Legless Lizard	V	V	OEH 2021a (1 record) GHD (in prep)	Populations occur in the Queanbeyan/Canberra district, Cooma, Yass, Bathurst, Albury and West Wyalong areas. Inhabits grassland and open woodland with substantial embedded rock cover in sunny situations. Recorded in both native and non-native grasslands. Usually recorded under small rocks (150 - 600 mm basal area) shallowly embedded in the soil (2 - 5 cm, and use ant burrows under these rocks.	Low	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. Some grassy woodland occurs in the proposal footprint, however given the degraded condition of the proposal footprint and the lack of grassy groundcover it is not suitable for the species and it is unlikely to occur.
Reptiles	*Delma impar*	Striped Legless Lizard	V	V	DAWE 2021a	Occurs in the Southern Tablelands, South-west Slopes and possibly the Riverina. Found in natural or secondary grassland or open areas in grassy eucalypt woodland. May occur in modified grasslands with high exotic grass cover. Shelters in base of grass tussocks, under rocks or logs or in soil cracks (Smith and Robertson 1999).	Nil	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. Some grassy woodland occurs in the proposal footprint, however given the degraded condition of the proposal footprint and the lack of grassy groundcover it is not suitable for the species and it is unlikely to occur.
Fish	*Maccullochella macquariensis*	Trout Cod	E	E	DAWE 2021a	The single naturally occurring population is restricted to a small (approximately 120 km) stretch of the Murray River from below Yarrawonga Weir to Strathmerton, but is occasionally taken downstream as far as the Barmah State Forest and further downstream to Gunbower.	Nil	Nil	No suitable habitat is present in the proposal site or will be affected by the proposed works.
Fish	*Macquaria australasica*	Macquarie Perch	V	E	DAWE 2021a	Occurs in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas. Inhabits river and lake habitats, especially the upper reaches of	Nil	Nil	No suitable habitat is present in the proposal site or will be affected by the proposed works.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						rivers and their tributaries. Requires clear water with deep, rocky holes and abundant cover (including aquatic vegetation, woody debris, large boulders and overhanging banks). Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems.			
Fish	*Maccullochella peelii*	Murray Cod	-	V	DAWE 2021a	Occurs throughout the Murray-Darling Basin. Can live in a wide range of habitats, from clear, rocky streams in the upper western slopes regions of New South Wales to the slow flowing, turbid rivers and billabongs of the western plains. Generally, they are found in waters up to 5 m deep and in sheltered areas with cover from rocks, timber or overhanging banks. The presence of wood debris has been shown to be the primary factor determining Murray cod presence.	Nil	Nil	No suitable habitat is present in the proposal site or will be affected by the proposed works.
Fish	*Bidyanus bidyanus*	Silver Perch	E	-	DAWE 2021a	Silver Perch are a moderate to large freshwater fish native to the Murray-Darling river system. They were once widespread and abundant throughout most of the Murray-Darling river system. They have now declined to low numbers or disappeared from most of their former range. Only one remaining secure and self-sustaining population occurs in NSW in the central Murray River downstream of Yarrawonga weir, as well as several anabranches and tributaries.	Nil	Nil	No suitable habitat is present in the proposal site or will be affected by the proposed works.
Plants	*Ammobium craspedioides*	Yass Daisy	V	V	DAWE 2021a GHD (in prep)	Occurs between Crookwell and Wagga Wagga, with most populations near Yass. Occurs in dry forest, Box-Gum Woodland and secondary grasslands derived from clearing of these communities. Grows in association with a range of eucalypts (Blakely's Red Gum, Apple Box, Broad-leaved Peppermint, Long-leaved Box, Red Stringybark, Brittle Gum, Yellow Box, Red Box, Candlebark).	Moderate	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. Not recorded despite targeted surveys in appropriate season and in suitable habitat in the proposal site.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
Plants	*Thesium australe*	Austral Toadflax	V	V	DAWE 2021a	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland. Found in association with Kangaroo Grass (*Themeda australis)*. Flowers in spring and summer.	Low	Nil	No suitable habitat is present in the proposal site.
Plants	*Amphibromus fluitans*	River Swamp Wallaby-grass	V	V	DAWE 2021a	There are many historic collections in the City of Greater Albury. It has been recorded recently in lagoons beside the Murray River near Cooks Lagoon (Shire of Greater Hume), Mungabarina Reserve, East Albury, at Ettamogah, Thurgoona (Charles Sturt University Campus), near Narranderra, and also further west along the Murray River (near Mathoura) and in Victoria. There is a recent record of this species near Laggan in Upper Lachlan Shire. Habitats in south-western NSW include swamp margins in mud, dam and tank beds in hard clay and in semi-dry mud of lagoons with Potamogeton and Chamaeraphis species.	Low	Nil	No suitable habitat is present in the proposal site.
Plants	*Leucochrysum albicans var. tricolor*	Hoary Sunray	-	E	DAWE 2021a	Occurs mainly in 2 areas: Ku-ring-gai Chase and Garigal National Parks N of Sydney, and far SE NSW, including Ben Boyd National Park, East Boyd State Forest, Nadgee Nature Reserve, Nadgee State Forest, South East Forest and Yambulla State Forest but also occurs between these areas. Occurs in scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities and prefers periodically burnt areas as this increases insect abundance.	Low	Nil	No suitable habitat is present in the proposal site.
Plants	*Prasophyllum petilum*	Tarengo Leek Orchid	E	E	DAWE 2021a	These area at Boorowa, Captains Flat, Ilford, Delegate and a newly recognised population 10 kilometres south east of Muswellbrook. Grows in natural temperate grassland and grassy woodland. Associated species include River Tussock (*Poa labillardierei)*,	Low	Nil	No suitable habitat is present in the proposal site.

Class	Scientific name	Common name	BC Status	EPBC Status	Previous records within locality (and including those threatened species recorded during surveys for the Wyangala Wall dam raising)	Habitat requirements (OEH 2020b)	Likelihood of occurrence in proposal site	Likelihood of impacts as a result of the proposal	Justification
						Black Gum (*Eucalyptus aggregata)* and tea-trees (*Leptospermum)* species. Occurs in relatively moist, poorly drained areas. Flowers in October.			
Plants	*Senecio garlandii*	Woolly Ragwort	V		-	This daisy is found between Temora, Bethungra and Albury and possibly Burrinjuck near Yass. The largest populations are at The Rock and Mt Tabletop (and surrounds). There is a single population in Victoria at Chiltern. Woolly Ragwort occurs on sheltered slopes of rocky outcrops.	Moderate	Unlikely	Not recorded despite targeted surveys in appropriate season and in suitable habitat in the proposal site.
Plants	*Senecio macrocarpus*	Large-fruit Fireweed		V	DAWE 2021a	Known from Gundaroo in NSW. 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	Low	Nil	No suitable habitat is present in the proposal site.
Plants	*Swainsona recta*	Small Purple-pea	E	E	DAWE 2021a GHD (in prep)	Recorded historically from places such as Carcoar, Culcairn and Wagga Wagga where it is probably now extinct. Populations still exist in the Queanbeyan and Wellington-Mudgee areas. Over 80% of the southern population grows on a railway easement. It is also known from the ACT and a single population of four plants near Chiltern in Victoria. Before European settlement occurred in the grassy understorey of woodlands and open-forests dominated by Blakely's Red Gum *Eucalyptus blakelyi*, Yellow Box *E. melliodora*, Candlebark Gum *E. rubida* and Long-leaf Box *E. goniocalyx*. Grows in association with understorey dominants that include Kangaroo Grass *Themeda australis*, poa tussocks (Poa spp.) and spear-grasses (*Austrostipa* spp.)	Moderate	Unlikely	This species was recorded in the locality around Wyangala dam during recent surveys. Not recorded despite targeted surveys in appropriate season and in suitable habitat in the proposal site.

Notes: E= endangered, v= vulnerable, CE= critically endangered, Mi= migratory

Appendix B Field survey results

Flora species recorded in plot/transects within and adjacent to proposal site

Family	Scientific name	Common name	WTP1 Cover	WTP1 Abundance	WTP2 Cover	WTP2 Abundance
Anthericaceae	*Arthropodium minus*	Small Vanilla Lily	0.1	150	0.1	100
Anthericaceae	*Dichopogon strictus*	Chocolate Lily			0.1	2
Apiaceae	*Daucus glochidiatus*	Native Carrot	0.2	100	2	400
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	0.1	1	0.5	4
Asteraceae	*Actinobole uliginosum*	Flannel Cudweed	25	2000		
Asteraceae	*Arctotheca calendula*	Capeweed	2	100	2	60
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	0.2	35	0.1	5
Asteraceae	*Cirsium vulgare*	Spear Thistle	0.1	10		
Asteraceae	*Hypochaeris radicata*	Catsear	0.5	100	5	400
Asteraceae	*Isoetopsis graminifolia*	Grass Cushion	0.5	200		
Asteraceae	*Lactuca serriola*	Prickly Lettuce			0.1	1
Asteraceae	*Senecio bathurstianus*	0	0.1	5		
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed			0.1	1
Asteraceae	*Silybum marianum*	Variegated Thistle			0.1	1
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	0.1	10	0.1	3
Asteraceae	*Stuartina muelleri*	Spoon Cudweed	0.1	100	0.2	100
Asteraceae	*Triptilodiscus pygmaeus*	Common Sunray	5	1000	0.2	100
Boraginaceae	*Anchusa arvensis*	Wild Bugloss			0.1	20
Boraginaceae	*Echium plantagineum*	Patterson's Curse	5	200	0.1	20
Brassicaceae	*Cardamine hirsuta*	Common Bittercress			0.1	20
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	0.1	50		
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed			0.2	30
Caryophyllaceae	*Petrorhagia nanteuilii*	Proliferous Pink	0.1	60	0.1	10
Caryophyllaceae	*Silene gallica*	French Catchfly	0.1	60	0.2	50
Caryophyllaceae	*Stellaria media*	Common Chickweed	0.1	100		
Caryophyllaceae	*Stellaria pungens*	Prickly Starwort	0.1	25		
Colchicaceae	*Wurmbea dioica*	Early Nancy			0.2	30
Convolvulaceae	*Dichondra repens*	Kidney Weed	0.1	5		

Family	Scientific name	Common name	WTP1 Cover	WTP1 Abundance	WTP2 Cover	WTP2 Abundance
Crassulaceae	*Crassula colorata*	Dense Stonecrop	5	1000		
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop	0.1	100	1	500
Cupressaceae	*Callitris endlicheri*	Black Cypress Pine, Woronora Plateau population	25	20	3	10
Cyperaceae	*Carex inversa*	Knob Sedge			0.1	5
Droseraceae	*Drosera peltata*	A Sundew			0.1	30
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla			0.1	1
Fabaceae (Faboideae)	*Melilotus indicus*	Hexham Scent			0.2	100
Fabaceae (Faboideae)	*Trifolium angustifolium*	Narrow-leaved Clover	0.5	500		
Fabaceae (Faboideae)	*Trifolium arvense*	Haresfoot Clover	5	500	5	500
Fabaceae (Faboideae)	*Trifolium campestre*	Hop Clover	0.2	200		
Fabaceae (Faboideae)	*Trifolium subterraneum*	Subterranean Clover			0.2	50
Fabaceae (Mimosoideae)	*Acacia verticillata*	0			15	15
Fumariaceae	*Fumaria capreolata*	Climbing Fumitory	0.2	60		
Fumariaceae	*Fumaria muralis*	Wall Fumitory			0.2	40
Geraniaceae	*Erodium crinitum*	Blue Crowfoot	0.1	25		
Geraniaceae	*Geranium solanderi*	Native Geranium	0.1	50	0.1	20
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort			0.2	100
Hypoxidaceae	*Hypoxis glabella*	Tiny Star			0.1	20
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush	0.1	15		
Malvaceae	*Brachychiton populneus*	Kurrajong			1	20
Myrtaceae	*Eucalyptus dealbata*	Tumbledown Red Gum			3	1
Orchidaceae	*Caladenia carnea*	Pink Fingers	0.1	25	0.1	2
Oxalidaceae	*Oxalis perennans*	0	0.1	50		
Phormiaceae	*Stypandra glauca*	Nodding Blue Lily	0.1	2		
Phytolaccaceae	*Phytolacca octandra*	Inkweed	0.1	1		
Poaceae	*Austrostipa scabra* subsp. *scabra*	Rough Speargrass	0.1	75		
Poaceae	*Avena fatua*	Wild Oats			0.1	20
Poaceae	*Briza maxima*	Quaking Grass			0.1	10
Poaceae	*Briza minor*	Shivery Grass			0.8	500

Family	Scientific name	Common name	WTP1 Cover	WTP1 Abundance	WTP2 Cover	WTP2 Abundance
Poaceae	*Pentaschistis airoides*	False Hairgrass	0.1	20		
Poaceae	*Vulpia bromoides*	Squirrel Tail Fesque			4	400
Poaceae	*Vulpia spp.*	Rat's-tail Fescue	0.1	120		
Pteridaceae	*cheilanthes austrotenuifolia*	Rock Fern			1	200
Pteridaceae	*Cheilanthes distans*	Bristly Cloak Fern	0.1	60	0.1	3
Pteridaceae	*Cheilanthes sieberi*	Rock Fern	1	300		
Ranunculaceae	*Ranunculus sessiliflorus*	Small-flowered Buttercup			0.1	20
Rubiaceae	*Galium aparine*	Goosegrass	0.2	60	0.2	30
Scrophulariaceae	*Linaria pelisseriana*	Pelisser's Toadflax	0.1	50		
Solanaceae	*Solanum cinereum*	Narrawa Burr	0.1	2		
Solanaceae	*Solanum nigrum*	Black-berry Nightshade	0.1	25	0.1	2
Urticaceae	*Parietaria debilis*	Native Pellitory	0.1	20	0.3	100

Fauna species recorded within the broader study area

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Birds	Australasian Darter	*Anhinga novaehollandiae*			Observed
Birds	Australasian Grebe	*Tachybaptus novaehollandiae*			Observed
Birds	Australian Boobook	*Ninox novaeseelandiae*			Observed/Heard
Birds	Australian King-parrot	*Alisterus scapularis*			Observed
Birds	Australian Magpie	*Cracticus tibicen*			Observed/Heard
Birds	Australian Owlet-nightjar	*Aegotheles cristatus*			Observed/Heard/Camera
Birds	Australian Pelican	*Pelecanus conspicillatus*			Observed
Birds	Australian Pipit	*Anthus novaeseelandiae*			Observed
Birds	Australian Raven	*Corvus coronoides*			Observed/Heard/Camera
Birds	Australian Wood Duck	*Chenonetta jubata*			Observed/Heard/Camera
Birds	Baillon's Crake	*Porzana pusilla*			Heard
Birds	Black Swan	*Cygnus atratus*			Observed
Birds	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*			Observed/Heard
Birds	Black-fronted Dotterel	*Elseyornis melanops*			Observed
Birds	Black-winged Stilt	*Himantopus himantopus*			Observed
Birds	Brown Falcon	*Falco berigora*			Observed
Birds	Brown Quail	*Coturnix ypsilophora*			Observed
Birds	Brown Thornbill	*Acanthiza pusilla*			Observed/Heard/Camera
Birds	Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V		Observed/Heard/Camera
Birds	Brown-headed Honeyeater	*Melithreptus brevirostris*			Observed/Heard
Birds	Brush Cuckoo	*Cacomantis variolosus*			Heard
Birds	Buff-rumped Thornbill	*Acanthiza reguloides*			Observed/Heard
Birds	Chestnut-rumped Thornbill	*Acanthiza uropygialis*			Observed
Birds	Cicadabird	*Coracina tenuirostris*			
Birds	Common Bronzewing	*Phaps chalcoptera*			Observed/Heard/Camera

