

HARPERS HILL RESERVOIR AND LOCHINVAR RISING MAIN UPGRADE

JANUARY 2023

REVIEW OF ENVIRONMENTAL
FACTORS





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GLOSSARY

Term	Definition
ACF	Asset Creation Framework
AHIMS	Aboriginal Heritage Information Management System
AS	Australian Standard
ASS	Acid Sulfate Soil
AWS	Automatic Weather Station
BC Act	<i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	<i>Biosecurity Act 2015</i>
°C	Degrees Celsius
CCLP	Construction Community Liaison Plan
CEMP	Construction Environmental Management Plan
CLM Act	<i>Contaminated Land Management Act 1997</i>
CME Tool	<i>Construction and Maintenance Estimator Tool</i>
CO	Carbon monoxide
CSWMP	Construction Soil and Water Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DECC	Department of Environment and Climate Change (former)
DECCW	Department of Environment, Climate Change and Water (former)
DMP	Dewatering Management Plan
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
DPI – Fisheries	Department of Primary Industries - Fisheries



Term	Definition
DPIE	Department of Planning, Industry and Environment (now the Department of Planning and Environment (DPE))
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>The Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
EPL	Environmental Protection Licence
ESD	Ecologically Sustainable Development
FM Act	<i>Fisheries Management Act 1994</i>
FMP	Frac-Out Management Plan
Heritage Act	<i>Heritage Act 1977</i>
HW Act	<i>Hunter Water Act 1991</i>
Hunter Water	Hunter Water Corporation
IBRA	Interim Biogeographic Regionalisation for Australia
ICNG	Interim Construction Noise Guideline
IMP	Incident Management Plan
ISBN	International Standard Book Number
T&ISEPP	<i>The State Environmental Planning Policy (Transport and Infrastructure) 2021</i>
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
LLS	Local Land Services
MCC	Maitland City Council



Term	Definition
MNES	Matters of National Environmental Significance
Non-perennial	Refers to a waterway that does not flow continually through the year.
NPI	Noise Policy for Industry
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NPWS	National Parks and Wildlife Service
NRAR	Natural Resources Access Regulator
NSW	New South Wales
NT Act	<i>Native Title Act 1993</i>
NVA	Noise and Vibration Assessment
OEH	Office of Environment and Heritage (former)
OOHW	Out of Hours Work
PCT	Plant Community Type
PMST	Protected Matters Search Tool
PM ₁₀	Particulate matter in the air with a diameter of 10 micrometres or less.
PM _{2.5}	Particulate matter in the air with a diameter of 2.5 micrometres or less.
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
PSI	Preliminary Site Investigation
PVA	polyvinyl acetate
PVC	polyvinyl chloride
Roads Act	<i>Roads Act 1993</i>
REF	Review of Environmental Factors
RMS	Roads and Maritime Services



Term	Definition
SCADA	Supervisory Control and Data Acquisition
SEE	Statement of Environmental Effects
SEPP	<i>State Environmental Planning Policy</i>
SIS	Species Impact Statement
TEC	Threatened Ecological Communities
TMP	Traffic Management Plan
WAL	Water Access Licence
WARR Act	<i>Waste Avoidance and Resource Recovery Act 2011</i>
WM Act	<i>Water Management Act 2000</i>
WPS	Water Pumping Station



EXECUTIVE SUMMARY

Hunter Water Corporation (Hunter Water) are proposing to construct and operate a new five megalitre (ML) potable water reservoir at Harpers Hill and trunk main between the new reservoir and the Lochinvar 2 Water Pump Station (WPS) (Lochinvar WPS) at Lochinvar.

The proposal key elements include:

- Constructing and operating a new 7 ML potable water reservoir
- Constructing and operating 2.4 kilometres (km) of new 375 millimetre (mm) water main between Lochinvar WPS and the new reservoir which would operate in parallel with the existing 250 mm water trunk main
- Constructing underground pipework at the new reservoir, including inlet, outlet, scour, overflow and connecting to existing outlet pipework
- Cutting and filling earthworks to create an even surface below the new reservoir and access road
- Harpers Hill Lane access improvement, comprising:
 - Upgrading the eastern portion of Harpers Hill Lane
 - Constructing an access road to connect the eastern portion of Harpers Hill Lane and the private road used to access the reservoir site
- Demolishing the existing 0.9 ML Harpers Hill 1 Reservoir (the existing reservoir).

The construction of the proposal would be expected to start in late 2023 and take up to 12 months (weather permitting) to complete.

Need for the proposal

The Maitland / North Rothbury water supply system currently supplies water to the majority of the Maitland LGA. The Maitland / North Rothbury water supply system have had several operational issues including storage and pumping capacity and risk of asset failure.

The proposal would increase storage and pumping capacity and avoid asset failure by replacing the existing 0.9 ML reservoir with the new 7 ML reservoir and duplicating the trunk main from Lochinvar 2 WPS to Harpers Hill Reservoir. This approach would reduce the risk of supply interruption and would increase storage and pumping capacity of the network to cater for current and future increased demand in the surrounding areas.

Statutory and planning framework

Chapter 2, Division 24, Section 2.159 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&ISEPP) enables development for the purpose of a water supply system to be carried out without consent.

As the proposal would form part of a water supply system and Hunter Water is a public authority, it is considered permissible without consent pursuant to the provisions of T&ISEPP and can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and development consent from the Maitland City Council (MCC) is not required. Therefore, Hunter Water is the proponent and determining authority for the proposal.

Community and stakeholder consultation

In accordance with the requirements of the T&ISEPP, consultation is required with local councils and/or public authorities in certain circumstances, including where council managed infrastructure is affected. Hunter Water engaged with MCC, Department of Primary Industries – Fisheries (DPI – Fisheries) and Transport for NSW (TfNSW) throughout development of the proposal.



Environmental impacts

The assessment of the potential environmental impacts concluded that the proposal would have minor environmental impacts, including:

- Erosion, sedimentation and contamination impacts during construction due to earthworks, and trenchless construction of Allandale Road and Terriere Drive. Trenchless construction also has the potential to cause frac outs (a frac out is the unintentional return of drilling fluids to the surface during underboring). Measures have been developed to mitigate and manage potential soil impacts during construction including implementing a Construction Soil and Water Management Plan (CSWMP).
- Trenching through two ephemeral creeks (Kaludah Creek and the unnamed stream) would have the potential to cause erosion and sedimentation impacts downstream
- Impacts on groundwater and surface water quality during construction, particularly on nearby creeks including Kaludah Creek, unnamed streams and Hunter River
- Removal of 2.3 hectares (ha) of Lower Hunter Spotted Gum – Ironbark forest (PCT3444), described as low condition and listed as a threatened ecological community (TEC) (endangered) under the *Biodiversity Conservation Act 2016* (BC Act). The test of significance determined that the proposal would be unlikely to result in a significant impact to this TEC
- Noise impacts at sensitive receivers nearest to the proposal, where noise management levels (NMLs) are predicted to be exceeded in most stages of construction
- Vibration impacts from construction related activities including hydraulic rock hammering.

The proposal would not be expected to have a substantial long term adverse environmental impact provided the mitigation measures identified in this Review of Environmental Factors (REF) are implemented.

No Environmental Impact Statement (EIS) or Species Impact Statement (SIS) would be required, and the proposal can be determined accordingly.

Justification and conclusion

While there would be some environmental impacts as a consequence of the proposal, they have been avoided or minimised wherever possible through design and site specific mitigation measures. The beneficial effects are considered to outweigh the mostly temporary adverse impacts and risks associated with the proposal. The proposal as described in this REF best meets the proposal objectives but would still result in some impacts on amenity (noise and vibration impacts), biodiversity, erosion and sedimentation and potentially water quality.

Mitigation measures as detailed in this REF would mitigate or minimise the assessed impacts and as such the proposal is not likely to have a significant environmental impact.

The proposal is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

The assessment identified that the proposal has the potential to result in some minor impacts. These are primarily related to the construction phase and would be short lived and temporary in nature. The proposal would avoid asset failure and risk of supply interruption and increase storage and supply capacity to cater for current and future increased demand in the surrounding areas.



1 INTRODUCTION

1.1 Proposal identification

Hunter Water Corporation (Hunter Water) proposes to construct and operate a new five megalitre (ML) potable water reservoir at Harpers Hill and new trunk main between the new reservoir and the Lochinvar 2 Water Pump Station (Lochinvar WPS) at Lochinvar (the proposal).

The proposal is located within an area subject to significant forecast growth and the adequate delivery of water to Harpers Hill reservoir from Lochinvar Water Pump Station is vital to continuously meet current and future demand for customers in the supply area. However, the system currently has operational issues relating to loss and security of supply. The proposal would help to boost the system capacity for growth and provide security of supply.

Key elements of the proposal include:

- Constructing and operating a new 7 ML potable water reservoir
- Constructing and operating 2.4 kilometres (km) of new 375 millimetre (mm) water main between Lochinvar WPS and the new reservoir which would operate in parallel with the existing 250 mm water trunk main
- Constructing underground pipework at the new reservoir, including inlet, outlet, scour, overflow and connecting to existing outlet pipework
- Cutting and filling earthworks to create an even surface below the new reservoir and access road
- Harpers Hill Lane access improvement, comprising:
 - Upgrading the eastern portion of Harpers Hill Lane
 - Constructing an access road to connect the eastern portion of Harpers Hill Lane and the private road used to access the reservoir site.
- Demolishing the existing 0.9 ML Harpers Hill 1 Reservoir (the existing reservoir).

The construction of the proposal would be expected to start in late 2023 and take up to 12 months (weather permitting) to complete.

The location of the proposal area is shown in **Figure 1-1** in overview of the proposal is provided in **Figure 1-2. Section 3** describes the proposal in more detail.

1.2 Proposal location

The proposal stretches about 3.5 km through the suburbs of Harpers Hill, Allandale and Lochinvar within the Maitland Local Government Area (LGA). It is located about 15 km to the north east of Cessnock and 11 km to the north west of Maitland.

The reservoir site is located to the south of the New England Highway. The reservoir site is currently accessed via a private road off the New England Highway. Hunter Water has a right of carriageway on this private road. The reservoir site has undergone previous clearing and is highly modified. Vegetation surrounding the reservoir site comprises short grass and occasional mature trees.

West of the reservoir site and between the reservoir site and the Lochinvar WPS, the majority of the proposal would be located within an existing cleared Hunter Water easement, characterised by sections of private property, paddocks, modified pastures, roads, driveways and Kaludah Creek and other unnamed streams.

The proposal area includes the Hunter Water easement, public and state roads, private property (including agricultural land, grazing pastures and residential land), and remnant patches of vegetation. Some of these patches of vegetation are consistent with the threatened ecological



community (TEC) referred to as Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions listed under the *Biodiversity Conservation Act 2016* (BC Act).

Within the western boundary of the proposal area, the two closest residential receivers are located between 75 and 90 metres (m) to the north-west of the existing reservoir. Within the eastern boundary of the proposal area, the closest residential receivers are located on St Helena Close around 10 m from the proposal.

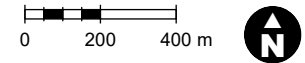
1.3 Purpose of the report

This report has been prepared by Jacobs Group (Australia) Pty Ltd (Jacobs) on behalf of Hunter Water. For the purposes of these works, Hunter Water the proponent and the determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the Review of Environmental Factors (REF) is to describe the proposal, to document the likely potential construction and operation environmental impacts of the proposal on the environment, and to detail mitigation measures to be implemented.



- Proposal area
- Railway
- New trunk main
- Local Government Area



1:20,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Aerometrex 2021

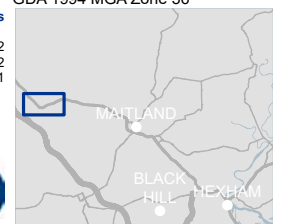


Figure 1-1 Proposal location



2 PROPOSAL NEED AND JUSTIFICATION

The Maitland / North Rothbury water supply system currently supplies water to the majority of the Maitland LGA. This region is one of the high growth precincts incorporating Lochinvar, Greta and the Huntlee Development area, which is anticipated to incorporate a residential growth of approximately 3,600 properties over the next 10 years, representing a 90 per cent (%) increase (Hunter Water, 2022). A number of operational issues have been identified in relation to the Maitland / North Rothbury water supply system including storage and pumping capacity.

A six-stage capital works program for the Maitland / North Rothbury water supply system has been developed by Hunter Water to address the above issues under the Water Supply Capacity Investment Program. The proposal is part of stage 4 of this program.