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Birds	Common Starling	*Sturnus vulgaris*			Observed
Birds	Crested Pigeon	*Ocyphaps lophotes*			Observed/Heard
Birds	Crested Shrike-tit	*Falcunculus frontatus*			Observed
Birds	Crimson Rosella	*Platycercus elegans*			Observed/Heard
Birds	Diamond Firetail	*Stagonopleura guttata*	V		Observed/Heard
Birds	Dollarbird	*Eurystomus orientalis*			Observed
Birds	Double-barred Finch	*Taeniopygia bichenovii*			Observed/Heard
Birds	Dusky Moorhen	*Gallinula tenebrosa*			Observed
Birds	Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V		Observed
Birds	Eastern Koel	*Eudynamys orientalis*			Heard
Birds	Eastern Rosella	*Platycercus eximius*			Observed/Heard/Camera
Birds	Eastern Spinebill	*Acanthorhynchus tenuirostris*			Observed/Heard
Birds	Eastern Yellow Robin	*Eopsaltria australis*			Observed/Heard
Birds	Eurasian Blackbird	*Turdus merula*			Heard
Birds	Eurasian Coot	*Fulica atra*			Observed/Heard
Birds	European Goldfinch	*Carduelis carduelis*			Observed
Birds	Fan-tailed Cuckoo	*Cacomantis flabelliformis*			Observed/Heard
Birds	Fuscous Honeyeater	*Ptilotula fuscus*			Observed/Heard
Birds	Galah	*Eolophus roseicapillus*			Observed/Heard
Birds	Gang-gang Cockatoo	*Callocephalon fimbriatum*	V		Observed/Heard
Birds	Glossy Black Cockatoo	*Calyptorhynchus lathami*	V		Observed
Birds	Golden Whistler	*Pachycephala pectoralis*			Observed/Heard
Birds	Great Cormorant	*Phalacrocorax carbo*			Observed
Birds	Grey Butcherbird	*Cracticus torquatus*			Observed/Heard
Birds	Grey Fantail	*Rhipidura albiscapa*			Observed/Heard
Birds	Grey Shrike-thrush	*Colluricincla harmonica*			Observed/Heard/Camera
Birds	Grey Teal	*Anas gracilis*			Observed/Heard

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Birds	Grey-crowned Babbler	*Pomatostomus temporalis*	V		Observed
Birds	Hardhead	*Aythya australis*			Observed
Birds	Hoary-headed Grebe	*Poliocephalus poliocephalus*			Observed
Birds	Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V		Observed/Heard
Birds	Horsfield's Bronze-Cuckoo	*Chalcites basalis*			Observed/Heard
Birds	House Sparrow	*Passer domesticus*			Observed
Birds	Jacky Winter	*Microeca fascinans*			Observed/Heard
Birds	Laughing Kookaburra	*Dacelo novaeguineae*			Observed/Heard/Camera
Birds	Leaden Flycatcher	*Myiagra rubecula*			Heard
Birds	Little Black Cormorant	*Phalacrocorax sulcirostris*			Observed
Birds	Little Corella	*Cacatua sanguinea*			Observed
Birds	Little Eagle	*Hieraaetus morphnoides*	V		Observed
Birds	Little Pied Cormorant	*Microcarbo melanoleucos*			Observed
Birds	Little Raven	*Corvus mellori*			Observed/Heard
Birds	Magpie-lark	*Grallina cyanoleuca*			Observed/Heard
Birds	Masked Lapwing	*Vanellus miles*			Observed/Heard
Birds	Mistletoebird	*Dicaeum hirundinaceum*			Observed
Birds	Nankeen kestrel	*Falco cenchroides*			Observed
Birds	Nankeen Night Heron	*Nycticorax caledonicus*			Observed
Birds	New Holland Honeyeater	*Phylidonyris novaehollandiae*			Observed
Birds	Noisy Friarbird	*Philemon corniculatus*			Observed/Heard
Birds	Noisy Miner	*Manorina melanocephala*			Observed/Heard/Camera
Birds	Olive-backed Oriole	*Oriolus sagittatus*			Observed/Heard
Birds	Pacific Black Duck	*Anas superciliosa*			Observed
Birds	Painted Button-Quail	*Turnix varius*			Heard/Camera
Birds	Pallid Cuckoo	*Cacomantis pallidus*			Observed/Heard
Birds	Peaceful Dove	*Geopelia striata*			Observed/Heard

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Birds	Peregrine Falcon	*Falco peregrinus*			Observed
Birds	Pied Butcherbird	*Cracticus nigrogularis*			Observed/Heard
Birds	Pied Cormorant	*Phalacrocorax varius*			Observed
Birds	Pied Currawong	*Strepera graculina*			Observed/Heard/Camera
Birds	Purple Swamphen	*Porphyrio porphyrio*			Observed/Heard
Birds	Rainbow Bee-eater	*Merops ornatus*			Observed/Heard
Birds	Red Wattlebird	*Anthochaera carunculata*			Observed/Heard/Camera
Birds	Red-browed Finch	*Neochmia temporalis*			Observed/Heard
Birds	Red-capped Robin	*Petroica goodenovii*			Observed/Heard
Birds	Red-rumped parrot	*Psephotus haematonotus*			Observed
Birds	Restless Flycatcher	*Myiagra inquieta*			Observed/Heard
Birds	Rufous Songlark	*Cincloramphus mathewsi*			Observed/Heard
Birds	Rufous Whistler	*Pachycephala rufiventris*			Observed/Heard
Birds	Sacred Kingfisher	*Todiramphus sanctus*			Observed/Heard
Birds	Shining Bronze-cuckoo	*Chalcites lucidus*			Heard
Birds	Silver Gull	*Chroicocephalus novaehollandiae*			Observed/Heard
Birds	Silvereye	*Zosterops lateralis*			Observed/Heard
Birds	Singing Honeyeater	*Gavicalis virescens*			Heard
Birds	Southern Whiteface	*Aphelocephala leucopsis*			Observed
Birds	Speckled Warbler	*Chthonicola sagittata*	V		Observed/Heard
Birds	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*			Observed/Heard
Birds	Spotted Pardalote	*Pardalotus punctatus*			Observed/Heard
Birds	Square-tailed Kite	*Lophoictinia isura*	V		Observed
Birds	Straw-necked Ibis	*Threskiornis spinicollis*			Observed
Birds	Striated Pardalote	*Pardalotus striatus*			Observed/Heard
Birds	Striated Thornbill	*Acanthiza lineata*			Observed/Heard
Birds	Striped Honeyeater	*Plectorhyncha lanceolata*			Observed/Heard

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Birds	Sulphur-crested Cockatoo	*Cacatua galerita*			Observed/Heard
Birds	Superb Fairy-wren	*Malurus cyaneus*			Observed/Heard
Birds	Superb Parrot	*Polytelis swainsonii*	V	V	Observed
Birds	Tawny Frogmouth	*Podargus strigoides*			Observed/Heard
Birds	Tree Martin	*Petrochelidon nigricans*			Observed
Birds	Turquoise Parrot	*Neophema pulchella*	V		Observed/Heard
Birds	Unidentified Falcon	*Falco sp.*			Observed
Birds	Unidentified Goshawk	*Accipiter sp.*			Observed
Birds	Varied Sittella	*Daphoenositta chrysoptera*	V		Observed
Birds	Wedge-tailed Eagle	*Aquila audax*			Observed
Birds	Weebill	*Smicrornis brevirostris*			Observed/Heard
Birds	Welcome Swallow	*Hirundo neoxena*			Observed
Birds	Western Gerygone	*Gerygone fusca*			Observed/Heard
Birds	Whistling Kite	*Haliastur sphenurus*			Observed/Heard
Birds	White-bellied Cuckoo-shrike	*Coracina papuensis*			Observed
Birds	White-bellied Sea-eagle	*Haliaeetus leucogaster*	V	C	Observed
Birds	White-browed Babbler	*Pomatostomus superciliosus*			Observed/Heard/Camera
Birds	White-browed Scrubwren	*Sericornis frontalis*			Observed
Birds	White-browed Treecreeper	*Climacteris affinis*			Observed
Birds	White-eared Honeyeater	*Nesoptilotis leucotis*			Observed/Heard
Birds	White-faced Heron	*Egretta novaehollandiae*			Observed
Birds	White-necked Heron	*Ardea pacifica*			Observed
Birds	White-plumed Honeyeater	*Ptilotula penicillatus*			Observed/Heard
Birds	White-throated Gerygone	*Gerygone olivacea*			Heard
Birds	White-throated Treecreeper	*Cormobates leucophaea*			Observed/Heard/Camera
Birds	White-winged Chough	*Corcorax melanorhamphos*			Observed/Heard/Camera
Birds	White-winged Triller	*Lalage sueurii*			Observed

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Birds	Willie Wagtail	*Rhipidura leucophrys*			Observed/Heard/Camera
Birds	Yellow Thornbill	*Acanthiza nana*			Observed
Birds	Yellow-faced Honeyeater	*Caligavis chrysops*			Observed/Heard
Birds	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*			Observed
Birds	Yellow-tufted Honeyeater	*Lichenostomus melanops*			Observed
Fish	Crayfish spp.	*Euastacus*			Observed
Mammals	Black Rat	*Rattus rattus*			Camera
Mammals	Brown Hare	*Lepus capensis*			Observed
Mammals	Cat	*Felis catus*			Observed/Camera
Mammals	Chocolate Wattled Bat	*Chalinolobus morio*			Anabat
Mammals	Common Brushtail Possum	*Trichosurus vulpecula*			Observed/Camera/Scats
Mammals	Common Ringtail Possum	*Pseudocheirus peregrinus*			Observed/Camera
Mammals	Common Wallaroo	*Macropus robustus*			Observed
Mammals	Common Wombat	*Vombatus ursinus*			Observed/Camera
Mammals	Dingo, domestic dog	*Canis lupus*			Observed
Mammals	Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V		Anabat
Mammals	Eastern Free-tailed Bat	*Mormopterus ridei*			Anabat
Mammals	Eastern Grey Kangaroo	*Macropus giganteus*			Observed/Camera/Scats
Mammals	Fallow Deer	*Dama dama*			Observed/Camera
Mammals	Fox	*Vulpes vulpes*			Observed/Camera
Mammals	Goat	*Capra hircus*			Observed/Camera/Scats
Mammals	Gould's Wattled Bat	*Chalinolobus gouldii*			Anabat
Mammals	Inland Broad-nosed Bat	*Scotorepens balstoni*			Anabat
Mammals	Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V		Anabat
Mammals	Large Forest Bat	*Vespadelus darlingtoni*			Anabat
Mammals	Lesser Long-eared Bat	*Nyctophilus geoffroyi*			Anabat/Trapped
Mammals	Little Forest Bat	*Vespadelus vulturnus*			Anabat/Trapped

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Mammals	Little Mastiff-bat	*Mormopterus planiceps*			Anabat
Mammals	Pig	*Sus scrofa*			Camera
Mammals	Platypus	*Ornithorhynchus anatinus*			Observed
Mammals	Rabbit	*Oryctolagus cuniculus*			Observed/Camera
Mammals	Sheep (feral)	*Ovis aries*			Camera
Mammals	Short-beaked Echidna	*Tachyglossus aculeatus*			Observed/Camera
Mammals	Southern Myotis	*Myotis macropus*	V		Anabat
Mammals	Sugar Glider	*Petaurus breviceps*			Observed
Mammals	Swamp Wallaby	*Wallabia bicolor*			Observed/Camera
Mammals	unidentified Antechinus	*Antechinus sp.*			Camera
Mammals	unidentified macropod	*Macropod sp.*			Camera
Mammals	Unidentified Microbat	*(Microchiroptera suborder) (Microchiroptera suborder)*			Observed
Mammals	White-striped Freetail-bat	*Austronomus australis*			Heard/Anabat
Mammals	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V		Anabat
Reptiles	Bearded Dragon	*Pogona barbata*			Observed
Reptiles	Copper-tailed Skink	*Ctenotus taeniolatus*			Observed
Reptiles	Cunningham's Skink	*Egernia cunninghami*			Observed
Reptiles	Dark-flecked Garden Sunskink	*Lampropholis delicata*			Observed
Reptiles	Eastern Blue-tongue	*Tiliqua scincoides*			Camera
Reptiles	Eastern Brown Snake	*Pseudonaja textilis*			Observed
Reptiles	Eastern Snake-necked Turtle	*Chelodina longicollis*			Observed
Reptiles	Eastern Water Dragon	*Intellagama lesueurii*			Observed
Reptiles	Eastern Water-skink	*Eulamprus quoyii*			Observed
Reptiles	Jacky Lizard	*Amphibolurus muricatus*			Observed
Reptiles	Lace Monitor	*Varanus varius*			Observed/Camera
Reptiles	Marbled Gecko	*Christinus marmoratus*			Observed

Class	Common name	Scientific name	BC Status	EPBC Status	Observation Type (GHD in prep)
Reptiles	Nobbi Dragon	*Diporiphora nobbi*			Observed/Camera
Reptiles	Patternless Delma	*Delma inornata*			Tiles
Reptiles	Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Observed/Tiles
Reptiles	Ragged Snake-eyed Skink	*Cryptoblepharus pannosus*			Observed
Reptiles	Red-throated Skink	*Acritoscincus platynota*			Observed
Reptiles	Shingle-back	*Tiliqua rugosa*			Observed
Reptiles	South-eastern Slider	*Lerista bougainvillii*			Observed/Tiles
Reptiles	Southern Rainbow-skink	*Carlia tetradactyla*			Observed
Reptiles	Thick-tailed Gecko	*Underwoodisaurus milii*			Observed/Tiles
Reptiles	Tree Skink	*Egernia striolata*			Observed/Camera/Trapped
Reptiles	Unidentified grass skink	*Lampropholis sp.*			Observed
Reptiles	Wood Gecko	*Diplodactylus vittatus*			Observed
Reptiles	Yellow-faced Whip Snake	*Demansia psammophis*			Skin
Frogs	Broad-palmed Frog	*Litoria latopalmata*			Heard
Frogs	Common Eastern Froglet	*Crinia signifera*			Heard
Frogs	Eastern Banjo Frog	*Limnodynastes dumerilii*			Heard/Songmeter
Frogs	Eastern Sign-bearing Froglet	*Crinia parinsignifera*			Heard/Songmeter
Frogs	Lesueur's Frog	*Litoria lesueuri*			Observed
Frogs	Peron's Tree Frog	*Litoria peronii*			Observed/Heard
Frogs	Spotted Grass Frog	*Limnodynastes tasmaniensis*			Observed/Heard
Frogs	Stony-creek Frog	*Litoria wilcoxii*			Observed
Insects	Bark-mimicking Grasshopper	*Coryphistes ruricola*			Observed

Appendix C BC Act Assessments of Significance

Overview

Section 7.3 of the BC Act and section 1.7 of the EP&A Act list five factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species', populations or ecological communities (or their habitats) listed under the BC Act. The '5-part test' is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a Biodiversity Development Assessment Report (BDAR) must be prepared.