The existing reservoir at Harpers Hill and trunk main to Lochinvar WPS forms part of the Maitland/North Rothbury water supply system supply existing and future customers between Lochinvar and North Rothbury. The adequate delivery of water to Harpers Hill reservoir from Lochinvar WPS is vital to continuously meet current and future demand for customers in the supply area.

The existing 0.9 ML steel reservoir has been identified as being in poor structural condition with a high inherent failure risk. Structural issues include deterioration of the roof members, deterioration of internal concrete lining, corrosion of the floor plate and corrosion of the floor/wall connection plate (refer to **Photo 2-1**). To reduce risks of failure, the Harpers Hill reservoir is currently operating at a reduced water capacity (70%). In its current state, Harpers Hill reservoir does not meet Hunter Water's security of supply requirements.



Photo 2-1 Harpers Hill Reservoir defects. Source (Hunter Water, 2021a)



Essentially all critical components of the reservoir require major refurbishment or replacement. However, even if the structural issues were addressed by refurbishment, it would still be undersized to meet current and future demand and supply constraints. An increased storage capacity of 7 ML would be required by the year 2024 to meet the increased demand.

By 2025, the existing trunk main from Lochinvar WPS to the existing reservoir would not have the capacity to fill the new 7 ML reservoir and may result in emptying of Harpers Hill and North Rothbury reservoirs during peak periods. This would result in up to approximately 4,000 customers out of water for several days until the reservoirs are able to refill.

The *Coalfields regional water servicing strategy* (Hunter Water, 2020) recommended upgrading the existing reservoir to a 7 ML and duplicating the main from Lochinvar 2 WPS to Harpers Hill Reservoir to boost system capacity for growth and provide security of supply by 2024.

Augmenting the water delivery capacity between Lochinvar WPS to Harpers Hill would ensure that the new 7 ML Harpers Hill Reservoir can be fully utilised during high demand periods. This approach would substantially reduce the risk of a supply interruption from asset failure to customers when the network is operating to its available capacity. Duplication of the trunk main would also reduce the risk of a supply interruption in the event of a major asset failure that interrupts the delivery of water to the reservoir.

2.1 Objectives of the proposal

The primary objectives of the proposal are to:

- Provide additional water storage and improve security of supply to the Lochinvar, Branxton and Greta areas
- Provide sufficient capacity for current demand and future growth demands
- Replace poor condition existing reservoir
- Provide design that are cost effective, maintainable, safe and sustainable
- Meet Hunter Water standards.

2.2 Existing water infrastructure

2.2.1 Harpers Hill reservoir

The Harpers Hill reservoir site is owned by Hunter Water and forms part of the Maitland/North Rothbury water supply system. Harpers Hill reservoir is a steel reservoir with a capacity of 0.9 ML built in the 1950s, and together with the 7 ML North Rothbury reservoir, serves approximately 3,000 customers between Lochinvar and the Branxton/ Greta, North Rothbury/Huntlee areas.

The relatively small volume of Harpers Hill reservoir means that it provides minimal capacity to the overall system, with a high draw and fill frequency.

The reservoir site has been previously cleared and access is via a private road. Hunter Water has an existing right of carriageway over this road. The reservoir site is not fenced.



Photo 2-2 The existing reservoir

2.2.2 Lochinvar WPS / Lochinvar Trunk Main

Lochinvar trunk main connects Lochinvar WPS (built in 2017) and Harpers Hill Reservoir. The trunk main was built in the late 1970s / early 1980s and is located within a Hunter Water easement. Its primary purpose is to feed Harpers Hill Reservoir, however there are two pressure reducing valve offtakes along the main at St Helena Close and Oswald Road. In addition, there are several non-standard property connections off the trunk main.

2.2.3 Harpers Hill Lane

Harpers Hill Lane is located within the Transport for NSW (TfNSW) road reserve for the New England Highway and is maintained by Maitland City Council (MCC). The eastern portion of this road is unformed and is unusable by all except high clearance vehicles.

2.3 Options considered

The *Coalfields Regional Water Servicing Strategy* (Hunter Water, 2020) recommended upgrading the Harpers Hill 1 Reservoir to 7 ML and duplicating the trunk main from the Lochinvar WPS to Harpers Hill Reservoir to boost system capacity for growth and provide security of supply by 2024. As such number of options were considered for the reservoir upgrade and trunk main duplication. These are discussed further in the following sections.

2.3.1 Reservoir options

The *Harpers Hill Reservoir Replacement Business Case* (Hunter Water, 2021b) identified shortlisted options to address the existing 0.9 ML reservoir in poor structural condition and to meet planning objectives for continued growth. These options included:

- **Options 1 – Do nothing:** The ‘do nothing’ option reflects the current condition, configuration and operation and maintenance activities. This option would continue the current approach of interim controls, including ongoing inspection, assessment, maintaining and repairing, with a reduced operating level of the existing 0.9 ML reservoir, until a new 7 ML reservoir is constructed within 10 years. This option assumes that maintaining and repairing the existing



reservoir could provide a service life extension of 10 years, however the risk of failure is still prevalent given the overall poor structural condition. Maintaining and repairing the existing reservoir would not address current security of supply risks due to reservoir size and reduced storage capacity. This problem would exacerbate as demand increases with forecast demand growth and increased storage volume is required

- **Option 2 – Replace the existing 0.9 ML reservoir with a new 7 ML reservoir within 5 years.** This option would involve the construction of a 7 ML reservoir within five years or sooner if possible, mitigating the risks of structural failure of the existing reservoir. This option would also provide additional storage to meet both existing security of supply and forecast demands. In this option, the existing 0.9 ML reservoir would continue to be operated and maintained until the new 7 ML reservoir is commissioned. The existing reservoir would then be decommissioned and demolished. This option meets the proposal objectives
- **Option 3 – Replace the existing 0.9 ML reservoir with a new 10 ML reservoir within 5 years.** This option would involve the construction of a 10 ML (or 2 x 7 ML reservoirs) reservoir within five years or sooner if possible. This option would mitigate the risks of structural failure of the existing reservoir and provide additional storage capacity for the forecast total demands of the Maitland/ North Rothbury supply system. This option meets the proposal objectives. However, there are likely to be site constraints in constructing a 10 ML (or 2 x 7 ML) reservoir while keeping the existing reservoir in service, due to land size and positioning.

2.3.2 Lochinvar to Harpers Hill Trunk Water Main Augmentation

The *Lochinvar to Harpers Hill Trunk Water Main Augmentation Business Case* (Hunter Water, 2022) identified a shortlist of options to address adequate delivery of water to Harpers Hill reservoir from Lochinvar Water Pump Station. These options included:

- **Option 1 – Do nothing:** This option assumes that the new 7 ML reservoir is constructed by 2025 as well as other planned trunk water main augmentations between Harpers Hill and Greta. The existing 250mm diameter trunk main between Lochinvar WPS and the reservoir would remain unchanged. This option does not meet the proposal objective and does not address the risks
- **Option 2 – Construct 2.4 km of new 375 mm trunk main from Lochinvar WPS to the reservoir by 2025 and second 375 mm main by 2035.** This option would include the construction of 2.4 km of new 375 mm main from Lochinvar WPS to the reservoir by 2025. The existing 250 mm water main would remain in service till 2036 (estimated) and then be decommissioned at end of its life span. A second 375 mm is planned to be built at this time with additional pump installed at Lochinvar WPS to provide for continued customer growth. This option means that there would be two parallel mains between Lochinvar WPS and Harpers Hill Reservoir that increases security of supply and operational flexibility
- **Option 3 – Construct 2.4 km of new 500 mm from trunk main from Lochinvar WPS to Harpers Hill Reservoir by 2025.** This option Construction of 2.4 km of new 500 mm trunk main from Lochinvar WPS to the reservoir by 2025. The existing 250 mm pipe would also remain in service until 2035 and then be decommissioned at end of its life span. An additional pump is planned to be installed at Lochinvar WPS in 2030 to provide for continued customer growth. While this option does meet the proposal objectives, it does not provide operational flexibility beyond 2035 as the existing 250 mm would be abandoned or decommissioned due to age. This option has a higher capital cost than Option 2.

2.4 Preferred option justification

The *Harpers Hill Reservoir Replacement Business Case* (Hunter Water, 2021b) determined that the preferred option for reservoir replacement is Option 2. Option 2 meets the proposal objectives and has the lowest capital costs. This option also has the operational benefit of reducing the risk of potential water quality issues by having a smaller reservoir initially rather than a single larger reservoir built upfront.



The *Lochinvar to Harpers Hill Trunk Water Main Augmentation Business Case* (Hunter Water, 2022) determined that preferred option for the trunk main augmentation is Option 2. Option 2 meets the proposal objectives, addresses risks within the same timeframe as other options, and provides the operational benefit of having two mains between Lochinvar WPS and the reservoir. This option has a lower capital cost than Option 3.



3 DESCRIPTION OF THE PROPOSAL

3.1 Scope of works

The proposal would provide a new 7 ML reservoir and 2.4 km of new 375 mm trunk main between the new reservoir and Lochinvar WPS. Details of the proposal and design are shown in **Figure 1-2** and are described in more detail in the following sections.

3.1.1 New water trunk main

The new trunk main would be a 375 mm polyvinyl chloride (PVC) pipe. Most of the new trunk main would be installed via open trenched method except for at Allandale Road (refer to **Photo 3-1**) and Terriere Drive. The trunk main across Allandale Road and Terriere Drive would be installed by underboring by horizontal directional drilling.

Sections of the new trunk main would be located outside of the existing Hunter Water easement. As such a new easement would need to be acquired.

It is not anticipated that any public utilities would require relocation during construction of the proposal.

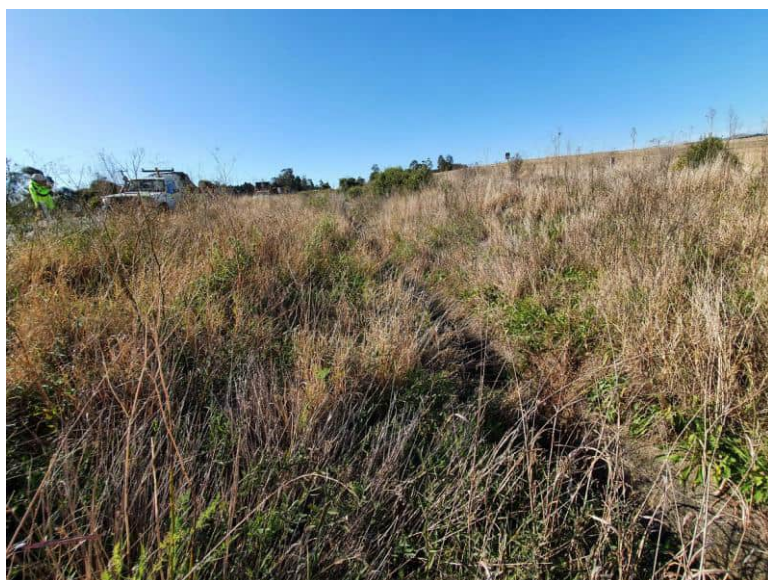


Photo 3-1 Location of trunk main (south east facing), east of Allandale Road within the central portion of the proposal

3.1.2 Reservoir

The new reservoir would be located within a Hunter Water owned block of land off the New England Highway at Harpers Hill (refer to **Photo 3-2**) The reservoir would have a capacity of 7 ML, would be approximately 8 m high and would have a footing diameter of approximately 38 m.

The reservoir structure would be constructed of either reinforced concrete or steel and would have a roof to prevent access by animals and/or wind-blown debris. The reservoir would be painted green, similar to the existing reservoir on the site. The area around the reservoir would be revegetated in accordance with the Potable Water Reservoir Specification STS409 (Hunter Water, 2009).



Photo 3-2 The location of the new reservoir, photo taken from the existing reservoir facing north west

3.1.3 Improvements to Harpers Hill Lane and access roads

The reservoir site is currently accessed via a private road that intersects with the New England Highway. The existing private road intersection with the New England Highway is hazardous. As such, improvements include an extension of the eastern portion of Harpers Hill Lane which is adjacent to the New England Highway. The improvements would connect Harpers Hill Lane to the private road to the reservoir site. The improvements would enable articulated vehicles to access the site via Harpers Hill Lane and New England Highway intersection (refer to **Photo 3-3**).

The Harpers Hill Lane extension would be a minimum of 3.5 m wide (subject to site constraints), with a two coat spray seal for mitigation of erosion sedimentation. Where required, barricades would be built between the lane extension and the New England Highway. Lockable gates would be installed on both sides of the lane extension. Hunter Water would be responsible for maintaining the lane extension, gates and barricades.

After construction, the reservoir site would continue to be accessed via the Harpers Hill Lane and New England Highway intersection. Hunter Water's right of carriageway over this road would remain following construction.

A new access road would be located around the full extent of the proposed reservoir, within the reservoir site. This access road would be approximately a minimum of 5.5 m wide and suitable for a 12.5 m long heavy rigid vehicle. It would be designed to direct runoff away from the reservoir. The road would be constructed of asphalt.

In addition to the access road, sufficient space would be provided to enable two 12.5 m long heavy rigid vehicles to be parked on the reservoir site.



Photo 3-3 Eastern portion of Harpers Hill Lane (south east facing) within the proposal area

Construction activities

This section provides a summary of the likely construction methodology, work hours, plant and equipment and associated activities that would be used to construct the proposal.

3.1.4 Work methodology

A Construction Environmental Management Plan (CEMP) would be prepared by the construction contractor and endorsed by Hunter Water prior to construction. The purpose of the CEMP is to provide a structured approach to the management of environmental issues during construction of the proposal.

The proposal would include the following construction activities:

- Site establishment/mobilisation:
 - Set up and implement environmental management plan which would include risks and mitigation measures for the activity sequence
 - Obtain all work permits and site approvals as necessary
 - Flag no go zones (if required)
 - Locate services and protect if necessary
 - Mobilise temporary ancillary areas, stockpile areas and laydown areas
 - Install sediment and erosion controls
 - Prepare the construction corridor. This may include stripping of the topsoil and vegetation clearing (individual trees and a number of small patches of remnant native vegetation).
- Trunk main construction:
 - Excavate area to install the trunk main in sections. The construction is expected to be linear in nature achieving 20 m - 40 m of trunk main pipeline installation each day. The majority of the trunk main would be installed by open trenching. Works to install the trunk main would be conducted within a construction corridor of up to 25 m wide and excavation of trenches about 1.5 m in width excluding any required batters (benching). The new trunk main would be bedded on granular material such as sand or gravel, which would be spread along the bottom of the trench prior to pipe laying. Trenches may require batters and shoring to support the ground. The trenches would be typically 2.0 m in depth for the majority of the alignment. The new trunk main would be inserted and backfilled concurrently



- Horizontal directional drilling under Allandale Road and Terriere Road. Horizontal directional drilling would require the excavation of an entry and exit pit on either side of Allandale Road to be underbored (refer to Figure 1-2). The launch area for underboring would be approximately 25 m by 25 m in size to allow for materials, machinery and access. The entry and exit pits themselves would be approximately 2 m by 3 m. The underboring excavation depth would be determined by the construction contractor depending on subsurface conditions
- Deeper excavation would be required for the installation of thrust blocks behind bends in the trunk main. These would be located at all areas where the trunk main bends. Thrust blocks are large concrete blocks that are located behind bends in the trunk main to stop the trunk main moving. The excavation for the thrust blocks would be up to 5 m deep, 1 m to 3 m wide and up to 5 m long
- Existing trunk mains shut down to allow connection to the existing network. This would include isolation and draining the trunk mains to allow sections to be removed (where required) and installation of the new connections.
- The activities associated with the construction of the new reservoir would include:
 - Grading and levelling the site
 - Excavation of the site
 - Construction of retaining walls
 - Construction of the reservoir
 - Construction of the inlet and outlet mains for the reservoir
 - Construction of the overflow / scour main and energy dissipation pit arrangement for the reservoir.
- Road improvements:
 - Upgrading of the eastern portion of Harpers Hill Road
 - Construction of the access road from the eastern end of Harpers Hill Road to the private road used to access the reservoir site (over which Hunter Water has an existing right of carriageway)
 - Construction of the access road within the reservoir site.
- Tie into the existing Lochinvar WPS:
 - Connect to blank flange offtake.
- Commissioning and testing of the new trunk main, would include:
 - Visual inspections
 - Soil compaction testing
 - Hydrostatic testing of the trunk main
 - Water quality testing
 - Flushing and disinfection
 - Handover of the pipeline to Hunter Water for operation.
- Site demobilisation and restoration:
 - Remove temporary ancillary and laydown areas as well as clear up stockpiles
 - All construction material would be removed from site and the area would be rehabilitated
 - Erosion and sediment controls would be in place until the site is stabilised with seeded groundcover.

The choice of materials procured for the proposal would aim to have a sustainability focus and where possible recycled content would be used.



3.1.5 Plant and equipment

The construction works would require a variety of construction plant and equipment including a mobile site office. The main plant and equipment required would be confirmed in detail design and would include, but is not limited to, the following:

- Delivery and haulage truck
- Small tools
- Compactor
- Excavators and backhoes
- Trencher
- Truck for transporting material
- Four-wheel drive vehicles
- Water truck
- Pile driving machine (if required)
- Pipe jacking equipment
- Rock hammer
- Dewatering equipment (e.g. generator, tank and pumps)
- Light vehicles for contractor staff
- Generators
- Horizontal directional drilling equipment (if required)
- Dozer / vacuum / grader truck
- Welding equipment
- Bobcat
- Franna truck
- Concrete truck
- Concrete saw
- Impact piling rig

3.1.6 Construction workforce

The construction workforce is expected to fluctuate, depending on the stage of construction and associated activities. It is estimated there would be approximately 20-50 workers, depending on whether the pipeline and reservoir are constructed concurrently or progressively. The final number of construction workers would be dependent on the construction method and be determined by the construction contractor.

3.1.7 Timing and staging

The proposal is anticipated to commence in 2023 and take up to 12 months (weather permitting) to complete.

Work would be undertaken during standard construction working hours as follows:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturdays
- No work Sundays or public holidays.

Hours of construction for the proposal would be in accordance with the *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change (DECC), 2009). If works are required outside of standard working hours, the works would need to be clearly justified, appropriate control measures identified and approval from Hunter Water would be required prior to works commencing.

3.1.8 Ancillary facilities and access

Site access

The proposal would be accessed via New England Highway, existing local roads and potentially private properties and driveways (refer to **Figure 1-2**). The use of the private property and driveways would be in agreement and consultation with the landowner.

Construction would generate heavy vehicle movements associated with the delivery of construction materials, plant and equipment and the removal of spoil, waste and equipment. Approximately 4 trucks would be required on site each day, resulting in up to about 20 movements in and out of site



per day. About 20 light vehicles associated with contractors would also contribute to traffic generated by the proposal, but traffic from the proposal is expected to be limited to the times before and after shifts. Vehicle numbers may fluctuate depending on stages of construction and would be confirmed during detailed design and construction planning. Vehicle parking would occur within the proposed ancillary laydown areas (as indicatively identified in **Figure 1-2**) before parking along local roads as a last resort.

A traffic management plan would be prepared by the construction contractor and endorsed by Hunter Water before implementation. Construction of the trunk main would require restriction of local roads within the proposal area including partial lane closure, local road closure and/or construction speed limits.

Access to driveways and the private road to the reservoir site would be maintained as far as practicable throughout construction. Vehicular access to some properties may be restricted for short periods during construction. As the proposal would be constructed progressively, this would minimise the duration of time that access would be impacted at any location. During construction, alternative informal pedestrian access would be made available at each construction location as required. Potential impacts on vehicular and pedestrian access are assessed in **Section 6.9**.

Ancillary and laydown areas

The number and location of proposed ancillary laydown areas for the proposal would be determined during the detailed design and confirmed prior to the construction contractor mobilisation. For the purpose of this REF, eight ancillary and laydown areas have been considered as shown on **Figure 1-2**.

These ancillary and laydown areas would be within the proposal area and within existing cleared areas. These areas would be used to store materials and machinery. The ancillary laydown areas would be securely fenced with temporary fencing. Signage would be erected advising the general public of access restrictions.

Ancillary laydown areas located on private property would be in agreement and consultation with the property owners.

Following construction, the ancillary sites, work areas and stockpiles would be removed, and the sites would be cleared of all rubbish and materials and rehabilitated to their existing condition or as otherwise agreed with the landowner on completion of works.

Additional ancillary laydown areas may be required, and this would require additional environmental assessment and approval.

Stockpiling and excavated material management

The location of stockpile areas within the proposal area is to be confirmed by the construction contractor. It is anticipated that stockpile areas would be used for storage of pipe and topsoil within the proposal area.

Excavated material would be stored adjacent to trench works. Excess clean spoil, including topsoil, weathered material and weathered rock would be reused onsite and spread over the surface near trenches. This spread would not exceed a depth of 100 mm following existing contours to avoid ponding or changes in surface water flows.



3.1.9 Property acquisition and leasing

The proposal would not require any property acquisitions. The current easement alignment would be adjusted to include both existing and new trunk main. The width of the current easement would remain the same and no acquisition of private land would be required.

Proposal construction would require a corridor of up to 25 m wide (the proposal area) to accommodate the construction activities, ancillary laydown areas and stockpiles. The majority of the land affected by the proposal is owned by Hunter Water, TfNSW and MCC. One private property would have the existing easement adjusted to include the new and existing trunk mains. No temporary leases or property acquisition would be required to support the proposal. Hunter Water would continue to consult with landowners regarding access, road closures, or traffic management (refer to **Section 5.1**).

3.2 Operational requirements

The proposal would be operated and maintained by Hunter Waters civil maintenance team. The new trunk main would remain unmanned during operation.

Maintenance would include yearly inspection of surface fittings to ensure accessibility. Tablet dosing of the reservoir would occur approximately two times a week.

The new reservoir would be integrated into the Hunter Water telemetry (supervisory control and data acquisition (SCADA)) system which is monitored on a 24-hour per day basis and allows remote operation of assets.



4 STATUTORY FRAMEWORK

4.1 Environmental Planning Instruments

The EP&A Act provides for the creation and implementation of State Environmental Planning Policies (SEPPs) and Local Environment Plans (LEP). Collectively they are referred to as Environmental Planning Instruments (EPIs) and can be used to determine whether an activity is permissible. The following section outlines relevant EPIs for this proposal.

4.1.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

The *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&ISEPP) describes certain developments that may be carried out without consent in order to facilitate the delivery of infrastructure in NSW.

The aim of Chapter 2 (Infrastructure) is to facilitate effective delivery of infrastructure projects across NSW. This chapter describes certain developments that may be carried out without consent in order to facilitate the delivery of infrastructure in NSW.

Chapter 2, Division 24, Section 2.159 of T&ISEPP enables development for the purpose of water supply system to be carried out without consent. As the proposal would form part of a water supply system and Hunter Water is a public authority, it is considered permissible without consent pursuant to the provisions of T&ISEPP and can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

The proposal area is not located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) and does not affect land or development regulated by the *State Environmental Planning Policy (Planning Systems) 2021*.

The REF will include confirmation of any consultation requirements under Chapter 2, Division 1 Consultation of the T&ISEPP and will include NPWS under Section 2.15(2)(b).

4.1.2 State Environmental Planning Policy (Resilience and Hazards) 2021

The *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP) consolidates and repeals the provisions of the following three SEPPs including the SEPP (Coastal Management) 2018 (Coastal Management SEPP), SEPP 33 – Hazardous and Offensive Development (SEPP 33) and SEPP 55 – Remediation of Land (SEPP 55).

Chapter 4 (Remediation of land) of the Resilience and Hazards SEPP provides a state-wide planning framework for the remediation of contaminated land and to minimise the risk of harm. Section 4.6 of Resilience and Hazards SEPP requires consideration of whether the land is contaminated and whether it is suitable (or can be made suitable) for proposed development. As the proposal is being assessed under Division 5.1 of the EP&A Act, Hunter Water is not required to consider Chapter 4 of the Resilience and Hazards SEPP, however potential contamination impacts are discussed in **Section 6.1**.

4.1.3 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP) incorporates and repeals 11 SEPPs including the SEPP (Vegetation in Non-rural areas) 2017 (Vegetation SEPP) and the SEPP (Koala Habitat Protection) 2021 (Koala SEPP 2021).

Chapter 3 (Koala SEPP 20) and Chapter 4 (Koala SEPP 21) aim to encourage conservation and management of areas of natural vegetation that form koala habitats. MCC LGA is subject to the provisions of Chapter 3 (Koala SEPP 20) and Chapter 4 (Koala SEPP 21) of the Biodiversity and



Conservation SEPP. However, these chapters only apply to developments where council are the consent authority. In addition, the proposal area does not include any mapped “potential” or “core” koala habitat. As such, no further assessment in accordance with Biodiversity and Conservation SEPP is required.