The desktop assessment, field surveys and habitat assessments described in this supplementary biodiversity assessment have been used to identify the suite of threatened biota that may be affected by the proposal, through either direct or indirect impacts.

Five-part tests have been prepared for threatened biota which were recorded or have a high or moderate likelihood of occurrence and could potentially be impacted by the proposal. Where feasible, threatened fauna have been grouped based on similar habitat requirements.

The following threatened biota have been assessed:

- Hollow-dependent mammals that may forage in the proposal site and den/roost in nearby habitat - Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat
- Hollow-dependent woodland birds that are likely to forage in the proposal site and may breed/nest in nearby habitat - Turquoise Parrot and Brown Treecreeper
- Woodland birds that are likely to forage in the proposal site and may breed/nest in the study area - Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin

Given the limited scale and magnitude of impacts arising from the proposal and impact mitigation and environmental management measures described in Section 7.2, no threatened biota outside of the proposal site are likely to be affected by off-site impacts of the proposal.

Hollow-dependant woodland birds: Turquoise Parrot, Brown Treecreeper

The Turquoise Parrot and Brown Treecreeper are vulnerable species listed under the BC Act and have been recorded nearby. Based on suitable habitat availability, these species may occur in the proposal site.

The proposal would result in the following impacts on potential habitat for the Turquoise Parrot and Brown Treecreeper:

- Removal of around 0.63 hectares of potential foraging habitat in native woodland for the Brown Treecreeper
- The removal of 0.90 hectares of degraded woodland and non-native vegetation providing potential foraging habitat for the Turquoise Parrot
- The potential removal of small tree-hollows not detected during surveys but that may occur within the proposal site and potentially providing breeding habitat for these species.

There are relatively extensive areas of potential habitat for local populations of these threatened fauna in the broader local area surrounding the proposal site. Much of this habitat is connected to the proposal site and associated with Wyangala State Park.

Assessments of significance of impacts on the Turquoise Parrot and Brown Treecreeper have been prepared and are included below. Where appropriate individual parts of the five-part test have been considered jointly for these threatened species. The outcome of these assessments of significance is that the proposal is not likely to have a significant impact on local populations of these threatened hollow-dependant woodland birds.

Brown Treecreeper (*Climacteris picumnus victoriae*)	Turquoise Parrot (*Neophema pulchella*)
The Brown Treecreeper is endemic to eastern Australia, and occurs in eucalypt forests and woodlands, particularly within Box-Gum woodlands and River Red Gum woodlands of the inland plains and slopes of the Great Dividing Range, where it forages on tree trunks and limbs predominantly, but also on the ground amongst leaf litter, tussocks and fallen timber. The species utilises hollows for breeding, and typically occurs in hollows with a diameter greater than 5 centimetres. There are 19 records for this species in the locality (OEH 2021a). While it was not observed within the proposal site during site surveys, it has been regularly recorded along the edge of Wyangala Dam, and the Lachlan and Abercrombie Rivers as part of recent surveys (GHD in prep).	The Turquoise Parrot forages on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. The species 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. Turquoise Parrots nests in tree hollows, logs or posts (OEH, 2021). There are 2 records for this species in the locality (OEH 2021a). While it was not observed within the proposal site during site surveys, it has been regularly recorded along the edge of Wyangala Dam, and the Lachlan and Abercrombie Rivers as part of recent surveys, including to the north of the proposal site and within the adjacent Holiday Park (GHD in prep).

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

The factors that could potentially disrupt the life cycle of the Turquoise Parrot and Brown Treecreeper include loss of foraging habitat and loss of breeding habitat.

The Brown Treecreeper and Turquoise Parrot were not recorded in the proposal site but are known to occur in similar habitats around Wyangala Dam and may occur in the proposal site on occasion.

The proposal will remove about 0.63 hectares of native woodland habitat that would provide foraging habitat for the Brown Treecreeper. This would include the removal of trees and fallen timber which is an important habitat feature for this species.

The proposal will remove 0.90 hectares of foraging habitat for the Turquoise Parrot within native woodland and non-native vegetation. Foraging resources in woodland and non-native vegetation in the proposal site include Common Raspwort (*Gonocarpus tetragynus*), Quaking Grass (*Briza maxima)*, Small Shivery Grass (*Briza minor*), Capeweed (*Arctotheca calendula*) and Common Chickweed (*Stellaria media*).

The proposal may potentially also remove small hollows within the proposal site that were not inconspicuous and not detected during surveys for the WTP. These small hollows (if present) may provide potential breeding habitat for these species. It is assumed that a breeding population of both species is present in the broader study area given they were regularly recorded during recent surveys around Wyangala Dam (GHD in prep).

Noise and vibration during construction have the potential to disturb individuals, if nesting in areas adjacent to the proposal site and may result in individuals foraging elsewhere. However, these noise and vibration impacts would be temporary and occur during construction only. Given the minor extent of the works required, it is possible that individuals would become habituated to the construction noise. Large areas of suitable foraging and nesting habitat are present in surrounding areas.

The proposal would include fauna management protocols including careful felling of potential habitat trees and salvage and treatment of any resident fauna. This would partially mitigate impacts

on the local populations of these species if any nesting individuals or their young are in the proposal site during construction. Vegetation management measures recommended for the proposal would avoid direct and minimise indirect impacts on habitat adjoining the proposal site. The likely magnitude of edge effects or other indirect effects would not be sufficient to tangibly affect the life cycle of these threatened species. The proposal is therefore unlikely to adversely affect the lifecycle of the Turquoise Parrot and Brown Treecreeper such that a viable local population would be placed at risk of extinction.	
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) 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**	
N/A to an endangered community	
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
N/A to an endangered community	
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**	
Up to 0.63 hectares of native woodland within Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland will be removed from the proposal site. This would primarily contain foraging resources for the Brown Treecreeper, including trees and fallen timber. No obvious tree-hollows were observed in the proposal site but smaller hollows may occur and have gone undetected. The removal of 0.63 of native woodland from the proposal site would comprise a very small portion of foraging and breeding habitat available for this species in the broader study area The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during construction.	Up to 0.63 hectares of native woodland within Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and 0.27 hectares of non-native vegetation will be removed from the proposal site. This would primarily contain foraging resources in the understorey for the Turquoise Parrot. No obvious tree-hollows were observed in the proposal site but smaller hollows may have gone undetected. The removal of 0.90 ha of native woodland from the proposal site would comprise a very small portion of foraging and breeding habitat available for this species in the broader study area The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during construction.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	
While the proposal site is modified and fragmented by an existing access road, infrastructure and a clearing in the north, it is surrounded by native vegetation which provides connectivity to the surrounding landscape. The proposal would involve the removal of native vegetation along a narrow strip on either side of the existing road and the removal of non-native vegetation around existing infrastructure. The small degree of clearing will not fragment or isolate potential habitat for these mobile species to a greater extent than the current condition of the site.	
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	

The proposal will remove about 0.63 hectares of native woodland habitat that would provide potential foraging habitat for the Brown Treecreeper.

The proposal will remove 0.90 hectares of potential foraging habitat for the Turquoise Parrot within native woodland and non-native vegetation. The vegetation to be removed is unlikely to provide important nesting habitat for either species as no hollow were identified and the vegetation comprises narrows strips of vegetation along the edges of cleared and disturbed areas.

There is no evidence such as field survey observations or an abundance of specific important habitat resources that suggests that the habitat within the proposal site is of particular value to local populations of these species. Habitat for the Turquoise Parrot and Brown Treecreeper outside of the proposal site is in better condition and features higher quantities of habitat resources such as mature hollow-bearing trees, woody debris and native understorey plants. The small area of habitat within the proposal site is unlikely to be important to the long-term survival of these species in the context of the extent of potential habitat in the surrounding study area and locality.

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

The proposal would not affect any habitat of outstanding biodiversity value.

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal would contribute to the operation of the following KTPs of relevance to the Turquoise Parrot and Brown Treecreeper;

Clearing of native vegetation -

The proposal would directly contribute to the operation of this KTP through the removal of around 0.63 hectares of native vegetation comprising Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland that may provide potential habitat for these species as described above.

Removal of hollow-bearing trees –

The proposal may possibly contribute to the operation of this KTP through the removal of small inconspicuous hollows not detected during surveys that may provide suitable nesting habitat for the Turquoise Parrot and Brown Treecreeper

As described in part c) the proposal would remove or modify a very small proportion of the habitat resources that support potentially occurring local populations of these threatened species through the operation of these KTPs.

Conclusion:
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on a local population of the Turquoise Parrot and Brown Treecreeper as:

- The removal of a small area (0.90 hectares) of foraging habitat for the Turquoise Parrot in roadside woodland and non-native vegetation
- The removal of a small area (0.63 hectares) of foraging habitat for the Brown Treecreeper in roadside woodland
- Impacts to the proposal site are small in extent, are not unlike impacts that have previously been experienced at the site due to its current use as an existing WTP, and as such, are unlikely to deter the species from utilising the site if they presently occur
- The vegetation to be removed is unlikely to comprise important breeding habitat being located along disturbed edges and given the apparent lack of tree-hollows
- The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these species through the study area or locality or to isolate patches of habitat

- There are areas of higher habitat quality within the study area that is connected with suitable habitat in the locality, and the habitat to be removed in the proposal site is unlikely to be important for the persistence of a viable local population of these species

Other threatened woodland birds: Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin

The Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow and Hooded Robin are vulnerable species listed under the BC Act and have been recorded nearby. Based on suitable habitat availability, these species may occur in the proposal site.

The proposal would result in the following impacts on potential habitat for these threatened woodland birds:

- Removal of around 0.63 hectares of potential foraging habitat in native woodlands and 0.27 hectares in non-native vegetation comprising a herbaceous exotic understorey around existing infrastructure
- Removal of potential likely low-value nesting habitat for these species in disturbed edge habitat.

There are relatively extensive areas of potential habitat for local populations of these threatened fauna in the broader local area surrounding the proposal site. Much of this habitat is connected to the proposal site and associated with Wyangala State Park.

Assessments of significance of impacts on the Speckled Warbler, Grey-crowned Babbler, Varied Sittella, Diamond Firetail, Dusky Woodswallow, Hooded Robin have been prepared and are included below. Where appropriate individual parts of the five-part test have been considered jointly for these six threatened species. The outcome of these assessments of significance is that the proposal is not likely to have a significant impact on local populations of these threatened woodland birds.

Speckled Warbler (*Chthonicola sagittata*)	**Grey-crowned Babbler (eastern sub-species) *(Pomatostomus temporalis temporalis)***	**Varied Sittella (*Daphoenositta chrysoptera*)**	**Diamond Firetail *(Stagonopleura guttata)***	**Dusky Woodswallow *(Artamus cyanopterus cyanopterus)***	**Hooded Robin *(south-eastern form) (Melanodryas cucullata)***
The Speckled Warbler is a small woodland bird occurring in the eastern half of NSW and into Victoria. It is typically found in large remnant patches of eucalypt dominated woodland with a grassy understory, often on rocky ridges or gullies. Large remnant woodland habitat is required for the species to persist in an area, and habitat typically includes scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. This species nests on the ground or in the base of low dense plants, often in dense leaf litter, which is an important habitat component for the species	The Grey-crowned Babbler is a medium size woodland bird that inhabits Box-gum, Box-cypress and open Box woodlands in NSW. They feed on invertebrates foraged from leaf litter and the trunks and branches of woodland trees. They build nests in shrubs and sapling trees, and occasionally in the low branches of mature eucalypts. This species finds flight laborious, preferring to hop along the ground and are often unable to cross large, open areas There are 5 records for this species in the locality (OEH, 2021a), and the species has been regularly recorded during recent surveys around Wyangala Dam (GHD in prep). As the proposal site contains both potential	The Varied Sittella is a sedentary species inhabiting most of mainland Australia. They feed on arthropods foraged from tree bark, dead branches, standing dead trees and some small branches and twigs in the canopy. This species builds a cup-shape nest in the high forks of the living canopy of trees and are thought to use the same fork for successive years. There are no records for this species in the locality (OEH, 2021a), but the species has been regularly recorded during recent surveys around Wyangala Dam (GHD in prep). As the proposal site contains both potential foraging and nesting habitat for the species it is assumed that the	The Diamond Firetail commonly occurs in grassy eucalypt woodlands such as Box-Gum and Snow Gum woodlands, as well as secondary grasslands derived from these communities. Often found in riparian areas, along rivers and creeks, and sometimes in lightly wooded farmland. They feed exclusively on the ground on seeds and insects and roost in dense shrubs. Nests are built in the shrubby understory and sometimes higher. There are 11 records for this species in the locality (OEH, 2021a), and the species has been sporadically recorded during recent surveys around Wyangala Dam (GHD in prep). As the proposal site contains both potential	Widespread in eastern, southern and western Australia, the Dusky Woodswallow primarily inhabits dry, open eucalypt forests, with an open/sparse understory of sapling trees and shrubs, with an understory of grassland and woody debris. They primarily eat invertebrates captured while hovering above the canopy, or from hovering over leaf-litter. Nesting sites generally occur in shrubs or low trees, living or dead, in tree forks and hollow stumps and logs, or behind loose bark. There are 5 records for this species in the locality (OEH, 2021a), and the species has been regularly recorded during recent surveys around Wyangala Dam (GHD in prep).	The Hooded Robin is widespread across Australia and occurs in lightly wooded country, usually open eucalypt woodland, often in or near clearings and open areas. They require structurally diverse habitat featuring mature eucalypts, some shrubs, saplings and a groundlayer of grasses. This species perches on dead stumps, fallen timber and low hanging branched to perch-and-pounce for insects. Nesting occurs in tree forks and crevices from 1 to 5 metres above the ground. There are 6 records for this species in the locality (OEH, 2021a), and the species has been regularly recorded during recent surveys

Speckled Warbler (*Chthonicola sagittata*)	**Grey-crowned Babbler (eastern sub-species) *(Pomatostomus temporalis temporalis)***	**Varied Sittella (*Daphoenositta chrysoptera*)**	**Diamond Firetail *(Stagonopleura guttata)***	**Dusky Woodswallow *(Artamus cyanopterus cyanopterus)***	**Hooded Robin *(south-eastern form) (Melanodryas cucullata)***
There are 5 records for this species in the locality (OEH, 2021a), and the species has been regularly recorded during recent surveys around Wyangala Dam (GHD in prep). As the proposal site contains both potential foraging and nesting habitat for the species it is assumed that the species could potentially occur.	foraging and nesting habitat for the species it is assumed that the species could potentially occur.	species could potentially occur.	foraging and nesting habitat for the species it is assumed that the species could potentially occur.	As the proposal site contains both potential foraging and nesting habitat for the species it is assumed that the species could potentially occur.	around Wyangala Dam (GHD in prep). As the proposal site contains both potential foraging and nesting habitat for the species it is assumed that the species could potentially occur.