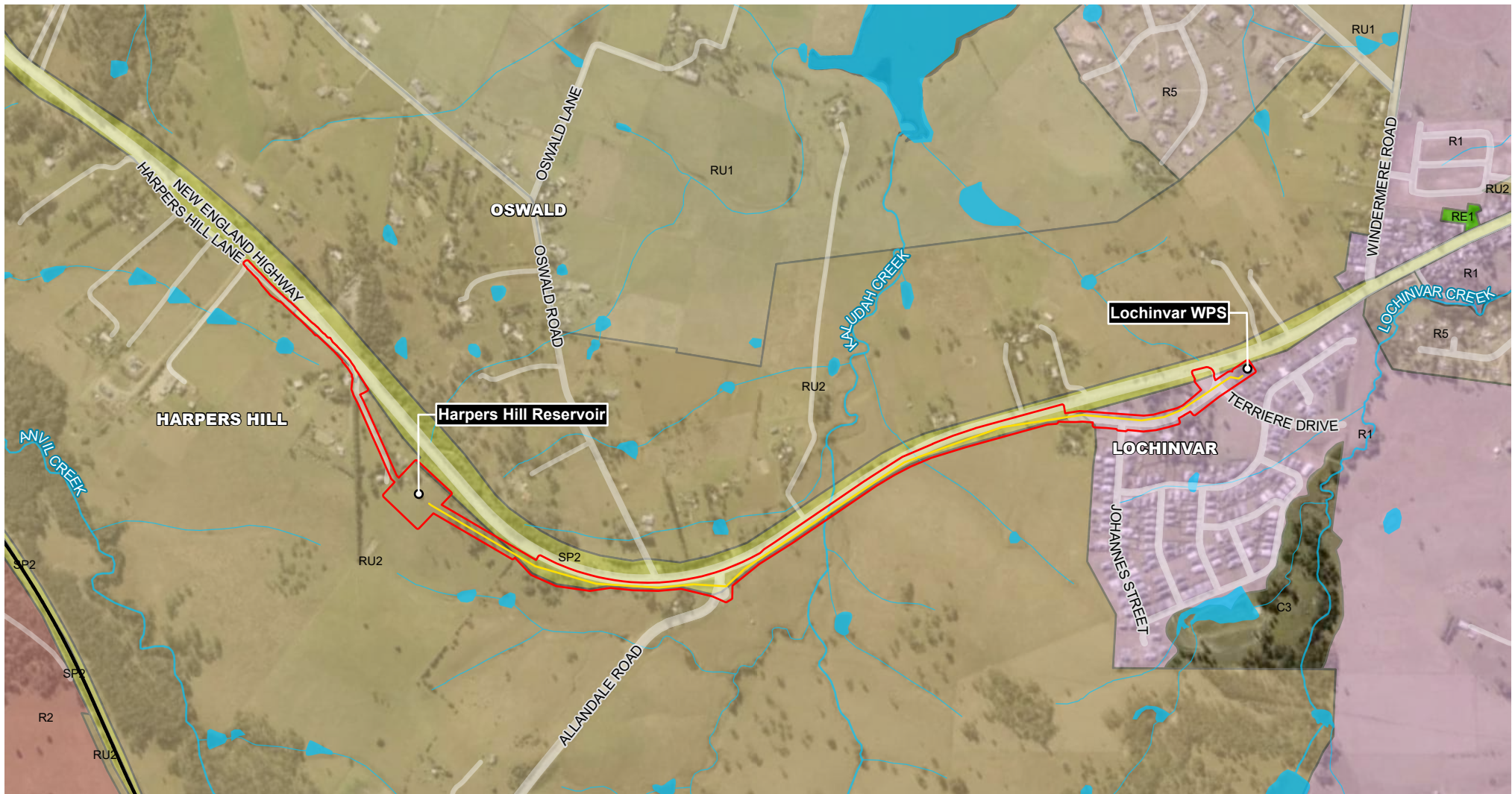
Section 6.3 provides further discussion in relation to biodiversity.

4.1.4 Maitland Local Environmental Plan 2011

The proposal area is located within the Maitland LGA. The relevant local planning instrument for the proposal area is the *Maitland Local Environmental Plan 2011* (LEP).

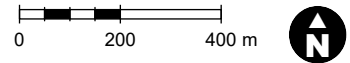
Land zoning maps indicate that the proposal area is located on Rural Landscape (RU2) and SP2 (Infrastructure) land zonings, with the easternmost section of the proposal area near Lochinvar zoned as R1 (General Residential) (refer to **Figure 4-1**).

Despite any provision of the LEP, the T&ISEPP prevails over the LEP to the extent of any inconsistencies. Therefore, the proposed works are permissible without consent due to the provisions of the T&ISEPP without the need for any further consideration of the LEP.



- Proposal area
 - New trunk main
- | | |
|---|--|
| <p>Land zoning</p> <ul style="list-style-type: none"> R1 General Residential R2 Low Density Residential R5 Large Lot Residential RE1 Public Recreation | <ul style="list-style-type: none"> RU1 Primary Production RU2 Rural Landscape SP2 Infrastructure |
|---|--|

— Railway



1:15,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Department of Planning and Environment 2022
- Aerometrex 2021

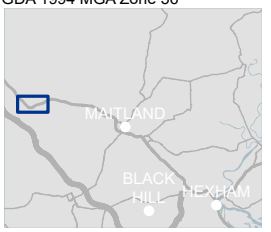


Figure 4-1 Land zoning

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4.2 NSW legislation

4.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act and its associated regulation, *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation 2021), provide the framework for assessing the environmental impacts of proposed developments in NSW.

Hunter Water is the determining authority under Division 5.1 of the EP&A Act and is required to determine whether the proposal is likely to have a significant impact on the environment.

The description of the proposal and associated environmental impacts has been carried out with consideration of section 171 of the EP&A Regulation 2021 (summarised in **Appendix A**), the BC Act, the *Fisheries Management Act* (FM Act), and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In doing so, the REF helps to fulfil the requirements of section 5.5 of the EP&A Act that Hunter Water examine and take into account to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the proposal.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an EIS to be prepared and approval to be sought from the Minister for Planning and Homes under Division 5.2 of the EP&A Act
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR).

Potential environmental impacts associated with the proposal are discussed in **Section 6**.

4.2.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is the primary piece of legislation regulating pollution control and waste disposal in NSW and is administered by the NSW Environmental Protection Authority (EPA). It provides an integrated system of licenses to set out protection of the environment policies and to adopt more innovative approaches to reduce pollution in the environment, having regard to the need to maintain ecologically sustainable development (ESD). Measures to address potential pollution as a result of the proposal have been prescribed in this REF and are included in **Section 6.1**.

Where an activity is deemed a scheduled activity an Environmental Protection Licence (EPL) is required. The proposal is not considered a scheduled development work or scheduled activity under the POEO Act and therefore does not require an EPL under this Act. However, under section 148 of the Act, the EPA must be notified of any pollution incidents that cause or threaten material harm to the environment.

4.2.3 Contaminated Land Management Act 1997

Contaminated land is regulated in NSW by the *Contaminated Land Management Act 1997* (CLM Act) and *Contaminated Land Management Regulation 2013*. Upon excavation, contaminated soils that are removed from a site as spoil may be classified as waste, the regulation and management of which is governed by the POEO Act and EPA Waste Classification Guidelines.

4.2.4 Biodiversity Conservation Act 2016

The BC Act lists out the legislative requirements needed to maintain a healthy, productive and resilient environment in NSW, consistent with the principle of ESD. If any of the listed threatened species or ecological communities under the BC Act could be impacted by the proposal, the proponent may either apply the Biodiversity Offset Scheme or prepare a SIS.

Due to the minor nature of the biodiversity impact, the proposal would not trigger the Biodiversity Offsets Scheme under the NSW BC Act, and thus a Biodiversity Development Assessment Report



(BDAR) is not required. The proposal is unlikely to have a significant impact on any threatened species or ecological community listed under the BC Act, as such, an SIS is not required.

Section 6.3 provides further discussion in relation to biodiversity.

4.2.5 Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) aims to protect and conserve non-Aboriginal cultural heritage, including scheduled heritage items, sites and relics.

The Heritage Act makes provision for a place, building, work, relic, moveable object, precinct, or land to be listed on the State Heritage Register. If an item is the subject of an interim listing, or is listed on the State Heritage Register, a person must obtain approval under section 58 of the Heritage Act for works or activities that may impact on these items.

The proposal is not anticipated to have an impact on non-Aboriginal heritage items as discussed in **Section 6.7**.

4.2.6 National Parks and Wildlife Act 1974

The NPW Act governs the establishment, preservation and management of national parks, historic sites and certain other areas, and Aboriginal relics. Items of Aboriginal cultural heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act. Aboriginal objects are protected under section 86 of the Act. Under section 90(1) of the NPW Act, the Chief Executive may issue an Aboriginal heritage impact permit for an activity which would harm an Aboriginal object.

There is one Aboriginal Heritage item listed within close proximity of the proposal area. An Aboriginal Heritage Due Diligence Report (Jacobs, 2022) has been prepared for the proposal and is summarised in **Section 6.6**. It is anticipated that the proposal would not impact on any Aboriginal heritage listed items.

4.2.7 Rural Fires Act 1997

Under section 63 of the *Rural Fires Act 1997*, public authorities must take all practicable steps to prevent the occurrence and spread of bush fires on or from land vested in or under its control or management. The proposal is located within bushfire prone land. Bushfire risk is discussed within **Section 6.3**.

4.2.8 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) covers all biosecurity risks, including pest animals, plant diseases and noxious weeds. The Act provides the regulatory controls and powers to manage noxious weeds in NSW and introduces the legally enforceable concept of a General Biosecurity Duty. This means that a person dealing with plant matter must take measures to prevent, minimise or eliminate the biosecurity risk (as far as reasonably practicable).

The proposal area is located within the Hunter Local Land Services (LLS) region of NSW. The *Hunter Regional Strategic Weed Management Plan (2017-2022)* (Hunter LLS, 2017) provides the framework for weed management within the Hunter region.



Under Part 3 of the Biosecurity Act, all landowners or land managers have a 'General Biosecurity Duty' to prevent, eliminate or minimise the biosecurity risk posed or likely to be posed by Priority Weeds and are required to follow the regional and non-regional duties which have been allocated to each Priority Weed. A stand of African Olive (*Olea europaea* subsp. *cuspidata*) is located within the proposal area, and Coolatai Grass and Cotoneaster weeds were identified during the field survey. While these species are not Weeds of National Significance, they are subject to General Biosecurity Duties under the Biosecurity Act (refer to **Section 6.3**).

4.2.9 Water Management Act 2000

The *Water Management Act 2000* (WM Act) provides that certain types of development and activities that have the potential to impact on a water resource are controlled activities which require approval from the Department of Planning and Environment – Water (DPE-Water).

While the proposed is located on waterfront land, as a public authority, Hunter Water is exempt from the requirement for a controlled activity approval (Section 91E(1)) under clause 41 of the *Water Management (General) Regulation 2018*. Management of potential impacts to water quality in nearby waterways are discussed in **Section 6.2**.

Should groundwater extraction be required during construction a Water Supply Work Approval must be sought from DPE – Water. Where greater than 3 ML in a financial year is taken a Water Access Licence (WAL) would also be required.

4.2.10 Waste Avoidance and Resource Recovery Act 2011

The *Waste Avoidance and Resource Recovery Act 2011* (WARR Act) aims to encourage the efficient use of resources and minimisation of waste generation through the minimisation of resources use, promotion of resource recovery and avoidance of disposal of wastes.

As detailed in **Section 6.11**, the proposal would be constructed and operated in accordance with the principles of the waste hierarchy in order to promote the objective of the WARR Act.

4.2.11 Roads Act 1993

The *Roads Act 1993* (Roads Act) regulates the carrying out of certain activities on public roads, provides classification of roads and establishes procedures for opening and closing public roads.

Section 138 of the Roads Act requires consent to be obtained from the appropriate roads authority for the following works:

- Erect a structure or carry out a work in, on or over a public road or
- Dig up or disturb the surface of a public road or
- Remove or interfere with a structure, work or tree on a public road or
- Pump water into a public road from any land adjoining the road or
- Connect a road (whether public or private) to a classified road.

The proposal involves disturbing the surface of the Harpers Hill Lane, and as such may temporarily interrupt traffic flows. Harpers Hill Lane is located within the New England Highway road reserve. Under section 138(1) of the Roads Act, consent from TfNSW and MCC is required. Approval would be sought for a road occupancy licence for the temporary closure of affected roads during construction.

4.2.12 Fisheries Management Act 1994

The FM Act includes provisions to list threatened species of fish and marine vegetation, including endangered populations, ecological communities and key threatening processes (KTPs). If the



proposal is likely to significantly impact on the threatened species, populations or ecological communities, then a SIS is required.

Under Section 199 of the FM Act, the Minister for Agriculture must be notified before dredging work or reclamation work is authorised by Hunter Water. Any matters concerning the proposed work raised within 21 days by the Minister must be considered. Consultation carried out under the FM Act is discussed in **Section 5.2.2**.

4.2.13 Hunter Water Act 1991

The *Hunter Water Act 1991* (HW Act) establishes the legal framework for the operation of the Hunter Water and the requirement for licences for Hunter Water operations.

All Hunter Water operations including the site are operated in accordance with Hunter Water Operating Licence 2017 – 2022 (the Licence). The licence conditions include requirements for the management of Hunter Water assets and for maintaining service levels with minimal disruption. The proposal has a role in supplying water management services to Hunter Water customers and is therefore integral to meeting its licence requirements. The proposal is therefore consistent with Hunter Water's current licence and therefore the requirements of the HW Act.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act a referral is required to the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) for proposed actions that have the potential to significant impact on matters of national environmental significance (MNES) or the environment of Commonwealth land.

The EPBC Act lists the MNES that are to be considered when determining whether an activity is a controlled action which requires referral to the Commonwealth Minister for the Environment.

The likelihood of an impact from the proposal on any MNES matters, as listed under the EPBC Act, is discussed in **Section 6.3** and **Appendix B**.

The proposal would not have a significant impact on MNES or the environment of Commonwealth land. Accordingly, the proposal has not been referred to DCCEEW.

4.3.2 Native Title Act 1993

The *Native Title Act 1993* (NT Act) provides a framework for the determination of native title claims within Australia, and for negotiations and decision making regarding the use and management of native title lands and waters. Exclusive rights to land are only available on certain unallocated or vacant Crown lands.

A Native Title Registrar is responsible for maintaining three Registers under the NT Act: the National Native Title Register, the Register of Native Title Claims, and the Register of Indigenous Land Use Agreements (ILUAs).

The proposal would not affect land subject to native title or to which an Indigenous Land Use Agreement applies.

4.4 Licences and approvals

Hunter Water is required to determine the proposal under Division 5.1 of the EP&A Act. A review of relevant legislation has been undertaken in preparation of this REF.



The following approvals may be required for the proposal:

- Water Supply Work Approval from the DPE – Water for dewatering works if required and a water access licence under section 56 of the WM Act for extraction of more than 3 ML of groundwater (if encountered)
- Council approval for work on local roads under section 138 of the Roads Act.

5 STAKEHOLDER AND COMMUNITY CONSULTATION

5.1 Community consultation

Hunter Water has consulted with local residents and private property owners that have the potential to be affected by the proposal. This community consultation involved the following:

- Letters/emails and phone calls with private property owners and local residents in September 2021 and June 2022 to inform the local community about project commencement
- Letter/emails to Maitland City Council in June 2022 and August 2022 to provide proposal update
- Notice of Entry issued to the private property owner (of 1351 New England Highway, Harpers Hill) in May 2022 and June 2022.

No other public consultation has been carried out for this proposal.

During construction, consultation would occur with the community as part of the Construction Community Liaison Plan (CCLP) and in accordance with Hunter Water procedures for notifying out of hours works (OOHW) and road closures or traffic management. The CCLP would likely include:

- A letter notifying adjoining landholders and neighbours at the start of works
- A letter notifying adjoining landholders, directly/indirectly impacted neighbours about change of work, night works, proposal delays
- Door knocking, meetings, phone calls, emails for directly impacted neighbours as required.

The Section 171(4) of the EP&A Regulation 2021 requires that an REF must be published on the determining authority's website or the NSW Planning Portal if:

- The proposal has a capital investment value of more than \$5 million
- The proposal requires an approval or permit under:
 - Sections 144, 201, 205 or 219 of the FM Act
 - Section 57 of the Heritage Act
 - Section 90 of the NPW Act
 - Sections 47-49 of the POEO Act.

The proposal may exceed the capital investment value of \$5 million and be of public interest. Hence, this REF will be published on the Hunter Water website.

5.2 Government agency and other stakeholder consultation

5.2.1 T&ISEPP consultation

Part 2.2 General, Division 1 of the T&ISEPP prescribes consultation to be undertaken by a public authority prior to the commencement of certain activities. A review of the T&ISEPP consultation requirements for the proposal is provided in **Table 5-1**.

Where consultation has been undertaken, the details of this have been provided in **Section 5.2.2**.



Table 5-1 T&ISEPP consultation requirements

Is consultation with Council required under sections 2.10-2.12 and 2.14 of T&ISEPP?	Yes/No
Is the proposal likely to have a substantial impact on stormwater management services which are provided by council?	No
Is the proposal likely to generate traffic to an extent that will strain the capacity of the existing road system in a LGA?	No
Will the proposal involve connection to a council owned sewerage system? If so, will this connection have a substantial impact on the capacity of any part of the system?	No
Will the proposal involve connection to a council owned water supply system? If so, will this require the use of a substantial volume of water?	No
Will the proposal involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a minor or inconsequential disruption to pedestrian or vehicular flow?	No
Will the proposal involve more than minor or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	Yes
Is the proposal likely to have a more than minor or inconsequential impact on a local heritage item (that is not also a State heritage item) or a heritage conservation area?	No
Is the proposal located on flood liable land? If so, will the works change flood patterns to more than a minor extent?	No
Is the proposal within the coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No
Is consultation with a public authority other than Council required under sections 2.13,2.15 and 2.16 of T&ISEPP?	Yes/No
Is the proposal located on flood liable land and permissible without development consent under the following provision of Part 2.3 of the T&ISEPP?:	No
<ul style="list-style-type: none"> (a) Division 1 (Air transport facilities), (b) Division 2 (Correctional centres and correctional complexes) (c) Division 6 (Emergency services facilities and bush fire hazard reduction) (d) Division 10 (Health services facilities) (e) Division 14 (Public administration buildings and buildings of the Crown) (f) Division 15 (Railways) (g) Division 16 (Research and monitoring stations) (h) Division 17 (Roads and traffic) (i) Division 20 (Stormwater management systems). 	
Is the proposal adjacent to a national park or nature reserve, or other area reserved under the <i>National Parks and Wildlife Act 1974</i> , or on land acquired under that Act?	No
Is the proposal on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No
Is the proposal adjacent to an aquatic reserve or a marine park declared under the <i>Marine Estate Management Act 2014</i> ?	No
Does the proposal consist of a fixed or floating structure in or over navigable waters?	No



Is consultation with Council required under sections 2.10-2.12 and 2.14 of T&ISEPP?	Yes/No
Is the proposal on land in a mine subsidence district within the meaning of the <i>Coal Mine Subsidence Compensation Act 2017</i> ?	No
Is the proposal located bush fire prone land and for the purpose of a health services facilities, correctional centres, or residential accommodation?	No

5.2.2 Agency consultation

Maitland City Council

Consultation was carried out with MCC as the proposal would impact on local roads under the Council's control.

Letters were sent to MCC on 24 November 2022 (refer to **Appendix C**). The letters provided information on the proposal and invited responses with any issues or concerns.

MCC responded on 26 October 2022 with specifications for the private road including 3.5 m width, two coat spray seal, barricading between the lane extension and the New England Highway and that the lane extension would be Hunter Water's responsibility to maintain.

MCC responded further on 9 December 2022 with comments regarding the positioning of a lockable gate and the lodgement of particular documents for a Section 138 assessment under the *Roads Act 1993*. MCC also requested further detail regarding the barricade between the lane extension and the New England Highway.

Hunter Water will continue to consult with MCC.

Transport for NSW

Consultation was carried out with TfNSW as the proposal would impact on TfNSW Road Reserve for the New England Highway.

Letters were sent to TfNSW on 24 November 2022 (refer to **Appendix C**). The letters provided information on the proposal and invited responses with any issues or concerns. A response had not been received at the time of writing.

Hunter Water will continue to consult with TfNSW.

Department of Primary Industries – Fisheries

Notification was provided to the Department of Primary Industries – Fisheries (DPI – Fisheries) as the proposal would involve carrying out of dredging work at Kaludah Creek and an unnamed stream.

Letters were sent to DPI - Fisheries on 24 November 2022 (refer to **Appendix C**). The letters provided information on the proposal and invited responses with any issues or concerns. To date responses have not been received at the time of writing. Hunter Water will continue to consult with DPI – Fisheries.



6 ENVIRONMENTAL ASSESSMENT

6.1 Soils and geology

6.1.1 Existing environment

Geology and soil landscapes

Reference to the Newcastle Coalfield 1:100,000 Geological Map indicates that the proposal is underlain by two geological formations (refer to **Figure 6-1**):

- The westernmost boundary of the proposal to the eastern boundary of the reservoir site is comprised of the Farley formation (Pdar) which typically consists of sandstone and silty sandstone
- The eastern boundary of the reservoir site to west of Allandale Road consists of Rutherford formation (Pdaa) which typically consists of siltstone, mudstone, shale, marl, sandstone, minor conglomerate
- West of Allandale Road to the eastern most boundary of the proposal is comprised of Lochinvar formation (Pdal) which typically consists of basalt, siltstone and sandstone.

Bedrock is generally overlain by soil that has weathered from these rock types. Siltstone / sandstone (generally horizontally bedded) was observed in the rock cutting at Walkers Hill Lane (Douglas Partners 2010).

The NSW government eSpade spatial viewer identified the soil classification type is Melanic Brown Ferrosol Australian Soil Classification with no presence of saline soils.

The subsurface conditions are expected to comprise of clay overlying weathered rock with no groundwater expected to be encountered.

The proposal area is between 36 m and 120 m above sea level. The topography in the proposal area is undulating with elevations lower at the eastern end and rising up to 120 m on top of the hill at the reservoir tank.

The site is not located within a Mine Subsidence District.

Acid sulfate soils and salinity

ASS are natural sediments that contain iron sulfides. They are common along the NSW coast. When disturbed or exposed to air these soils can release acid, damaging built structures and harming or killing animals and plants.

A review of the NSW government 1:25,000 scale ASS risk mapping identified the proposal area within an area classified as no risk of ASS (Class 5) (refer to **Figure 6-2**).

Contamination

As part of the geotechnical investigation works a contamination preliminary site investigation was carried out between 21 and 24 June 2022. The results of the preliminary contamination testing are documented in the *Summary Report on Preliminary Contamination Testing - Harpers Hill Reservoir and Lochinvar 2 WPS Rising Main, Harpers Hill Lane, Harpers Hill & New England Highway, Lochinvar* (Douglas Partners, 2022a) (contamination assessment report). The findings of this report is summarised below.

A search of the EPA's Contaminated Land Record of Notices, List of NSW Contaminated sites notified to the EPA and the EPA POEO Act public register in August and October 2022 did not identify any registered contaminated sites within 500 m of the proposal area.



Within pasture areas there is some risk of contamination due to pesticide use and potential elevated nutrient levels. Within the road reserves there is some risk of contamination due to potential imported fill, leaching of hydrocarbons and / or heavy metals from road pavements.

Field observations identified potential contamination, including:

- Unknown fill material at 12 out of 14 bores collected along the length of the proposal
- Bitumen and hydrogen odour in the fill at a bore directly to the east of the unnamed stream
- Bitumen in a bore located about 220 m west of Allandale road
- Brick in the fill at the reservoir
- Opportunistic dumping comprising concrete rubble, general rubbish and litter and soil stockpiles. A brief inspection of these dumping sites did not observe fibro fragments, adhering fibro formwork or asbestos containing materials.

A total of 20 soil samples were collected along the length of the proposal and analysed for a series of contaminants of potential concern. The contamination assessment report concluded the following:

- Metals (including copper) were detected above laboratory reporting limits in all soil samples tested
- PAH and TRH were detected at or above laboratory detection limits in some soil samples tested
- No coal tar was found in the soil samples containing bitumen
- Brick fragments at the reservoir site were found to contain friable asbestos / asbestos fines.

The contaminant concentrations were compared against the human health and ecological criteria and the waste classification guideline relevant to the existing land uses within the proposal area.