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

The factors that could potentially disrupt the life cycle of threatened woodland birds are loss of likely foraging habitat and loss of potential breeding habitat.

The Speckled Warbler, Grey-crowned Babbler, Diamond Firetail, Dusky Woodswallow, Varied Sittella and Hooded Robin were not recorded in the proposal site but are known to occur in similar habitats around Wyangala Dam and could occur in the proposal site given the presence of suitable habitat.

The proposal will remove up to 0.63 hectares of native woodland habitat and an additional 0.27 hectares of non-native vegetation. The woodland habitat may providing foraging habitat and potential breeding habitat for the Speckled Warbler, Grey-crowned Babbler, Diamond Firetail, Dusky Woodswallow and Hooded Robin. The proposal would remove 0.63 hectares of foraging habitat in woodland for the Varied Sittella (noting it is unlikely to forage in non-native vegetation at the proposal site). Foraging resources for these species includes trees, leaf litter and woody debris. It is assumed that a breeding population of threatened

Speckled Warbler (*Chthonicola sagittata*)	Grey-crowned Babbler (eastern sub-species) *(Pomatostomus temporalis temporalis)*	Varied Sittella (*Daphoenositta chrysoptera*)	Diamond Firetail *(Stagonopleura guttata)*	Dusky Woodswallow *(Artamus cyanopterus cyanopterus)*	Hooded Robin *(south-eastern form) (Melanodryas cucullata)*
woodland birds listed above is present in the broader study area given they were all recorded on multiple occasions during recent surveys around Wyangala Dam (GHD in prep). Breeding habitat for these species would include shrubs, sapling trees, and branches of mature eucalypts where nests can be constructed. Noise and vibration during construction have the potential to disturb individuals if nesting in areas adjacent to the proposal site and may result in individuals foraging elsewhere. However, these noise and vibration impacts would be temporary and occur during construction only. Given the minor extent of the works required, it is possible that individuals would become habituated to the construction noise. Large areas of suitable foraging and nesting habitat are present in surrounding areas. The proposal would include fauna management protocols including careful felling of habitat trees and salvage and treatment of any resident fauna. This would partially mitigate impacts on the local populations of these species if any nesting individuals or their young are in the proposal site during construction. Vegetation management measures recommended for the proposal would avoid direct and minimise indirect impacts on habitat adjoining the proposal site. The likely magnitude of edge effects or other indirect effects would not be sufficient to tangibly affect the life cycle of these threatened species. The proposal is therefore unlikely to adversely affect the lifecycle of the Speckled Warbler, Grey-crowned Babbler, Diamond Firetail, Dusky Woodswallow, Varied Sittella and Hooded Robin such that a viable local population would be placed at risk of extinction.					
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) 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**					
N/A to an endangered community					
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,					
N/A to an endangered community					
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**					

Speckled Warbler (*Chthonicola sagittata*)	**Grey-crowned Babbler (eastern sub-species) *(Pomatostomus temporalis temporalis)***	**Varied Sittella (*Daphoenositta chrysoptera*)**	**Diamond Firetail *(Stagonopleura guttata)***	**Dusky Woodswallow *(Artamus cyanopterus cyanopterus)***	**Hooded Robin *(south-eastern form) (Melanodryas cucullata)***
The proposal will remove up to 0.63 hectares of Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and an additional 0.27 hectares of exotic grassland providing foraging habitat and potential breeding habitat for the Speckled Warbler, Grey-crowned Babbler, Diamond Firetail, Dusky Woodswallow and Hooded Robin. The proposal would remove 0.63 hectares of foraging habitat in woodland for the Varied Sittella (noting it is unlikely to forage in grassland). The proposal would remove grasses, leaf litter, decorticating bark, mature trees, saplings and shrubs that provide foraging resources for these species along the edge of degraded woodland. Potential breeding habitat in the proposal site would include shrubs or low trees, living or dead, in tree forks and hollow stumps and logs, however is unlikely to occur along a disturbed edge. The removal of 0.63 of native woodland from the proposal site would comprise a very small portion of foraging and breeding habitat available for these species in the broader study area The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during construction such as the temporary modification of habitat due to noise impacts.					
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and					
While the proposal site is surrounded by native vegetation, the site is highly modified and disturbed with an access road occurring north to south through the site and an existing clearing in the north. The proposal would involve the removal of native vegetation along a narrow strip on either side of the existing road and also non-native vegetation around existing infrastructure. The small extent of clearing will not result in any substantial further fragmentation or isolation of potential habitat for these mobile species.					
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,					
The proposal would result in the removal of Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and exotic vegetation providing foraging resources for threatened woodland birds. The vegetation to be removed is unlikely to provide nesting habitat for threatened woodland birds in the proposal site as they occur on the edges of cleared and disturbed areas.					

Speckled Warbler (*Chthonicola sagittata*)	**Grey-crowned Babbler (eastern sub-species) *(Pomatostomus temporalis temporalis)***	**Varied Sittella (*Daphoenositta chrysoptera*)**	**Diamond Firetail *(Stagonopleura guttata)***	**Dusky Woodswallow *(Artamus cyanopterus cyanopterus)***	**Hooded Robin *(south-eastern form) (Melanodryas cucullata)***

There is no evidence such as field survey observations or an abundance of specific important habitat resources that suggests that the habitat within the proposal site is of particular value to local populations of these species. Habitat for the these species outside of the proposal site is in better condition and features higher quantities of habitat resources such as mature trees, extensive grassland patches and/or an abundance of woody debris. The small area of likely foraging and potential nesting habitat within the proposal site is unlikely to be important to the long-term survival of these species in the context of the extent of potential habitat in the surrounding study area and locality.

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

The proposal would not affect any habitat of outstanding biodiversity value.

e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal would contribute to the operation of the following KTPs of relevance to threatened woodland birds;

Clearing of native vegetation -

The proposal would directly contribute to the operation of this KTP through the removal of around 0.63 hectares of native vegetation comprising Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland that may provide potential habitat for these species as described above.

Given the limited extent and duration of construction in areas of potential habitat and proposed mitigation the proposal is unlikely to increase in the operation of this KTP to the extent that it would cause habitat for these species to decline.

Conclusion:
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on a local population of the Speckled Warbler, Grey-crowned Babbler, Diamond Firetail, Dusky Woodswallow and Hooded Robin as:

- The removal of a small area of foraging habitat (0.90 hectares) in roadside woodland and non-native vegetation
- The removal of a small area of foraging habitat (0.63 hectares) for the Varied Sittella in roadside woodland

Speckled Warbler (*Chthonicola sagittata*)	**Grey-crowned Babbler (eastern sub-species) *(Pomatostomus temporalis temporalis)***	**Varied Sittella (*Daphoenositta chrysoptera*)**	**Diamond Firetail *(Stagonopleura guttata)***	**Dusky Woodswallow *(Artamus cyanopterus cyanopterus)***	**Hooded Robin *(south-eastern form) (Melanodryas cucullata)***
• No known breeding habitat would be removed by the proposal and the vegetation to be removed along the roadside edge is unlikely to comprise important breeding habitat • Impacts to the proposal site are small in extent, are not unlike impacts that have previously been experienced at the site due to its current use as an existing WTP, and as such, are unlikely to deter the species from utilising the site if they presently occur • The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these species through the study area or locality or to isolate patches of habitat • There are areas of higher habitat quality within the study area that is connected with suitable habitat in the locality, and the habitat to be removed in the proposal site is unlikely to be important for the persistence of a viable local population of these species.					

Hollow-dependant mammals: Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat

Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat are vulnerable species listed under the BC Act. Based on suitable habitat availability and nearby records, these species may occur in the proposal site.

The proposal would result in the following impacts on potential habitat for these hollow-dependant mammals:

- Removal of around 0.63 hectares of potential foraging in native woodlands for Squirrel Glider
- Removal of around 0.63 hectares of potential foraging and roosting habitat in native woodlands and an additional 0.27 hectares of foraging habitat in non-native vegetation comprising exotic herbaceous groundcover for Yellow-bellied Sheathail Bat
- Removal of around 0.63 hectares of potential roosting habitat in native woodlands for Southern Myotis

There are relatively extensive areas of potential habitat for local populations of these threatened fauna in the broader local area surrounding the proposal site. Much of this habitat is connected to the proposal site and associated with Wyangala State Park.

Assessments of significance of impacts on the Squirrel Glider, Southern Myotis and Yellow-bellied Sheathtail Bat have been prepared and are included below. Where appropriate individual parts of the five-part test have been considered jointly for these three threatened species. The outcome of these assessments of significance is that the proposal is not likely to have a significant impact on local populations of these hollow-dependant mammals.

Squirrel Glider (*Petaurus norfolcensis*)	**Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)***	**Southern Myotis (*Myotis macropus*)**
The Squirrel Glider is a small arboreal marsupial that occupies mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest in areas west of the Great Dividing Range. The species prefers mixed species stands with a shrub or Acacia midstorey that provides nectar and blossom and requires abundant tree hollows for refuge and denning habitat. The Squirrel Glider has an average gliding width of 20 to 40 metres, and a maximum gliding width of about 70 to 80 metres (van der Ree et al 2003). Squirrel Gliders are rarely known to travel across the ground (Jackson 1999; van der Ree and Bennett 2003) and treeless gaps of more than 75 metres between woodland fragments therefore pose a physical limit to the ability of individuals to traverse gaps by gliding (van der Ree *et al.* 2003). There are no records of the species in the locality (OEH 2021a) and was not recorded during recent surveys around Wyangala Dam (GHD in prep). However the proposal site contains potential foraging habitat within Tumbledown Red Gum and occasional Acacia spp. and adjacent areas contain hollow-bearing trees which may provide potential denning	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. They forage in most habitats with and without trees. Breeding habitat includes tree-hollows and buildings. Its seasonal movements are unknown, but there is speculation about a migration to southern Australia in late summer and autumn. While it was not recorded within the proposal site during site surveys, it has been recorded along the edge of Wyangala Dam as part of recent surveys (GHD in prep). The species may forage in the proposal site and roost in small tree hollows if present.	The Southern Myotis is generally found around a coastal band from the north-west of Australia to the top-end and south to western Victoria of Australia and is rarely found more than 100 kilometres inland except along major rivers. Generally roosts in caves, buildings, under bridges, in hollow-bearing trees and in dense foliage in close vicinity to water and forages for insects and small fish over streams and pools. No foraging habitat occurs in the proposal site, however foraging habitat is available in the broader study area and locality (Wyangala Dam and watercourses). The Southern Myotis may roost in the proposal site if small hollows are present. While it was not observed within the proposal site during site surveys, it has been regularly recorded along the edge of Wyangala Dam, Lachlan and Abercrombie Rivers as part of recent surveys (GHD in prep).

Squirrel Glider (*Petaurus norfolcensis*)	Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)*	Southern Myotis (*Myotis macropus*)
habitat, it is assumed that the species may occur in the proposal site and use habitat in the study area.		

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

The factors that could potentially disrupt the life cycle of hollow-dependant mammals are loss of potential foraging habitat and loss of potential hollow-bearing trees with suitably sized hollows.

The proposal would remove up to 0.63 hectares of native woodland habitat providing potential poor condition foraging habitat for the Squirrel Glider, with the occasional tree and shrubs providing nectar and pollen during periods of flowering. The Squirrel Glider requires hollows five centimetres or greater in diameter for denning. Hollows were not recorded in the proposal site, but inconspicuous hollows of this size may still be present and would be removed as part of the proposal.

The proposal would also remove a small area of potential foraging habitat (0.63 hectares) in native woodlands and non-native vegetation with a herbaceous understorey (0.27 hectares) for the Yellow-bellied Sheathail Bat. The proposal would not remove foraging habitat for the Southern Myotis.

The Yellow-bellied Sheathail Bat and Southern Myotis may potentially roost in small tree hollows if present, within the proposal site. The Southern Myotis may also roost under culverts and bridges in the locality. Hollow-bearing trees are more abundant in the less disturbed stands of vegetation in the surrounding area. It is assumed that a breeding population of both species is present in the broader study area given they were regularly recorded during recent surveys around Wyangala Dam (GHD in prep).

Noise and vibration during construction have the potential to disturb individuals, if denning/roosting in areas adjacent to the proposal site, particularly in the north of the site where adjacent hollow-bearing trees were recorded. However, these noise and vibration impacts would be temporary and occur during construction only. It is likely that individuals would become habituated to the construction noise. Large areas of suitable denning/roosting habitat are present in surrounding areas.

The proposal would include fauna management protocols including careful felling of potential habitat trees and salvage and treatment of any resident fauna. This would partially mitigate impacts on the local populations of these species if any nesting individuals or their young are in the proposal site during construction.

Squirrel Glider (*Petaurus norfolcensis*)	Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)*	Southern Myotis (*Myotis macropus*)
Vegetation management measures recommended for the proposal would avoid direct and minimise indirect impacts on habitat adjoining the proposal site. The likely magnitude of edge effects or other indirect effects would not be sufficient to tangibly affect the life cycle of these threatened species. The proposal is therefore unlikely to adversely affect the lifecycle of the Squirrel Glider, Yellow-bellied Sheathtail Bat and Southern Myotis such that a viable local population would be placed at risk of extinction.		
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: **(i) 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**		
N/A to an endangered community		
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,		
N/A to an endangered community		
c) In relation to the habitat of a threatened species or ecological community: **(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**		
Up to 0.63 hectares of native woodland within Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and 0.27 hectares of exotic grassland will be removed from the proposal site. This would primarily contain foraging resources for the Squirrel Glider within mixed species stands in the midstorey as well as mature eucalypts. Potential nesting habitat may also be	Up to 0.63 hectares of native woodland within Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and 0.27 hectares of non-native vegetation will be removed from the proposal site. This would primarily contain foraging resources for the Yellow-bellied Sheathail Bat where it would forage over the forest canopy or lower in more open country for insects. Potential roosting habitat may also be removed within small	Up to 0.63 hectares of native woodland within Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and 0.27 hectares of exotic grassland will be removed from the proposal site. Potential roosting habitat may also be removed within small inconspicuous hollows not recorded during field surveys. The proposal would not remove any foraging habitat for the species.