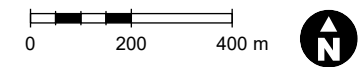
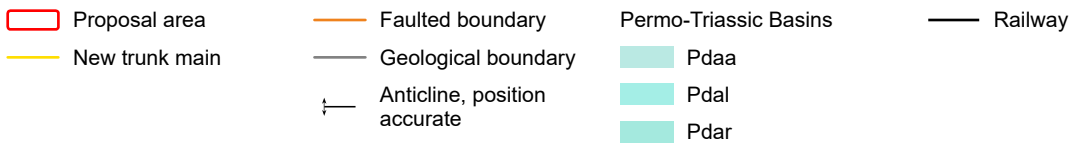
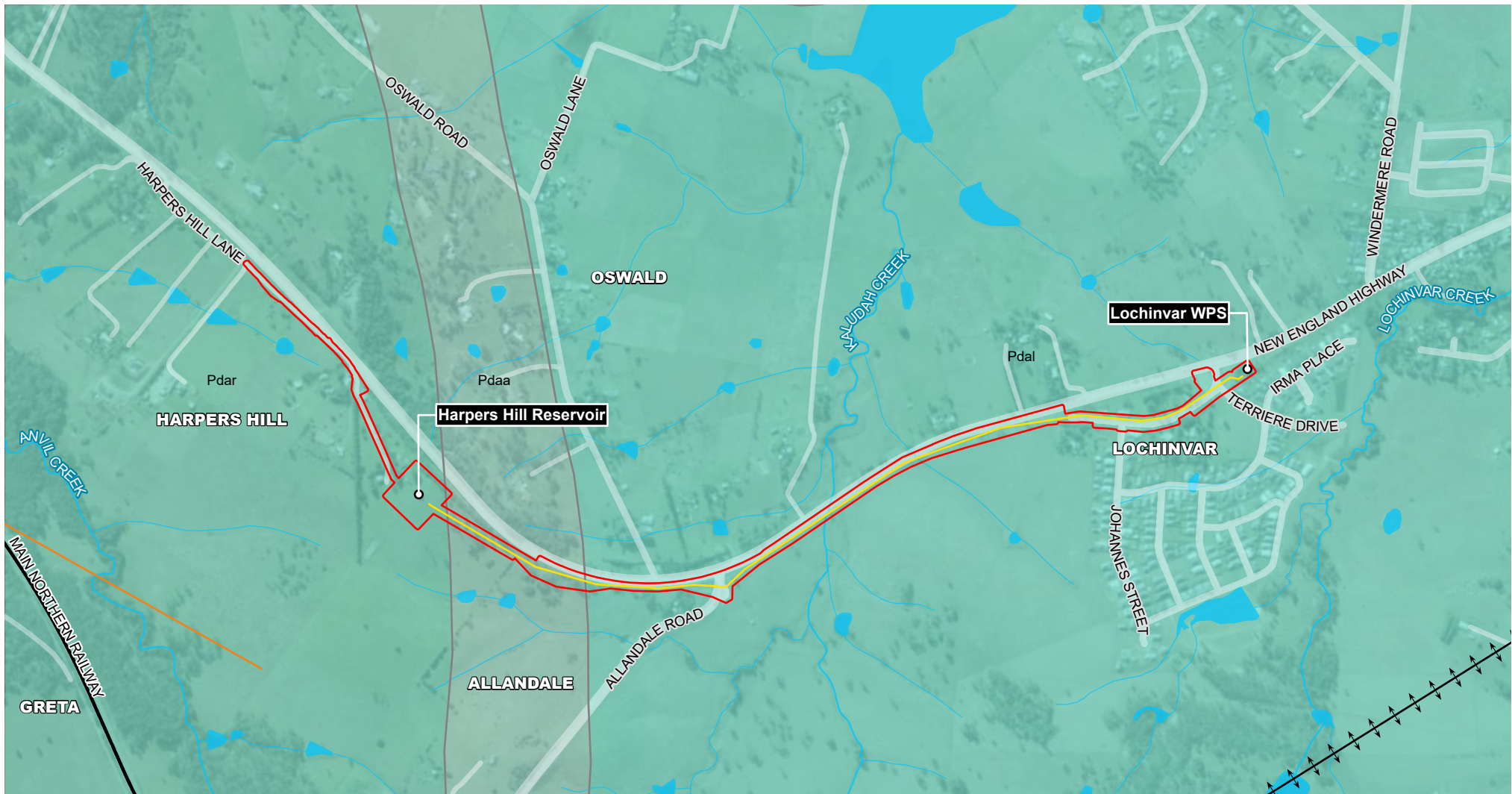
The contaminant concentrations within the soil samples were compared against the *human health criteria* (NEPC, 2013) and were generally within the adopted criteria. Seven samples exceeded the criteria for carcinogenic polycyclic aromatic hydrocarbons (PAHs) within the health investigation levels (HIL) and health screening levels (HSL) for residential and recreational / open spaces land use. In addition, friable asbestos (less than 7 mm in size) was detected at a low concentration in one sample and fell below the NEPC (2013) criteria.

The ecological investigation levels (EIL) and ecological screening level (ESL) for urban residential and public open spaces were compared against the contaminant concentrations within the soil samples. There were multiple exceedances of metals (copper), PAHs in the form of benzo(a)pyrene and total recoverable hydrocarbons. A comparison of the contaminant concentrations and EIL and ESL for commercial / industrial use found two exceedances of metals (copper) and multiple exceedances of PAHs in the form of benzo(a)pyrene.

The contaminant concentrations were also compared against the Waste Classification Guidelines (NSW EPA, 2014). The following contaminants exceeded the criteria:

- Nickel and friable asbestos was identified at a bore located at the reservoir site
- Benzo(a)pyrene was identified at bores located at Lochinvar WPS, Allandale Road, east of the unnamed stream and Harpers Hill Lane
- Nickel and benzo(a)pyrene was identified at a bore in St Helens Close and a bore around 220 m west of Allandale Road.

This conclusion provides an indication of what would be found in the proposal area during construction. This is particularly important given the unpredictable nature of the placement of imported fill materials and wastes in the past and the uncertainty associated with waste distribution and composition.



1:15,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Department of Regional NSW 2022
- Aerometrex 2021

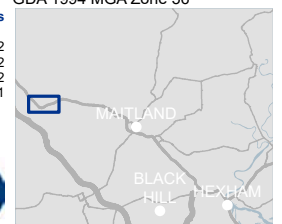
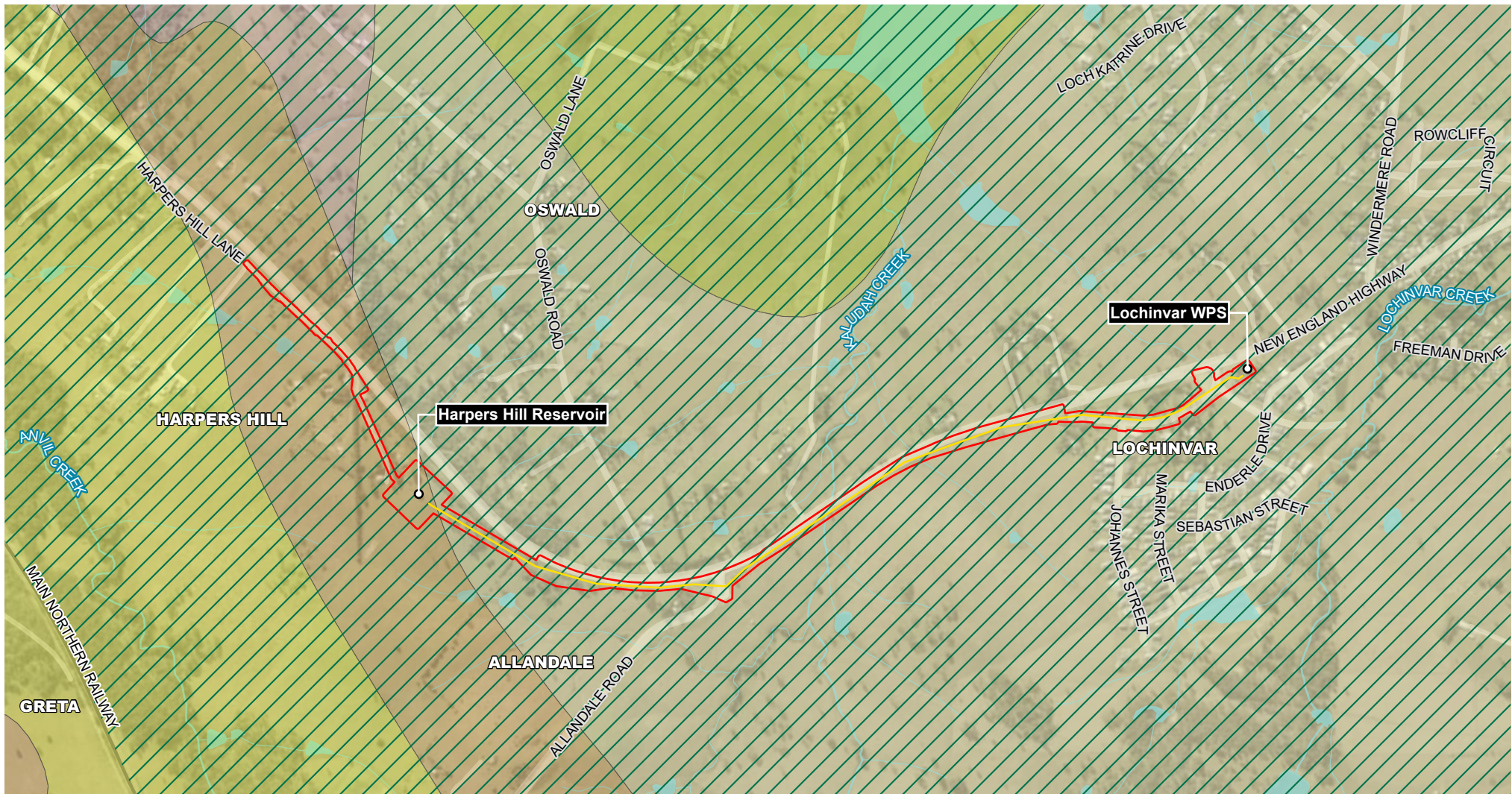


Figure 6-1 Geology



Proposal area	Acid Sulfate Soil Risk Class 5	Soils (1:250000, Singleton) Alluvial soils	Railway
New trunk main		Chocolate soils	
		Non-calcic brown soils	
		Red podzolic soils	
		Yellow podzolic soils	

1:15,000 at A4
GDA 1994 MGA Zone 56

Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Department of Regional NSW 2022
 Aerometrex 2021

Figure 6-2 Soils



6.1.2 Impact assessment

Construction

Construction activities would have the following impacts on soils and contamination:

- Soil erosion and loss of topsoil: Excavation would be required for construction of the proposal which may result in the mobilisation of sediment, particularly during wet weather. This may be further exacerbated by removal of grass / trees and / or their roots that provide additional soil stability. Loss of soil from the proposal area may also occur from stockpiles and dust generated during vehicle movements. Soil erosion impacts may be greater where Kaludah Creek and the unnamed creek are crossed
- Erosion and sedimentation may have adverse environmental impacts on water quality and biodiversity and would be managed through on-site erosion and sediment control coordinated by the construction contractor. Additionally, minimising the time that soil is exposed from trenches and excavations would reduce potential for erosion and sedimentation
- Spills of contamination materials: There would be potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials. Spill kits would be used to contain spills and spill response procedures would be followed. These impacts would generally be temporary.
- Frac-outs: While underboring, there is the potential for frac outs, where drilling fluid is released or there is mud loss to the ground surface during horizontal directional drilling.

As discussed in **Section 6.1.1**, there is potential for asbestos, PAHs and other contaminated materials to occur within the proposal area. There is potential for construction activities to disturb and expose contaminants. Exposure to contaminated materials pose a risk to human health and to the environment and would require appropriate management.

Disposal of any contaminated material would be classified in accordance with the NSW EPA Waste Classification Guidelines 2014 (NSW EPA, 2014) and appropriately disposed of at a registered waste management facility. Waste is further discussed in **Section 6.11**.

Operation

There are no anticipated issues with soil disturbance or contamination risk during operation of the proposal.

6.1.3 Mitigation measures

The mitigation measures that would be implemented to minimise soil impacts of the proposal, along with the responsibility and timing for those measures, are presented in **Table 6-1**. Water quality impacts from the proposal are discussed in **Section 6.2**.