Squirrel Glider (*Petaurus norfolcensis*)	Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)*	Southern Myotis (*Myotis macropus*)
removed within small inconspicuous hollows not recorded during field surveys. The removal of 0.63 of native woodland from the proposal site would comprise a negligible portion of foraging and breeding habitat available for this species in the broader study area The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during construction.	inconspicuous hollows not recorded during field surveys. The removal of native woodland and non-native vegetation from the proposal site would comprise a small portion of foraging and roosting habitat available for this species in the broader study area The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during construction.	The removal of 0.63 of native woodland from the proposal site would comprise a negligible portion of roosting habitat available for this species in the broader study area The proposed impact mitigation and environmental management measures are likely to mitigate against erosion, sedimentation or any other indirect effects on adjacent habitat during construction.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and		
While the proposal site is modified and fragmented by an existing access road, infrastructure and a clearing in the north, it is surrounded by native vegetation which provides connectivity to the surrounding landscape. The proposal would involve the removal of native vegetation along a narrow strip on either side of the existing road and the removal of non-native vegetation around existing infrastructure. The small degree of clearing will not fragment or isolate potential habitat for these mobile species to a greater extent than the current condition of the site. The two bat species are highly mobile species capable of traversing cleared areas and may utilise the clearings as flyways and foraging habitat. The small amount of clearing is unlikely to impede the movements of the Squirrel Glider, as connectivity will be maintained beyond the site. Connectivity is likely to be maintained with adjoining potential habitat and there would not be isolation of any stands of habitat.		
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,		
The proposal would result in the removal of Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland and Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland exotic vegetation providing potential foraging resources for hollow-dependant mammals. No suitable hollows or nesting resources were identified on the proposal site.		

Squirrel Glider (*Petaurus norfolcensis*)	**Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)***	**Southern Myotis (*Myotis macropus*)**
No important habitat resources were recorded on the proposal site. It is unlikely that the habitat within the proposal site is of high value for local populations of these species. Habitat for hollow-dependant mammals outside of the proposal site is in better condition and features higher quantities of habitat resources such as mature trees, hollow-bearing trees and native understorey plants. The small area of foraging habitat within the proposal site is unlikely to be important to the long-term survival of these species in the context of the extent of potential habitat in the surrounding study area and locality.		
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),		
The proposal would not affect any habitat of outstanding biodiversity value.		
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.		
The proposal would contribute to the operation of the following KTPs of relevance to hollow-dependant mammals; *Clearing of native vegetation -* The proposal would directly contribute to the operation of this KTP through the removal of around 0.63 hectares of native vegetation comprising Tumbledown Red Gum – Black Cypress Pine – Red Stringybark shrubby low woodland that may provide potential habitat for these species as described above. *Removal of hollow-bearing trees –* The proposal may possibly contribute to the operation of this KTP through the removal of small inconspicuous hollows that may provide suitable denning or roosting habitat for the Squirrel Glider, Yellow-bellied Sheathtail Bat and Southern Myotis although no trees with obvious hollows were detected during the surveys As described in part c) the proposal would remove or modify a very small proportion of the habitat resources that support potentially occurring local populations of these threatened species through the operation of these KTPs.		
Conclusion: Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on a local population of the Squirrel Glider, Yellow-bellied Sheathtail Bat and Southern Myotis as:		

Squirrel Glider (*Petaurus norfolcensis*)	Yellow-bellied Sheathtail Bat *(Saccolaimus flaviventris)*	Southern Myotis (*Myotis macropus*)
• The Squirrel Glider has not been previously recorded on the proposal site or in the locality and the proposal will remove only a small area of low quality foraging habitat that does not appear to contain hollows suitable for breeding • Removal of a small amount (0.63 hectares) of potential foraging and roosting/breeding habitat in native woodland and an additional 0.27 hectares of foraging habitat in non-native vegetation for Yellow-bellied Sheathail Bat, if small hollows are present • Removal of a small amount (0.63 hectares) of potential roosting habitat in native woodlands for Southern Myotis, if small hollows are present • The proposal is unlikely to further increase existing habitat fragmentation so as to pose a barrier to movement of these species through the study area or locality or to isolate patches of habitat • There are areas of higher habitat quality within the study area that is connected with suitable habitat in the locality, and the habitat to be removed in the proposal site is unlikely to be important for the persistence of a viable local population of these species.		

GHD Quality Statement Signoff

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Document Status

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C	B James K Crosby	B James		S Fox		02/09/21

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Appendix C – Due Diligence Archeological Assessment

Wyangala Water Treatment Plant

Due Diligence Archaeological Assessment

August 2021

Navin Officer

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Document revision status

Author	Revision number	Internal review	Date issued
Joel Mason	v1	Nicola Hayes	9/10/2020
Nicola Hayes	v2	Nicola Hayes	4/08/2021
Joel Mason	v3	Nicola Hayes	13/08/2021

EXECUTIVE SUMMARY

Water Infrastructure NSW are proposing to construct a new WTP to replace the existing Wyangala WTP. The new WTP will treat water from the Wyangala reservoir to produce potable water to service the Wyangala village and Wyangala Waters Holiday Park (Figure 2.1). The proposal includes the following key features:

- new WTP building located north of the existing WTP adjacent to the existing raw water tanks
- new clear water tank adjacent to existing raw water tanks
- new sludge handling area adjacent to existing sludge drying beds, including wash water tank and sludge thickener
- new pipeline between existing raw water pipeline at existing WTP and new WTP
- new pipeline between new WTP and sludge handling area
- adjustment to pipework within existing WTP to ensure connections to raw water pipeline and supply to Wyangala village
- upgrade of existing road from existing WTP to new WTP
- upgrade of existing power supply including widening of associated easement.

Construction of the proposal is proposed to commence after receipt of development consent and would take approximately 12 months to complete. Navin Officer Heritage Consultants were consulted in performing a due diligence for this initial phase of the process. The following report explains the results of the archaeological field survey that was conducted on the 10th August 2020.

No new sites were recorded during the investigation. The current design for the proposed road realignment, upgrades and utilities avoids the recorded Aboriginal sites. It is recommended that:

1. Should archaeological material be found during impacts in the project area, the unanticipated discovery protocol (Appendix 2) be enacted.

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1 INTRODUCTION

1.1 Project Framework

This assessment is undertaken to satisfy the NSW Office of Environment and Heritage *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*. This Code of Practice helps individuals and organisations to exercise due diligence when conducting activities that may harm Aboriginal objects and to identify whether they need to apply for an Aboriginal Heritage Impact Permit (AHIP) (NSW DECCW 2010: 2).

This code sets out the steps to take in order to:

1 identify whether or not Aboriginal objects are, or likely to be, present in an area;

2 determine whether or not their activities are likely to harm Aboriginal objects (if present); and

3 determine whether an AHIP application is required.

The steps are (Figure 1.1):

Step 1: Determine if the activity will disturb the ground surface

Step 2a: Search the AHIMS database and use any other sources of information of which you are already aware

Step 2b: Determine if the activity is in area where landscape features indicate the presence of Aboriginal objects

Step 3: Can you avoid harm to the object or disturbance of the landscape feature?

Step 4: Desktop assessment and visual inspection

Step 5: Further investigation and impact assessment

This report documents the results of a Due Diligence archaeological assessment for the WTP at Wyangala Village. The report was commissioned by SGJV (GHD Pty Ltd) on behalf of Water Infrastructure NSW.

1.2 Contributors

Heritage Specialists Joel Mason and Jasmine Fenyvesi undertook the field survey for this assessment. Joel Mason and Nicola Hayes compiled this report.

1.3 This Report

1.3.1 Outline

This report:

- Describes the proposed development/works etc (Section 2);
- Describes the methodology employed in the study (Section 3);
- Describes the environmental setting of the study area (Section 4);
- Describes the results of the data review, field survey and Aboriginal consultation program conducted in the context of the assessment (Section 5); and
- Provides management recommendations based on the results of the investigation (Section 6).

1.3.2 Restricted Information

Information in this report relating to the exact location of Aboriginal sites should not be published or promoted in the public domain. No information provided by Aboriginal stakeholders in this report has been specifically identified as requiring access restrictions due to its cultural sensitivity.

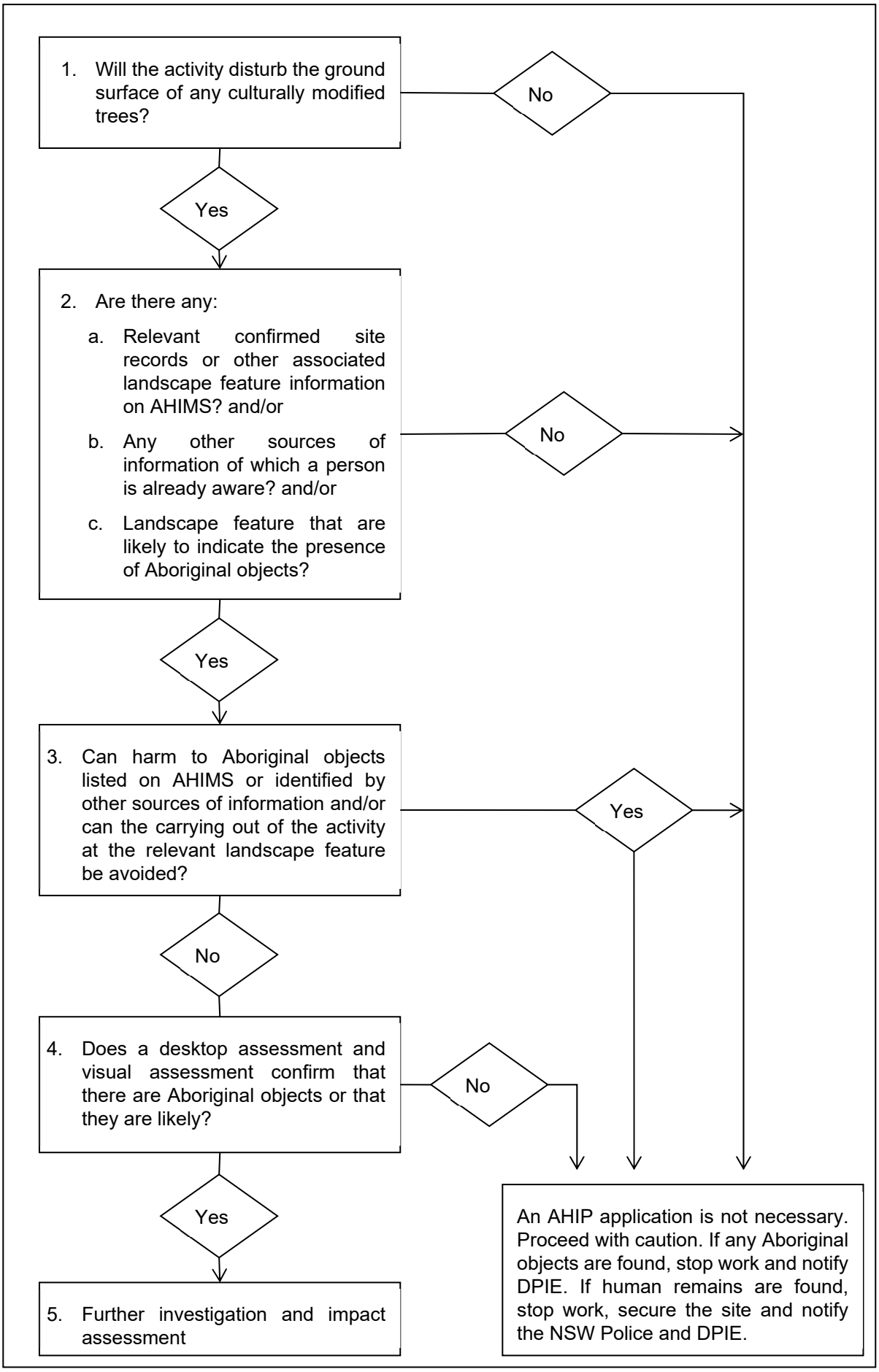

Figure 1.1 Generic due diligence process (from DECCW 2010)

2 PROPOSAL DESCRIPTION

Water Infrastructure NSW are proposing to construct a new WTP to replace the existing Wyangala WTP. The new WTP will treat water from the Wyangala reservoir to produce potable water to service the Wyangala village and Wyangala Waters Holiday Park (Figure 2.1). The proposal includes the following key features:

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- new pipeline between new WTP and sludge handling area
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- upgrade of existing road from existing WTP to new WTP
- upgrade of existing power supply including widening of associated easement.

This report presents the results of the archaeological field survey conducted by NOHC in accordance to the due diligence process. The proposal and study area are defined in Figure 2.2.

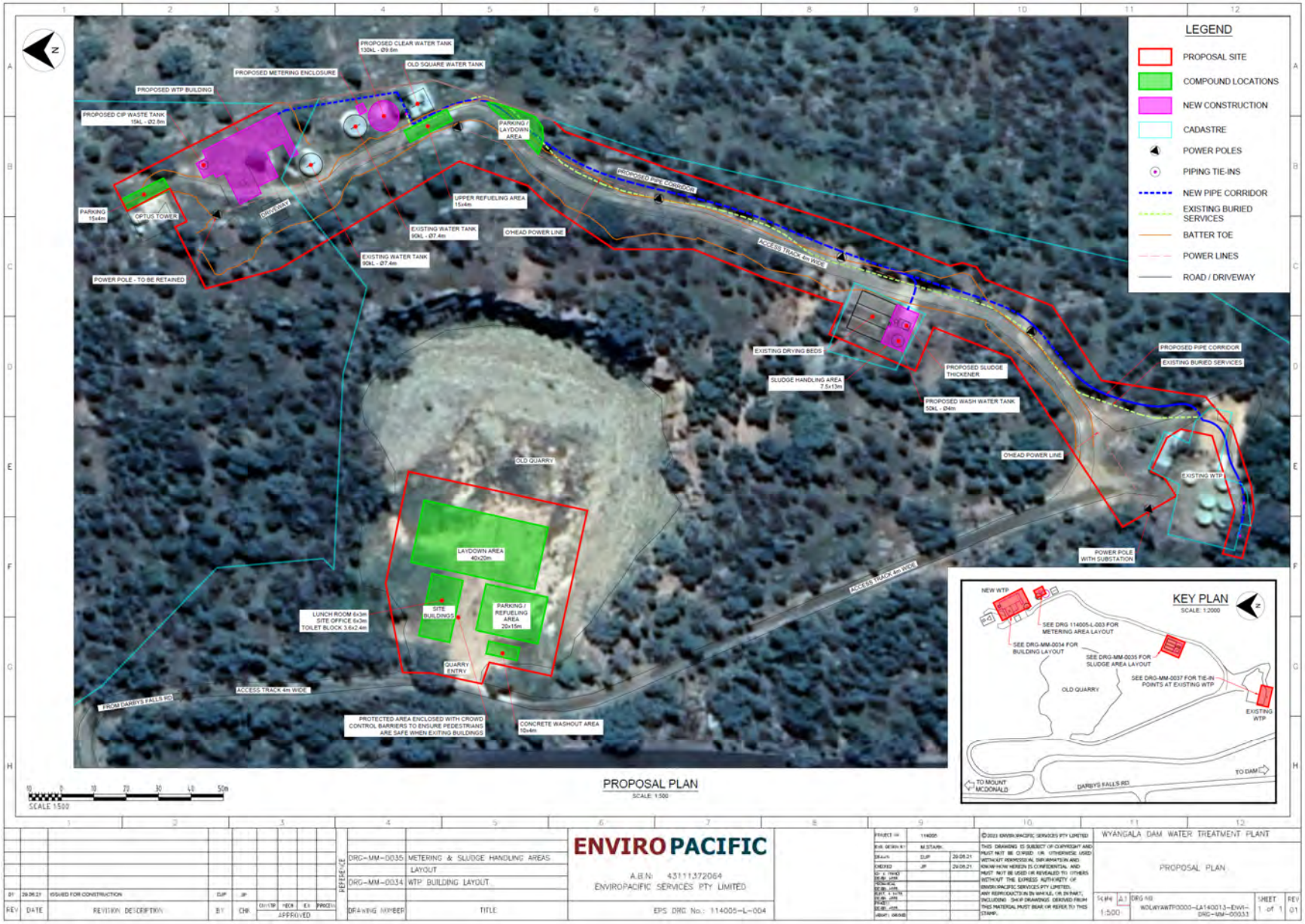

Figure 2.1 Water treatment plant development envelope and indicative layout

Figure 2.2 Study Area of Wyangala Village Water Treatment Plant

3 AHIMS SEARCH AND LITERATURE REVIEW

3.1 Methodology

A range of archaeological and historical data was reviewed for the study area and its surrounds. This literature and data review was used to determine if known Aboriginal and historical sites were located within the area under investigation, to facilitate site prediction on the basis of known regional and local site patterns, and to place the area within an archaeological and heritage management context. The review of documentary sources included heritage registers and schedules, local histories, and archaeological reports. Searches were undertaken of the following statutory and non-statutory heritage registers and schedules:

- Aboriginal Heritage Information Management System (AHIMS) (NSW DPIE);
- Atlas of Aboriginal Places (NSW DPIE);
- World Heritage List;
- The National Heritage List (Australian Heritage Council);
- The Commonwealth Heritage List (Australian Heritage Council);
- The State Heritage Register (NSW Heritage Branch, Office of Environment and Heritage);
- Section 170 Heritage and Conservation Register(s); and
- Heritage Schedule(s) from Local Environmental Plan.