Table 6-1 Mitigation measures – Soils and geology

Impact	Mitigation measure	Timing	Responsibility
Erosion and sediment control	The Construction Soil and Water Management Plan (CSWMP) will include as a minimum, type and location of sediment/erosion controls to be used.	Prior to construction	Contractor
Erosion and sediment control	Erosion and sediment controls are to be implemented and maintained consistent with <i>Managing Urban Stormwater: Soils and Construction. Fourth Edition ed. Sydney (NSW) (Landcom, 2004) (the Blue Book)</i> . Controls include: <ul style="list-style-type: none"> • Be installed prior to disturbance commencing 	Prior to construction/ construction	Contractor



Impact	Mitigation measure	Timing	Responsibility
	<ul style="list-style-type: none"> Prevent sediment moving off-site and sediment laden water entering any watercourse, drainage line, or drain inlets Divert clean surface flow around exposed areas and stockpiles Reduce water velocity and capture sediment Minimise the amount of material tracked onto paved surfaces Be cleaned out before 30% capacity of controls is reached. 		
Erosion and sediment control	Disturbed areas will be stabilised as soon as practical after completion of works. Erosion and sediment controls will not be removed until suitable ground cover is achieved in accordance with the Blue Book.	Construction	Contractor
Landform	The natural landform of the site will be restored as closely as possible to the pre-works condition.	Construction	Contractor
Unknown finds	If during construction activities, contaminated soils are uncovered or are suspected to have been uncovered due to odour or discolouration of soils works will cease immediately, the Hunter Water Project Manager will be contacted, and the appropriate management requirements determined.	Construction	Contractor
Stockpile management	Any spoil storage areas or stockpiles (including within its stability limits) will have appropriate erosion control devices installed to control runoff and prevent sedimentation.	Construction	Contractor
Contamination	Contaminated solid wastes will be transferred to a registered waste management facility. Contaminated materials will be classified in accordance with the Waste Classification Guidelines to support appropriate disposal, selection of facilities and disposal cost. The CEMP will include protocols for unexpected finds and handling of contaminated soil.	Prior to and during construction	Contractor

6.2 Hydrology, flooding and water quality

6.2.1 Existing environment

Regional setting

The proposal area is located in the lower portion of the Hunter River catchment, which is about 24 km north-west of Newcastle. The prominent hydrological features associated with the proposal area include Kaludah Creek, Lochinvar Creek, various unnamed streams, and various water infrastructure owned by Hunter Valley Flood Mitigation Scheme and Hunter Water.

Kaludah Creek, a fourth order non-perennial creek, runs through the proposal area.

Kaludah Creek flows in a north-easterly direction towards the Hunter River and traverses the proposal area approximately 330 m northeast of the Allandale Road-New England Highway intersection. A non-perennial, unnamed first order stream joins Kaludah Creek approximately 300 m north of the proposal area and traverses the proposal area approximately 600 m northeast of Allandale Road-New England Highway intersection.



Lochinvar Creek flows in a north-easterly direction towards the Hunter River and is located approximately 350 m east of the proposal area. A perennial, unnamed first order stream joins Lochinvar Creek approximately 350 m east of the proposal area and flows adjacent to the southern boundary of the proposal area in an east-north-easterly direction.

Hydrology and flooding

A review of Maitland LEP in October 2022 indicated that the proposal would not be located within a Flood Planning Area. However, a Flood Planning Area associated with Kaludah Creek lies about 150 m north of the proposal, refer to **Figure 6-3**.

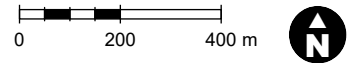
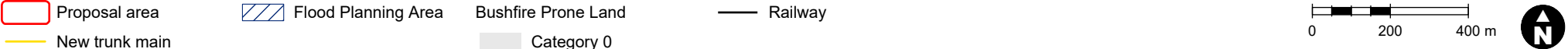
Groundwater

The proposal area is located in the Sydney Basin–North Coast Groundwater Source of the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 (NSW Government, 2016a) (applicable for groundwater). A search of the Australian Groundwater Explorer in August 2022 identified no recorded boreholes with standing water levels in and near the proposal area.

Groundwater was not encountered below the trunk main depth or near the new reservoir during the geotechnical investigations (Douglas Partners, 2022b). Groundwater was encountered at one bore (#104) at 2 m depth, however, was not encountered at the remaining bores.

Preliminary calculations were undertaken to estimate likely groundwater dewatering required as part of the proposal. These calculations were based on assumptions including soil type, exposed trenching per day and groundwater levels. Calculations found that the threshold level of 3 ML per year would unlikely be met.

Groundwater modelling would be carried out in subsequent stages of the proposal and would further assess the requirement for groundwater dewatering. If more than 3 ML of groundwater is expected to be extracted a Water Supply Work Approval from DPE – Water and a WAL would be required.



1:15,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Department of Planning and Environment 2022
- Department of Communities and Justice 2022
- Aerometrex 2021



Figure 6-3 Hazards



6.2.2 Impact assessment

Construction

Water quality

Construction activities next to and under Kaludah Creek and the unnamed stream have the potential to impact water quality by disturbing sediments. These sediments may be transported offsite into receiving watercourses which may include the unnamed stream, Kaludah Creek and eventually the Hunter River.

Activities that may increase erosion potential, resulting in an impact on local water quality through sedimentation, include:

- Trenching through Kaludah Creek and the unnamed creek (discussed further below)
- Removing vegetation
- Earthworks, including topsoil stripping, excavation and trenching
- Stockpiling of soils and vegetation
- Transporting cut and/or fill materials
- Moving heavy vehicles across exposed earth.

The potential impact of unmitigated construction activities on receiving surface waters include:

- Increased sedimentation due to increased erosion during rainfall events
- Transportation of sediment to the Hunter River
- Increased turbidity from sedimentation, resulting in reduced oxygen levels, clarity of water and restricting light and photosynthesis
- Reduced water quality, particularly increased nutrient loading released from mobilised sediments potentially leading to increased risk of algal blooms
- Reduced water quality from transportation of pollutants such as toxicants, heavy metals, oil and grease, and petroleum hydrocarbons from accidental spills or leaks of fuels and/or oils. which can impact on aquatic fauna that cannot tolerate poor water quality.

Trenching activities through Kaludah Creek and the unnamed stream poses the greatest risk to water quality. Direct unmitigated impacts would include release of eroded soil downstream into Hunter River and other receiving environments resulting in increased turbidity and smothering of downstream habitats. The risk of erosion is influenced by the extent of vegetation clearance and soil disturbance and topography. Soil and water quality measures would be applied to minimise the impact of downstream water quality impacts, including scheduling work (where reasonable and feasible) to occur during dry periods and when the ephemeral creeks are not flowing. These measures would be captured in the CSWMP.

The unmitigated risks to water quality from sediment or chemical runoff during the other construction activities (not including trenching through waterways) would be moderate. These potential impacts can, however, be readily mitigated with erosion and sediment controls and additional management measures as outlined in **Table 6-2**. Water quality within the proposal area during construction would be managed with temporary water quality controls in accordance with the guidelines set out in the *Soils and Construction – Managing Urban Stormwater Volume 1 (Landcom, 2004) and Volume 2D (Department of Environment, Climate Change and Water (DECCW), 2008)*. With the implementation of the proposed mitigation measures, the proposal would unlikely result in any significant long term impacts to downstream, water quality and aquatic ecosystems.

Trenching through Kaludah Creek and the unnamed stream would not likely impact on the bankful level as the creeks are 1-4 order streams and largely ephemeral. As such detailed design of waterway crossings are not required to consider the DPI guidelines *Why do Fish Need to Cross the*



Road? Fish Passage Requirements for Waterway Crossings (2003), DPI Guidelines for watercourse crossings on waterfront land (2012a), Guidelines for riparian corridors on waterfront land (2012b) and DPI Guidelines for controlled activities on waterfront land – riparian corridors (2018). Despite this, works within or near waterways would be undertaken with consideration given to the *Guidelines for Controlled Activities on Waterfront Land*.

Groundwater

The proposal has potential to directly or indirectly interfere with subsurface or groundwater flows associated with Kaludah Creek and other small unnamed streams.

Operation

There are no anticipated issues with hydrology, flooding or water quality during operation as the proposal would not affect hydrology, flooding or water quality after construction.

6.2.3 Mitigation measures

The mitigation measures that would be implemented to minimise hydrology, flooding and water quality impacts of the proposal are presented in **Table 6-2**.

Table 6-2 Mitigation measures – Hydrology, flooding and water quality

Impact	Mitigation measure	Timing	Responsibility
Incident management	An Incident Management Plan (IMP) will be prepared as part of the Contractor's CEMP and will include a contingency plan and emergency procedures for dealing with the potential spillage of fuel or other environmental incidents that may occur on the work site. The IMP should also contain procedures dealing with the unexpected onset of rainfall during the work period.	Prior to construction	Contractor
Contaminants entering receiving environments during construction	The storage and handling of fuels and chemicals will comply with Australian Standard (AS) AS1940. This includes the provision of a 'spill kit' to be kept on site at all times for potential chemical or fuel spills. All staff are to be made aware of the location of the spill kit and trained in its use.	Prior to construction/ construction	Contractor
	No chemicals, fuels, and/or waste will be stored or collected for disposal within or adjacent to drainage lines or unsealed surfaces.	Construction	Contractor
	Refuelling, fuel decanting and vehicle maintenance work will take place in a designated area on an impermeable surface.	Construction	Contractor
	Daily checks of vehicles working on the construction works will be conducted to ensure that no oils or fuels are leaking.	Construction	Contractor
Dewatering	Should groundwater extraction be required during construction, a Water Supply Work Approval will be sought from DPE - Water. Where greater than three ML in a financial year, a WAL would also be required. Any dewatering of groundwater should be undertaken in accordance with an approved dewatering management plan (DMP), which may	Prior to dewatering during construction	Contractor / Hunter Water



Impact	Mitigation measure	Timing	Responsibility
	include water quality requirements and discharge locations.		
	Water from trench/pits de-watering will be pumped and either collected in tanks for appropriate disposal or filtered through geotextile fabric onto grass filter areas. Groundwater volumes removed are to be reported to Hunter Water monthly. Any affected property owners will be consulted, and work agreed to before dewatering commences.	Construction	Contractor
	Water from excavations would be prevented from entering areas of native vegetation. The soil and water management measures would minimise any water runoff from dewatering activities. In addition, the area of soil surface disturbed and wetted would be kept to the minimum amount necessary to complete the works.	Construction	Contractor
Erosion and sedimentation	<p>A CSWMP will be prepared as part of the CEMP. The CSWMP will include but not be limited to:</p> <ul style="list-style-type: none"> • Measures to minimise/manage erosion and sediment transport • Measures to manage accidental spills, including the requirement to maintain material such as spill kits • Measures to manage stockpiles • Measures to rehabilitate disturbed areas as soon as practicable. 		
Trenching through waterways	<p>Control measures to manage potential pollution or sedimentation impacts from instream works will include but not be limited to:</p> <ul style="list-style-type: none"> • Floating silt fences and/or coffer dams for instream works • Provision to only undertake works when flows are low/dry for a suitable duration to complete work • Develop a methodology with consideration of contingencies for moderate to high flows occurring during instream works. <p>Control measures will be in place prior to commencement of any instream works.</p> <p>The CSWMP will outline procedures and water quality standards (ANZG, 2018) to be achieved prior to dewatering sites withing temporary cofferdams (dry work areas).</p>	Construction	Contractor
Underboring management	<p>A Frac-Out Management Plan (FMP) will be prepared to manage potential impacts of underboring and will be integrated into the CEMP.</p> <p>Drilling water and lubricating fluids will be reused wherever possible prior to disposal at a licenced waste management facility. Where practicable, benign lubricating fluids will be used. All details of</p>	Pre-construction and construction	Contractor



Impact	Mitigation measure	Timing	Responsibility
	drilling fluids and lubricating fluids to be used during the underboring will be outlined in the FMP Appropriate containment measures will be used to ensure that all drilling fluids from directional drilling or boring activities are captured and contained and not released into the environment.		

6.3 Biodiversity and bushfire

6.3.1 Methodology

Desktop assessment

A background review of existing information was undertaken to identify the existing environment of the proposal within a search area of 10 km. The review focused on database searches, and relevant ecological reports pertaining to the study area and surrounds. The review was used to prepare a list of threatened species, populations, and communities as well as important habitat for migratory species with a likelihood of occurrence in the study area. The searches were also undertaken to identify if any Areas of Outstanding Biodiversity Value were present.