3.2 AHIMS Search Results

No Aboriginal recordings are listed on the DPIE AHIMS for the area around the survey area.

Searches of the AHIMS database undertaken by EMM (2020) identified 329 previously Aboriginal sites in an approximate 3,300 km^2 area centred on the dam (Figure 3.1; Appendix 1). The sites are situated across the search area, with the majority located on the northern fringe of the Wyangala Dam itself, and lesser aggregations at Copperhannia Nature Reserve and surrounds, and near Reids Flat. Generally, sites appear to be found close to water (acknowledging that many on the banks of the dam may have been some distance from water historically) and/or on crest and ridgeline features. The previous sites are dominated by stone artefactual sites (n=262/79%) followed by culturally modified trees (n=37/11%), with lesser occurrences of rarer site types such as rock shelters, burials, hearths, grinding grooves, stone arrangement and quarries. A single restricted site was documented it has been verified with Heritage NSW that it remains outside the study area. Searches of the Commonwealth Heritage List (CHL), National Heritage List (NHL), and Local Environment Plan (LEP) databases of Cowra and Hilltops, identified no Aboriginal objects, sites or places in the vicinity of the study area.

Subsequently, NOHC have undertaken an Aboriginal cultural Heritage Assessment for the Wyangala Dam Wall Raising (WDWR) project. There are one hundred and seventy-nine (179) Aboriginal sites within the WDWR project area. These are made up of Aboriginal Heritage Information Management System (AHIMS) sites located within the current inundation area (76), AHIMS sites within the current project impact areas (24) and sites recorded during the current assessment (79). A total of 689 stone artefacts were recovered from the test excavation of 56 test pits across the 5 test excavation areas in the project area.

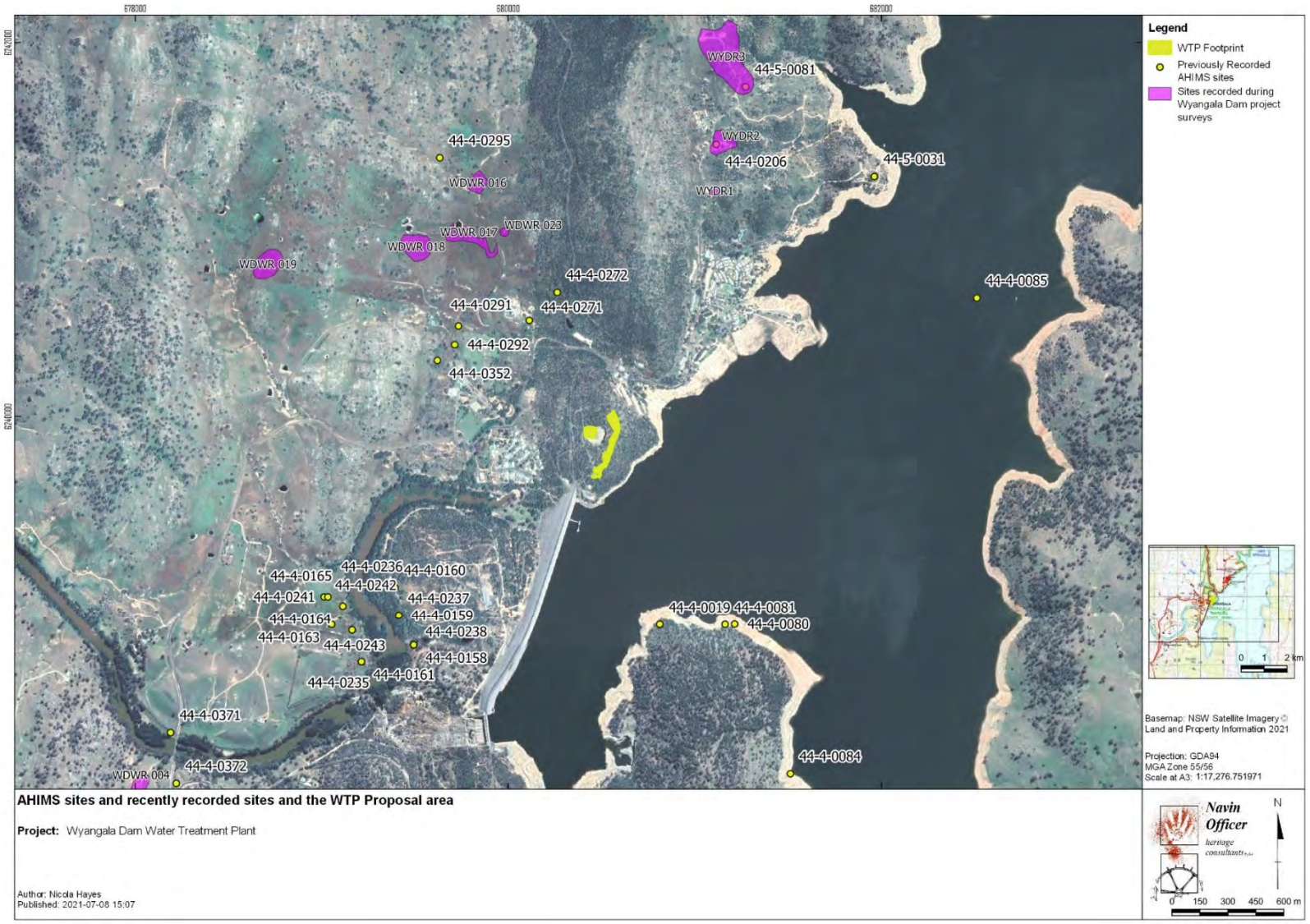

Figure 3.1 AHIMS sites surrounding the proposed Wyangala Dam Water Treatment Plant

3.3 Previous Aboriginal Archaeological Research

Previous studies of the region are relatively sparse, and primarily constrained to cultural resource management studies as part of various residential or infrastructure related activity around Wyangala dam or Cowra itself. Jim Kelton (University of Canberra) in the mid-1990s, undertook both excavations and survey of areas around the Lachlan River and Wyangala. These included the excavations of the Bigga Aboriginal rock art site on the Lachlan River east of the study area, and the identification of numerous other similar sites in the vicinity; and documentation of numerous stone artefacts along the edges of the dam itself (English and Gay 1995; Kelton 1991). Along with work in the 1970s by Johnson (1977) at Abercrombie Caves Tourist Reserve – where a rockshelter containing over 10,000 artefacts was excavated. Kelton's work highlights the importance of granite tors and outcroppings for containing past occupation activities in this area. A detailed survey was undertaken of the dam edge, and many of the AHIMS sites discussed above are the result of these works. Specifically, English and Gay (1995) identified a large number of stone artefact sites, generally of low density and often in poor condition as a result of inundation.

Following the assessment of the WDWR project area NOHC conclude that there are two main landscape characteristics that can be used to determine the archaeological sensitivity of the Wyangala Dam area, slope and distance to water. High-gradient terrain would be difficult to transverse and camp on whereas any areas of gradual sloping to flat ground would be likely to be used by humans in the past. Secondly, sites are more likely to be found closer to water and based on previous studies in the region it has been shown that after 250 m, the potential likelihood of finding sites dramatically decreases (DECC 2007).

The field survey and subsurface test excavation program has both confirmed and refined the predictive model developed for the project. All of the test excavation areas confirmed that subsurface archaeological deposits exist in all areas tested. The test excavation concentrated on areas of predicted high and moderate archaeological sensitivity in proximity to major rivers and creeks. Three landform types were tested: mid-slope, basal slope and river bench. Mid-slopes display the highest artefact density (n=30.3), basal slopes have a slightly smaller density (n=25.8), distantly followed by river bench (n=13.4). Proximity to water appears is also a factor in artefact density with higher densities present 50–100 m from a 3rd order watercourse, and smaller densities 100–200 m from a watercourse.

The field survey also confirmed the regional site location model in that more sites were found closer to water (Figure 4-2). Also, interestingly, of the 13 sites that were greater than 250 m from water, eight of them are located at the confluence of the Abercrombie and Lachlan Rivers and a further two are located at a creek confluence. These sites are also particularly large in size with most containing estimated 200–1000 artefacts. This indicated that confluences, particularly those of major river systems are also an important landscape characteristic.

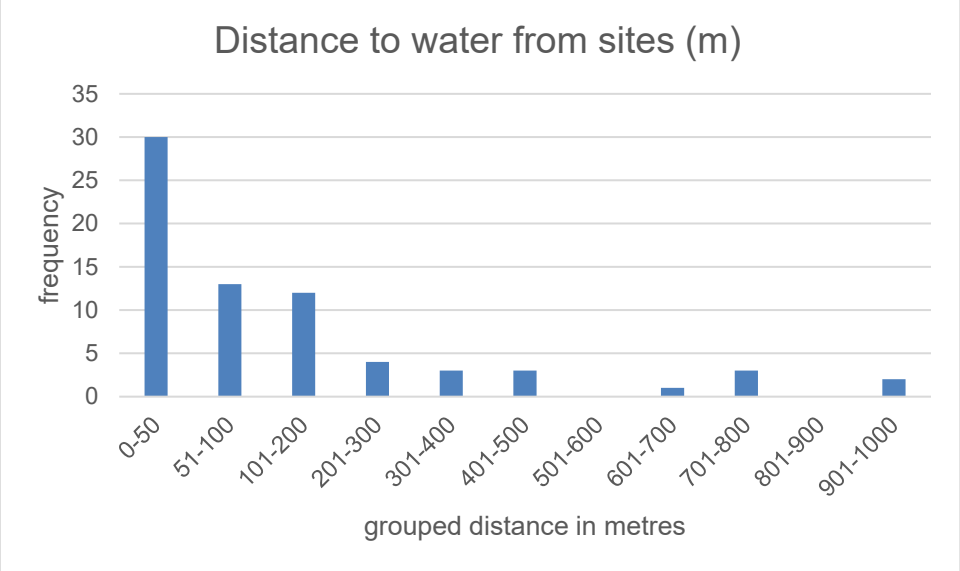

Figure 4-2 Distance to water of sites found during the current assessment

4 LANDSCAPE CONTEXT

The proposal area is located within the NSW South West Slopes Bioregion (NSS) within the Upper Slopes Granites subregion and is characterised by foothills and isolated pockets of steeper ranges. The study area falls predominantly within a terrain of narrow ridges, steep slopes and gullies transitioning to undulating plains further south along the Lachlan River. This environment encompasses the Wyangala landscape and related Pine Mountain and soil landscapes in the west and south (King 1998). The Wyangala and Pine Mountain soil landscapes occur in association as landscapes that have formed on granite or similar geology from the Silurian period. The landform present within the study area is a steep hill with granite outcrops, a common feature surrounding the study area and Wyangala Dam in general. Slope lengths range from 430-380 m with gradients between 10-25% though some can reach up to 40% within the Pine Mountain soil landscape. The dominant soils are siliceous and/or loamy sands.

Hydrologically, the study area sits above the Lachlan River catchment. This is a substantial (8th order) inland river that formed the focus of early European investigations and was likely extensively used by Aboriginal people in the past. The Dam is situated on its confluence with the Abercrombie River, another significant river system of the region. The establishment of Wyangala Dam between 1928 and 1935 and modified in the 1960s dammed the Lachlan and inundated an area of some 54 km^2. Apart from the dam activities, remaining development in the region has been fairly limited, and constrained to farming, pastoralism and/or low density residential and recreational facilities associated with the Holiday Park.

The existing environment heavily influences the potential types of cultural material that may be present and survive in the study area. The geological formations include incised valleys and rock outcrops that are not conducive for sheltering (Figures 4.1 and 4.2). The shallow soil profiles and numerous slopes (prone to natural and anthropogenic erosion) make the potential for substantive buried cultural stone artefact deposits less likely. The construction of Wyangala Dam has inundated most of the low relief landscape once adjacent to the Lachlan River, which would likely have been a key focus of Aboriginal occupation in and adjacent to the study area. As such, evidence of past occupation may be more likely to occur on elevated areas (perhaps ridgelines), and flat to low gradient well drained landforms adjacent to low relief drainage lines.

Figure 4.1 Broad view of ridge crest landforms on top of eastern portion of study area facing west.

Figure 4.2 Example of steep slopes coming down from the hill with granite boulders and granite outcrops.

5 VISUAL ASSESSMENT

5.1 Results Summary

No new sites were located during the field survey.

5.2 Field Methodology

Archaeological field survey was conducted on the 11th August 2020 by archaeologists Joel Mason and Jasmine Fenyvesi. The overall survey area is represented in Figure 2.1.

5.3 Survey Coverage and Visibility Variables

The effectiveness of archaeological field survey is to a large degree related to the obtrusiveness of the sites being looked for and the incidence and quality of ground surface visibility. Visibility variables were estimated for all areas of comprehensive survey within the study area. These estimates provide a measure with which to gauge the effectiveness of the survey and level of sampling conducted. They can also be used to gauge the number and type of sites that may not have been detected by the survey.

Ground surface visibility is a measure of the bare ground visible to the archaeologist during the survey. There are two main variables used to assess ground surface visibility, the frequency of exposure encountered by the surveyor and the quality of visibility within those exposures. The predominant factors affecting the quality of ground surface visibility within an exposure are the extent of vegetation and ground litter, the depth and origin of exposure, the extent of recent sedimentary deposition, and the level of visual interference from surface gravels. Two variables of ground surface visibility were estimated during the survey:

- A percentage estimate of the total area of ground inspected which contained useable exposures of bare ground; and

- A percentage estimate of the average levels of ground surface visibility within those exposures. This is a net estimate and accounts for all impacting visual and physical variables including the archaeological potential of the sediment or rock exposed.

6 CONCLUSION AND RECOMMENDATIONS

Field survey of the proposal area was conducted on the 12th August 2020. The survey did not locate any new sites or potential archaeological deposits within the survey area.

6.1 Impact assessment

The current design for the proposed Water Treatment Plant avoids all recorded Aboriginal sites.

6.2 Recommendations

1. Should archaeological material be found during impacts in the proposal area, the unanticipated discovery protocol (Appendix 2) be enacted

7 REFERENCES

Australia ICOMOS 2013a The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance, 2013.

Australia ICOMOS 2013b Burra Charter Practice Note – Understanding and assessing cultural significance.

EMM 2020 Aboriginal and Historic Heritage Constraints Assessment Report: WYANGALA DAM WALL RAISING. Report for WaterNSW

English, A and Gay, L 1995 *Archaeological survey and assessment of Aboriginal sites, Wyangala Catchment, NSW*. Report prepared for the Project Steering Committee.

Johnson, I 1977 Abercrombie Arch Shelter, An Excavation Near Bathurst NSW, *Australian Archaeology* 6, pp. 28-40.

Kelton, J 1991 *A Heritage Study of the Bigga Aboriginal Rock Art Site near Cowra in the Southern-Central Tablelands of NSW*. Report prepared for the National Estate and University of Canberra.

King, D.P. 1998 Soil landscapes of the Forbes 1:250 000 sheet. Department of Land & Water Conservation: Sydney.

NSW DECCW 2010 Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.

Office of Environment and Heritage (OEH) 2011. Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW. OEH, Sydney South.

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APPENDIX 1

AHIMS SEARCH RESULT

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-6-0095	HEBRON IF #4	Open site	Valid	Art (Pigment or Engraved) : -	Rockshelter (with art)		
51-2-0001	Bigga	Closed site	Valid	Art (Pigment or Engraved) : -	Rockshelter (with art)	15,004,431,101,027	
44-4-0007	Glenella Site 1 Glenella Homestead	Open site	Valid	Artefact : -	Undefined artefactual site	806	
44-4-0014	Riverslea 1;	Open site	Valid	Artefact : -	Undefined artefactual site	1675	
44-4-0015	Riverslea 2;	Open site	Valid	Artefact : -	Undefined artefactual site	1675	
44-4-0018	Oaky Point (1)	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0019	Wyangala Dam;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0073	MBR 1;Marhams Bay Ridge 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0074	MC 1;Markhams Creek 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0075	MC 2;Markhams Creek 2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0076	MC 3;Markhams Creek 3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0077	MC 6;Markhams Creek 6;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0078	MC 5;Markhams Creek 5;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0079	MC 4;Markhams Creek 4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0080	Sandy Point (iii);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0081	Sandy Point (ii);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0082	Alston Bay (iii);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0083	Alston Bay (ii);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0084	Alston Bay (i);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0085	Blunderstone (1);B1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0088	AB4;Alston Bay 4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0095	DR-OS- 8;Down River Open Scatter Site (8);	Open site	Valid	Artefact : -	Undefined artefactual site		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-4-0097	OC-ER-1;Oaky Creek East Ridge open Scatter 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0098	OC-ER-2;Oaky Creek East Ridge open Scatter 2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0099	MC-ii;Markhams Creek ii;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0100	CR-OS 2;Crooked Oak (2);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0104	MC-OS 7;Markhams Creek (7)	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0108	Oaky Creek/ Bay west Ridge Open Scatter;OC/BWR-OS 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0110	Oaky Creek/ Bay west Ridge Open Scatter;OC/BWR-OS 3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0111	Oaky Creek/ Bay west Ridge Open Scatter;OC/BWR-OS 2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0112	MC8;Markhams Creek 8;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0113	MC9;Markhams Creek 9;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0114	MC10;Markhams Creek 10;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0115	CO-OS 1;Crooked Oak (1);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0128	OC/IB-OS 1 Oaky Ck/ Ivan's Block open scatter	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0152	Wyangala Waters- Markhams Creek;MC-WS-OS-13;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0153	Wyangala Waters- Markhams Creek;MC-WS-OS-12;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0155	Oaky Creek Bay-West- Wyangala Dam;OCB-W-OS 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0158	WW 1;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0159	WW 2;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0160	WW 3;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0161	WW 4;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0162	WW 5;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0163	WW 6;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-4-0164	WW 7;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0165	WW 8;Wyangala Weir;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0166	S-OS-1;Springwood Open Scatter Site (1);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0169	GA 3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0170	GA 2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0171	GA 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0193	HC-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0196	OCB-E-OS(3);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0197	OCB-E-OS (2);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0202	OP-OS-3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0203	OP-OS-4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0204	S-OS-2.	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0205	Oaky Point Open Scatter (6);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0206	Flannery's Camp;O/S (1);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0207	Wyangala Dam O/S (6);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0210	HC-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0215	Springwood OS-2;S-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0218	2 Markhams Creek	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0219	3 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0220	5 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0221	6 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0222	8 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-4-0223	9 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0224	10 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0225	11 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0226	12 Markhams Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0227	13 Oaky Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0228	14 Oaky Creek	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0229	16 Oaky Creek	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0230	18 Oaky Creek	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0231	19 Oaky Creek	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0232	21 Round Hill	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-4-0235	WW 4;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0236	WW 3;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0237	WW 2;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0238	WW 1;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0241	WW 8;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0242	WW 7;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0243	WW 6;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0244	WW 5;?;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0246	B-OS-1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0258	G-IF-1	Open site	Valid	Artefact : -	Isolated Aboriginal object		
44-4-0259	G-IF-2	Open site	Valid	Artefact : -	Isolated Aboriginal object		
44-4-0260	G-IF-3	Open site	Valid	Artefact : -	Isolated Aboriginal object		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-4-0271	S-0S-01	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0273	Marhams Bay Ridge 1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0291	05-05-03	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0292	S-IF-1	Open site	Valid	Artefact : -	Isolated Aboriginal object	98024	
44-4-0293	ES-S-1	Closed site	Valid	Artefact : -	Undefined artefactual site		
44-4-0294	EL-OS-1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-4-0295	S-OS-2 (Shalom)	Open site	Valid	Artefact : -	Undefined artefactual site	98024	
44-5-0001	Abercrombie Caves	Closed site	Valid	Artefact : -	Rockshelter (with deposit)	4,651,298	
44-5-0004	Abercrombie Caves	Open site	Valid	Artefact : -	Undefined artefactual site	4,601,298	
44-5-0011	Grabine 1;	Closed site	Valid	Artefact : -	Rockshelter (with deposit)		
44-5-0012	Pye 005	Open site	Valid	Artefact : -	Undefined artefactual site	2512	
44-5-0013	Gerties 8;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0014	Dr-OS (1);Down River -1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0015	DR-OS (4);Down River;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0016	DR-OS (5);Down River;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0017	DR-OS (6);Down River;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0018	DR-OS (7);Down River;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0019	SC-1;Spicers Creek;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0020	SC-2;Spicers Creek;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0021	DR-OS (2);Down River;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0022	DR-OS (3);Down River;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0023	Gerties 1;	Open site	Valid	Artefact : -	Undefined artefactual site		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-5-0024	Gerties 7;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0025	Gerties 6;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0026	Gerties 5;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0027	GOS 2;Gerties Open Scatter 2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0028	GOS 3;Gerties Open Scatter 3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0029	GOS 4;Gerties Open Scatter 4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0030	GOS 1;Gerties Open Scatter 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0031	SH 1;Steel Head 1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0032	G-OS 10;Gerties Open Scatter (10);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0033	Dr-OS 8;Down River Open Scatter Site (8);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0034	G-OS 9;Gerties Open Scatter (9);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0035	DR-OS 10;Down River open Scatter (10);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0036	DR-OS 9 a+b;Down River open Scatter (9)a+b;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0037	G-OS 11;Gerties open Scatter site (11);	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0041	South GErties o/s;SG-OS-3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0042	South GErties o/s;SG-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0043	South Gerties o/s;SG-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0044	Moores Flat;MF-OS-4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0045	Moores Flat;MF-OS-3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0046	Moores Flat;MF-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0047	Moores Flat;MF-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0048	Butchers Flat;BF-OS-5;	Open site	Valid	Artefact : -	Undefined artefactual site		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-5-0049	Butchers Flat;BF-OS-4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0050	Butchers Flat;BF-OS-3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0051	Butchers Flat;BF-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0052	Butchers Flat;BF-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0053	Butchers Flat_Yard;BF-Y-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0054	Abercrombie River;AR-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0055	Abercrombie River;AR-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0056	Licking Hole Creek;LHC-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0057	Spicers Creek/North Bank;SC/NB-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0058	Spicers Creek/North Bank;SC/NB-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0059	Grabine;GR-OS-6;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0060	Grabine;GR-OS-5;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0061	Grabine;GR-OS-4;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0062	Grabine;GR-OS-3;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0063	Grabine;GR-OS-2;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0064	Grabine;GR-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0065	Quart Pot_1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0071	Garbine 1;	Closed site	Valid	Artefact : -	Rockshelter (with deposit)		
44-5-0081	ELWT-OS-1;	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0084	BS-IF-1;	Open site	Valid	Artefact : -	Isolated Aboriginal object		
44-5-0086	22 Quart Pot	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0087	23 Quart Pot	Open site	Valid	Artefact : -	Undefined artefactual site	3321	

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-5-0088	24 Quart Pot	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0089	25 Quart Pot	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0090	26 Quart Pot;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0091	27 Gerties;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0092	28 Gerties;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0093	29 Gerties;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0094	31 Gerties;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0095	32 Gerties;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0096	34 Spring Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0097	35 Moores Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0098	37 Spicers Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0099	38 Spicers Creek;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0100	39 Green Mantle;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0101	40 Green Mantle;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0102	R41 Green Mantle;	Open site	Valid	Artefact : -	Undefined artefactual site	3321	
44-5-0109	HEBRON IF 1	Open site	Valid	Artefact : -	Isolated Aboriginal object		
44-5-0110	HEBRON OS1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0120	Quart Pot O/S 3	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0138	Kempfield Processing Area Open Site 6 with PAD	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0139	Kempfield Tailings Dam Open Site 1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0141	Kempfield Tailings Dam Open Site 3 with PAD	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0154	Kempfield Open Site 7 with PAD	Open site	Valid	Artefact : -	Undefined artefactual site; potential archaeological deposit		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-5-0167	Junction Point Rd AS2	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0168	Junction Point Rd AS1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0169	Junction Point Rd AS3	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0171	AR-AS-6	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0172	Rocky Bridge Creek, IF-1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-6-0096	HEBRON IF 5	Open site	Valid	Artefact : -	Isolated Aboriginal object		
44-6-0097	HEBRON Q1	Open site	Valid	Artefact : -	Undefined artefactual site		
44-6-0099	HEBRON IF 3	Open site	Valid	Artefact : -	Isolated Aboriginal object		
44-6-0100	Hebron if 2	Open site	Valid	Artefact : -	Isolated Aboriginal object		
45-6-2397	Marhams Bay Ridge 1	Open site	Valid	Artefact : -	Undefined artefactual site		
47-1-0050	Mick Mahones Creek Isolated 1	Open site	Valid	Artefact : -	Isolated Aboriginal object	103146	
47-1-0051	Phils Creek Scatter 1	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0004	Boorowa 4	Open site	Valid	Artefact : -	Undefined artefactual site	98836	
51-1-0005	Boorowa 5	Open site	Valid	Artefact : -	Undefined artefactual site	98836	
51-1-0006	Boorowa 6	Open site	Valid	Artefact : -	Undefined artefactual site	98836	
51-1-0007	Boorowa 7	Open site	Valid	Artefact : -	Undefined artefactual site	98836	
51-1-0047	Clarence Gap / Maryamma Creek Open Scatter (1) CG / MC-OS-1	Open site	Valid	Artefact : -	Undefined artefactual site		
51-1-0048	Clarence Gap Open Scatter Site CG-OS-1	Open site	Valid	Artefact : -	Undefined artefactual site		
51-1-0050	Clarence Gap Open Scatter Site (2) CG-OS-2	Open site	Valid	Artefact : -	Undefined artefactual site		
51-1-0051	Clarence Gap / Maryamma Creek Open Scatter (3) CG / MC-OS-3	Open site	Valid	Artefact : -	Undefined artefactual site		
51-1-0052	Clarence Gap / Maryamma Creek Open Scatter (2) CG / MC-OS-2	Open site	Valid	Artefact : -	Undefined artefactual site		
51-1-0055	GP-IF-1 Mount Darling	Open site	Valid	Artefact : -	Isolated Aboriginal object	3912	

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
51-1-0056	PC-OS-1 Phil's Creek	Open site	Valid	Artefact : -	Undefined artefactual site	3912	
51-1-0120	Bramah Creek Scatter 1	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0121	Bramah Creek Scatter 2	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0122	Fell Timber Creek Scatter 1	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0123	Five Mile Creek Isolated Find 1	Open site	Valid	Artefact : -	Isolated Aboriginal object	103146	
51-1-0124	Five Mile Creek Isolated Find 2	Open site	Valid	Artefact : -	Isolated Aboriginal object	103146	
51-1-0126	Five Mile Creek Scatter 1	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0128	Kennys Creek Scatter 2	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0129	Kennys Creek Scatter 3	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0130	Phils Creek Scatter 2	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0131	Phils Creek Scatter 3	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0132	Phils Creek Scatter 4	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0133	Rugby Ridge Scatter 1	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0134	Rugby Ridge Scatter 2	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0135	RWF11-01	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0136	RWF11-02	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0137	RWF11-03	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0138	RWF11-04	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0139	RWF11-05	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0140	RWF11-06	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0141	RWF11-07	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0142	RWF11-08	Open site	Valid	Artefact : -	Undefined artefactual site	103146	

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
51-1-0143	RWF11-10	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0144	RWF11-11	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0145	RWF11-12	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0146	RWF11-13	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-1-0147	RWF11-14	Open site	Valid	Artefact : -	Undefined artefactual site	103146	
51-2-0002	Bigga	Closed site	Valid	Artefact : -	Rockshelter (with deposit)	1500	
51-2-0003	The Meadows	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0004	Big Art Site	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0005	Edenvale 1	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0007	KWNP01	Open site	Partially Destroyed	Artefact : -	Undefined artefactual site	102,342,102,463, 102,000	3508
51-2-0015	Razorback Dam	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0019	Relocated BFT1-1 (Blanket Flat Trail)	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0020	Relocated BFT1-2 (Blanket Flat Trail)	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0021	Relocated BFT1-3 (Blanket Flat Trail)	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0022	Relocated BFT2 (Blanket Flat Trail)	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0023	Relocated BFT3 (Blanket Flat Trail)	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0024	Relocated BFT4 (Blanket Flat Trail)	Open site	Valid	Artefact : -	Undefined artefactual site		
51-2-0038	Junction Point Rd AS4	Open site	Valid	Artefact : -	Undefined artefactual site		
44-5-0118	Quart Pot O/S 2	Open site	Valid	Artefact : -, Hearth : 10	Small artefact scatter (<10); hearth		
44-4-0346	GQ-IF-1	Open site	Valid	Artefact : 1	Isolated Aboriginal object		
44-4-0371	WYANGALA ROAD DEVIATION 4	Open site	Valid	Artefact : 1	Isolated Aboriginal object		3552
44-4-0372	WYANGALA DAM ROAD DEVIATION 2	Open site	Partially Destroyed	Artefact : 1	Isolated Aboriginal object		3552

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
51-1-0117	Rye Park SU23/Locale 1	Open site	Valid	Artefact : 1	Isolated Aboriginal object	102,664,102,808	
51-1-0150	Rye Park WF SU28/L2	Open site	Valid	Artefact : 1	Isolated Aboriginal object		
51-2-0012	KENP 04	Open site	Valid	Artefact : 1	Isolated Aboriginal object		
51-2-0018	Blanket Flat Trail 4 (BFT4)	Open site	Partially Destroyed	Artefact : 1	Isolated Aboriginal object	102,342,102,463, 102,000	3508
51-2-0027	BLANKET FLAT TRAIL 3	Open site	Valid	Artefact : 1	Isolated Aboriginal object		
51-2-0028	BLANKET FLAT TRAIL 4	Open site	Valid	Artefact : 1	Isolated Aboriginal object		
51-2-0037	Peelwood_9	Open site	Valid	Artefact : 1	Isolated Aboriginal object	102,667,102,668	
51-1-0151	Rye Park WF SU29/L1	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -	Isolated Aboriginal object; potential archaeological deposit		
51-2-0033	Peelwood_5	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -	Isolated Aboriginal object; potential archaeological deposit	102,667,102,668	
51-2-0025	BLANKET FLAT TRAIL 2	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1	Isolated Aboriginal object; potential archaeological deposit		
51-2-0026	BLANKET FLAT TRAIL 2 A	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1	Isolated Aboriginal object; potential archaeological deposit		
51-2-0030	Peelwood_2	Open site	Valid	Artefact : 14	Small artefact scatter (<10)	102,667,102,668	
51-2-0011	KENP 03	Open site	Valid	Artefact : 2	Small artefact scatter (<10)		
51-1-0116	The Meadows OS 2	Open site	Valid	Artefact : 20	Moderate artefact scatter (20-50)		
51-2-0008	KWNP02	Open site	Valid	Artefact : 20	Moderate artefact scatter (20-50)	102463	
51-1-0153	Rye Park WF SU30/L2	Open site	Valid	Artefact : 22, Potential Archaeological Deposit (PAD) : -	Moderate artefact scatter (20-50); potential archaeological deposit		
51-1-0152	Rye Park WF SU30/L1	Open site	Valid	Artefact : 23, Potential Archaeological Deposit (PAD) : -	Moderate artefact scatter (20-50); potential archaeological deposit		
44-4-0352	S-OS-3 (Shalom)	Open site	Valid	Artefact : 3	Small artefact scatter (<10)	98024	
51-2-0009	KENP 01	Open site	Valid	Artefact : 3	Small artefact scatter (<10)		
51-2-0032	Peelwood_4	Open site	Valid	Artefact : 3	Small artefact scatter (<10)	102,667,102,668	
44-5-0119	Abercrombie/The Orchard OS-1	Open site	Valid	Artefact : 30	Moderate artefact scatter (20-50)		
44-5-0121	Abercrombie / The Orchard OS 2	Open site	Valid	Artefact : 30	Moderate artefact scatter (20-50)		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
51-2-0014	Keverstone National Park	Open site	Partially Destroyed	Artefact : 30	Moderate artefact scatter (20-50)	102,342,102,463, 102,000	3508
51-1-0114	Bakers Creek OS 1	Open site	Valid	Artefact : 4	Small artefact scatter (<10)		
51-1-0149	Rye Park WF SU28/L1	Open site	Valid	Artefact : 4	Small artefact scatter (<10)		
51-1-0118	Rye Park SU24/Locale 1	Open site	Valid	Artefact : 5	Small artefact scatter (<10)	102808	
51-2-0010	KENP 02	Open site	Valid	Artefact : 5	Small artefact scatter (<10)		
51-2-0031	Peelwood_3	Open site	Valid	Artefact : 5	Small artefact scatter (<10)	102,667,102,668	
51-2-0035	Peelwood_7	Open site	Valid	Artefact : 5	Small artefact scatter (<10)	102,667,102,668	
51-2-0016	Blanket Flat Trail 2 (BFT2)	Open site	Partially Destroyed	Artefact : 5, Potential Archaeological Deposit (PAD) : 1	Small artefact scatter (<10); potential archaeological deposit	102,342,102,463, 102,000	3508
44-5-0114	Hobcroft Trail	Open site	Valid	Artefact : 6	Small artefact scatter (<10)		
51-2-0034	Peelwood_6	Open site	Valid	Artefact : 6	Small artefact scatter (<10)	102,667,102,668	
51-2-0029	Peelwood_1	Open site	Valid	Artefact : 60	Large artefact scatter (>50)	102,667,102,668	
51-1-0154	Rye Park WF SU30/L3	Open site	Valid	Artefact : 64, Potential Archaeological Deposit (PAD) : -	Large artefact scatter (>50); potential archaeological deposit		
44-5-0113	Little Bread Creek	Open site	Valid	Artefact : 7	Small artefact scatter (<10)		
51-2-0017	Blanket Flat Trail 3 (BFT3)	Open site	Partially Destroyed	Artefact : 7	Small artefact scatter (<10)	102,342,102,463, 102,000	3508
44-5-0080	Possible Burial Site;	Open site	Valid	Burial : -	Burial/s		
44-6-0080	Gerties Camp Site Possible Burial;	Open site	Valid	Burial : -	Burial/s		
51-2-0006	Eurimburra Burial	Open site	Valid	Burial : -	Burial/s		
44-5-0164	Crowford Sounder Flat1	Open site	Valid	Grinding Groove : -	Grinding groove		
51-2-0013	TIN TIN 302	Open site	Valid	Hearth : -	Hearth		
44-4-0010	The Peppers Koorawatha	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree	1027	
44-4-0089	OC-ST-2;Oaky Creek Scarred Tree (2);	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-4-0090	OC-ST-1;Oaky Creek Scarred Tree (1);	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
44-4-0091	MC-ST-1 Markhams Creek Scarred Tree (1)	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree	97839	
44-4-0109	VR-ST 1;vale Road Scarred Tree;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree	103499	
44-4-0194	PB-ST-1 - Purfleet Bluff Scarred Tree (1)	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-4-0198	Oaky Creek Road Scarred Tree (3);OC-ST-3;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-4-0201	GOCE-ST-1;Oaky Creek East-Scarred Tree (1);	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-4-0261	EL-ST-1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-4-0272	S-ST-1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0005	Grove Creek	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree	651,298	
44-5-0039	DR-ST (1);Down River Scarred Tree (1);	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0040	DR-ST (2);Down River Scarred Tree (2);	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0066	Quart Pot_1;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0067	Quart Pot st_1;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0068	Quart Pot Point;QPP-ST-1;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0082	ELWT-ST-1;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0085	BH-ST-1;	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0142	Kempfield Tailings Dam Scarred Tree 1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0159	Sounder	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0160	Sounder Paddock	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0161	Crowford3	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0162	Crow ford 2	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0163	Crowford4	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-6-0098	HEBRON ST 1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		

Site_ID	Site_name	Context	Site_statu	Site_featu	Site_types	Reports	Permits
51-1-0016	MY-ST-1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree	98836	
51-1-0049	Clarence Gap Scarred Tree	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
51-1-0125	Five Mile Creek Scar Tree 1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree	103146	
51-1-0161	Merringullalung TSR 2	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
51-1-0162	Merringullalung TSR 1	Open site	Valid	Modified Tree (Carved or Scarred) : -	Culturally modified tree		
44-5-0111	Pot O Tea Creek MT1	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
44-5-0112	Copperhannia Trig Trail ST1	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
44-5-0115	Little Hells Hole Creek Modified Tree 1	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
44-5-0116	Hells Hole Creek Modified Tree 1	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
44-5-0117	Copperhannia Trig Trail Modified Tree 2	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
44-5-0123	Old Yard Creek - Modified Tree	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
51-1-0067	Coleman's Lane, NE of Crogan NSW	Open site	Valid	Modified Tree (Carved or Scarred) : 1	Culturally modified tree		
44-4-0101	OC-OD 1;Oaky Creek Ochre deposit (1);	Open site	Valid	Ochre Quarry : -	Quarry		
51-2-0036	Peelwood_8	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : 10	Potential archaeological deposit	102,667,102,668	
44-5-0038	GR-SA (1);Gerties Ridge Stone Arrangement (1);	Open site	Valid	Stone Arrangement : -	Stone arrangement		
51-1-0014	Clarence Gap Stone Arrangement (1)	Open site	Valid	Stone Arrangement : -	Stone arrangement		
51-1-0015	Clarence Gap Stone Well (1)	Open site	Valid	Stone Arrangement : -	Stone arrangement	98836	
51-1-0053	Clarence Gap Stone Arrangement CG-SA-2	Open site	Valid	Stone Arrangement : -	Stone arrangement		
51-1-0115	Bakers Mount Stone Arrangement 1	Open site	Valid	Stone Arrangement : 1	Stone arrangement		
44-4-0087	BQ1;Bayview Quarry Site 1;	Open site	Valid	Stone Quarry : -, Artefact : -	Quarry		

APPENDIX 2

UNANTICIPATED DISCOVERY PROTOCOLS

Protocol to follow in the event that Aboriginal object(s) or historical relics (other than human remains) are encountered and no AHIP has been approved

In the event that object(s) which are suspected of being Aboriginal object(s) or relic(s) are encountered during development works, then the following protocol will be followed:

1. Cease any further excavation or ground disturbance, in the area of the find(s);

    a. The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be temporarily halted; and

    b. The site supervisor and the Principal will be informed of the find(s).

2. Do not remove any find(s) or unnecessarily disturb the area of the find(s);

3. Ensure that the area of the find(s) is adequately marked as a no-go area for machinery or further disturbance, and that the potential for accidental impact is avoided;

4. Note the location and nature of the finds, and report the find to:

    a. Relevant project personnel responsible for project and construction direction and management, and

    b. Report the find to the Department of Planning, Industry and Environment (DPIE).

5. Where feasible, ensure that any excavation remains open so that the finds can be recorded and verified. An excavation may be backfilled if this is necessary to comply with work safety requirements, and where this action has been approved by the DPIE. An excavation that remains open should only be left unattended if it is safe and adequate protective fencing is installed around it.

6. Following consultation with the relevant statutory authority (DPIE), and, where advised, any other relevant stakeholder groups, the significance of the finds should be assessed and an appropriate management strategy followed. Depending on project resources and the nature of the find(s), this process may require input from a consulting heritage specialist as well as with the WaterNSW heritage officer.

7. Development works in the area of the find(s) may re-commence, if and when outlined by the management strategy, developed in consultation with, and approved by the relevant statutory authority.

8. If human skeletal material is encountered, the protocol for the discovery of human remains should be followed (refer attached).

Protocol to follow in the event of the discovery of suspected human remains

The following protocol will be actioned if suspected human material is revealed during development activities or excavations:

1. All works must halt in the immediate area of the find(s) and any further disturbance to the area of the find(s) prevented.

    c. The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be halted; and

    d. The site supervisor and the Principal/Project manager will be informed of the find(s).

2. If there is substantial doubt regarding a human origin for the remains, then consider if it is possible to gain a qualified opinion within a short period of time. If feasible, gain a qualified opinion (this can circumvent proceeding further along the protocol for remains which are not human). If conducted, this opinion must be gained without further disturbance to the find(s) or the immediate area of the find(s). (Be aware that the site may be considered a crime scene that retains forensic evidence). If a quick opinion cannot be gained, or the identification is positive, then proceed to the next step.

3. Immediately notify the following of the discovery:

    a. The local Police (this is required by law);

    b. A DPIE archaeologist or Aboriginal Heritage

    c. The project archaeologist (if not already notified).

4. Co-operate and be advised by the Police and/or coroner with regard to further actions and requirements concerning the find area. If required, facilitate the definitive identification of the material by a qualified person (if not already completed).

5. In the event that the Police or coroner instigate an investigation, construction works are not to resume in the designated area until approval in writing is gained from the NSW Police.

6. In the event that the Police and/or Coroner advise that they do not have a continuing or statutory role in the management of the finds then proceed with the following steps:

7. If the finds are not human in origin but are considered to be archaeological material relating to Aboriginal occupation then proceed with Protocol for the discovery of Aboriginal objects (other than human remains).

8. If the finds are Aboriginal or probably Aboriginal in origin:

    a. Ascertain the requirements of DPIE, the Heritage Division, the Project Manager, the WaterNSW heritage officer and the views of the AFG, and the project archaeologist.

    b. Based on the above, determine and conduct an appropriate course of action. Possible strategies could include one or more of the following:

        i. Avoiding further disturbance to the find and conserving the remains *in situ*;

        ii. Conducting archaeological salvage of the finds following receipt of any required statutory approvals;

iii. Scientific description (including excavation where necessary), and possibly also analysis of the remains prior to reburial;

iv. Recovering samples for dating and other analyses; and/or

v. Subsequent reburial at another place and in an appropriate manner determined by the AFG.

9. If the finds are non-Aboriginal in origin:

c. Ascertain the requirements of the Heritage Division, Project Manager, and the views of any relevant community stakeholders and the project archaeologist.

a. Based on the above, determine and conduct an appropriate course of action. Possible strategies could include one or more of the following:

a. Avoiding further disturbance to the find and conserving the remains *in situ*;

b. Conducting archaeological salvage of the finds following receipt of any required statutory approvals;

c. Scientific description (including excavation where necessary), and possibly also analysis of the remains prior to reburial;

d. Recovering samples for dating and other analyses; and/or

e. Subsequent reburial at another place and in an appropriate manner determined in consultation with the Heritage Division and other relevant stakeholders.

10. Construction related works in the area of the remains (designated area) may not resume until the proponent receives written approval in writing from the relevant statutory authority: from the Police or Coroner in the event of an investigation, from DPIE in the case of Aboriginal remains outside of the jurisdiction of the Police or Coroner, and from the Heritage Branch in the case of non-Aboriginal remains outside of the jurisdiction of the Police or Coroner.