The following database and reports were reviewed:

- BioNet - the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection
- EPBC Act Protected Matters Search Tool (PMST)
- BioNet Vegetation Classification Database
- Regional vegetation classification and vegetation mapping reports for the lower Hunter Valley.

Field survey

A field survey was undertaken on 10 June 2022 to ground truth the desktop assessment and to identify biodiversity areas within the proposal area. Surveys generally comprised a random meander to verify vegetation and conduct habitat assessments. No targeted species surveys were undertaken.

6.3.2 Existing environment

The proposal area contains the occasional, scattered native trees and shrubs in these locations, the vegetation has been modified and no longer comprises a contiguous native plant community type (PCT) and is dominated by weeds and exotic species, shown in **Figure 6-4**.

Landscape and environmental context

The proposal area is highly modified and disturbed as it is within a rural area with history of agricultural use, refer to **Photo 6-1**. However, the surrounding study area and locality contain various ecological landscape features. The landscape and environment features of the study area are outlined in **Table 6-3**.



Photo 6-1 Surrounding landscape at the site of the existing reservoir

Table 6-3 Landscape and environment features

Feature		Description
Landscape and soils	Interim Biogeographic Regionalisation for Australia (IBRA) region and sub region	The proposal area is within the Sydney Basin IBRA region and the Hunter subregion.
	Connectivity	There is poor vegetation connectivity in the study area which is characterised by a heavily cleared landscape with only small and isolated fragments of native vegetation. Connectivity is more evident to the north and west of the study area, where large patches of remnant vegetation are evident from the west of Harpers Hill through to Rothbury and Belford National Park. Vegetation in the proposal area is not connected to these large patches and further to this, the New England highway corridor creates a barrier for fauna movements in the locality.
Biodiversity values	Biodiversity Values Map	The study area is not within the Biodiversity Values Map.
	Areas of Outstanding Biodiversity Value	The study area is not within an area of Outstanding Biodiversity Value.
Waterways and hydrology	Waterways and Key Fish Habitat	A number of first and second order ephemeral drainage lines traverse the proposal area and flow to the north draining into the Hunter River. These are not mapped as Key Fish Habitat. The closest mapped Key Fish Habitat (Hunter River) is about 1.7 km downstream.
	Federal Directory of Important Wetlands in Australia	There are no federally listed wetlands in the study area or the locality.
	Coastal wetlands and littoral rainforest	There are no coastal wetlands and littoral rainforest (as mapped under the Resilience and Hazards SEPP) within the study area or the locality.



Vegetation communities, plant community types (PCT) and threatened ecological communities (TEC)

Native forests in the surrounding locality, including the proposal area, have been extensively cleared in the past and are now limited to a small and isolated patches, weeds, exotics and planted areas.

Small and isolated patches of native vegetation representing Lower Hunter Spotted Gum – Ironbark Forest (PCT3444) occur in the proposal area (refer to **Figure 6-4**). These patches are of a low condition, due to a reduced native floristic diversity and abundance of exotics.

These small patches comprise a low density of *Eucalyptus crebra* (Narrow-leaved Ironbark), and *Corymbia maculata* (Spotted Gum) with *Eucalyptus teriticornis* (Forest Red Gum), *Eucalyptus mollucana* (Grey Box), and occasional *Angophora floribunda* (Rough-barked Apple) and *Allocasuarina leuhmanii* (Bulloak). There is a lack of native shrubs and groundcovers, with a predominantly exotic understorey and ground layer dominated by woody weeds such as African Olive (*Olea europaea* subsp. *cuspidata*) and exotic grasses, in particular *Cenchrus clandestinus* (Kikuyu), *Paspalum dilatatum* (Paspalum) and *Hyparrhenia hirta* (Coolatai Grass). Several native grasses are present in the ground layer and co-occur with the exotic grasses, these include *Sporobolus creber* (Western Rat-tail Grass), *Bothriochloa macra* (Red Grass), *Chloris virgata* (Feathertop Rhodes Grass) and *Aristida vagans* (Threeawn Speargrass), however are in lower density.

PCT3444 is listed as a TEC (endangered) under the BC Act, referred to as 'Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions. However, the fragments in the study area are lacking in native flora diversity, particularly in the shrub and ground layer, and dominated by woody weeds, such that the vegetation is below the condition threshold required for determining the listed threatened community. PCT3444 is not a groundwater dependent ecosystem.

The remainder and majority of the proposal area is occupied by non-native vegetation, which comprises miscellaneous exotic plant species on former cleared land, and in some areas, there are dense patches solely comprising African Olive (*Olea europaea* subsp. *cuspidata*). Exotic pasture grasses dominant the slopes surrounding the reservoir site. Planted trees and shrubs have established in road edges, driveways and property entrances, examples of which occur along the access driveway to the reservoir and include planted and now mature *Lophostemon confertus* (Brush Box), and Pines (*Pinus* spp).

No riparian habitat was observed at Kaludah Creek and the unnamed stream in the proposal area.

The area of each vegetation type in the proposal area is identified in **Table 6-5**.

Table 6-4 Vegetation in the proposal area

Vegetation	Area (ha)
Miscellaneous exotic species and scattered trees	10.2 ha
Lower Hunter Spotted Gum-Ironbark Forest (Low condition) (PCT3444)	2.3 ha
Planted trees	0.7 ha
Dense exotic Olive	0.2 ha



Weeds and exotics

Exotic grasses observed during the site inspection included *Hyparrhenia hirta* (Coolatai Grass), *Chloris gayana* (Windmill Grass), *Paspalum dilatatum* (Paspalum), *Megathrysus maximus* (Guinea Grass), *Melinis repens* (Red Natal Grass) and Kikuyu.

Other common weeds observed include *Cotoneaster glaucophylla* (Cotoneaster), *Plantago lanceolata* (Plantain), *Gomphocarpus fruticosus* (Narrow-leaved Cotton Bush), *Sida rhombifolia* (Paddys Lucerne), *Verbena bonariensis* (Purpletop), *Foeniculum vulgare* (Fennel) and *Senecio madagascarensis* (Fireweed). Occasional scattered trees were noted including *Corymbia maculata* (Spotted Gum) and two *Acacia stricta* (Straight Wattle, the latter likely planted).

Of the exotic plants identified within the proposal area, none are Weeds of National Significance (WONS). General biosecurity duties under the *Biosecurity Act 2015* are associated with African Olive (*Olea europaea* subsp. *cuspidata*), Coolatai Grass (*Hyparrhenia hirta*) and Cotoneaster (*Cotoneaster glaucophylla*), and care should be taken when removing and disposing plants to avoid spread.

Pests and pathogens

The proposal area and locality are likely occupied by a range of pest species including the feral cat (*Felis catus*), European Rabbit (*Oryctolagus cuniculus*), Red Fox (*Vulpes vulpes*) and Black Rat (*Rattus rattus*), although these were not observed during field survey.

Several pathogens known from NSW have potential to impact on biodiversity as a result their movement and infection during construction. Of these, three are listed as a KTPs under either the EPBC Act and/or BC Act including:

- Dieback caused by *Phytophthora* (Root Rot; EPBC Act and BC Act)
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and BC Act)
- Introduction and establishment of exotic Rust Fungi of the order *Pucciniales* on plants of the family *Myrtaceae* (BC Act).

Pathogens were not observed or tested for in the proposal area, however the potential for pathogens to occur should be treated as a risk during construction. The most likely causes of pathogen dispersal and importation associated with the proposal include earthworks, movement of soil, and attachment of plant matter to vehicles and machinery.

Threatened species

The desktop study identified 35 threatened and/or migratory species that have been previously recorded or may have suitable habitat in the locality (refer to **Appendix D**). Due to its highly disturbed nature, the proposal area does not provide suitable habitat for any threatened species.

The closest known flying-fox camp is about 20 km to the north. The closest area mapped on the Important Areas Map is for the Swift Parrot (*Lathamus discolor*) about 5 km to the north-west.

Some mobile threatened species (i.e. Masked Owl (*Tyto novaehollandia*), Grey-headed Flying-fox (*Pteropus poliocephalus*)) may fly over the proposal area in reaching nearby areas of foraging habitat, however the proposal area itself is not considered suitable or important habitat for these species.

No threatened species were recorded during the field survey.

Fauna habitat

Fauna habitat within the proposal area is limited. Opportunistic foraging for local birds is possible in the low condition small patches of Lower Hunter Spotted Gum – Ironbark forest, as well as in areas of non-native vegetation.



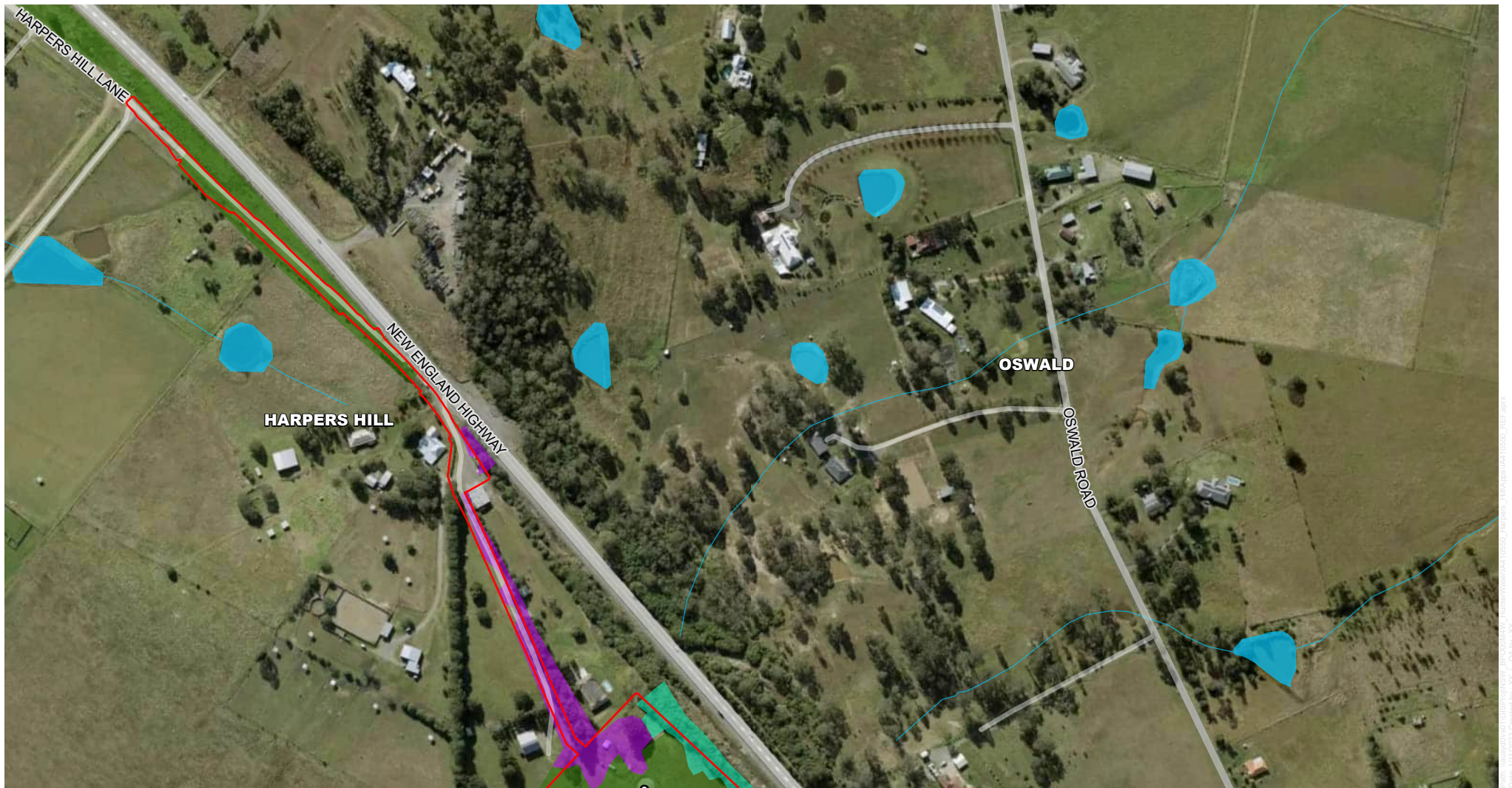
No hollow-bearing trees or ground habitat features such as hollow logs or woody debris are present in the proposal area. There are no culverts or manmade structures that are likely to provide suitable habitat for microbat species.

No aquatic habitat is present.

Bushfire risk

A search of ePlanning Spatial Viewer on 1 November 2022 identified that the majority of the proposal area is within bushfire prone land (refer to **Figure 6-3**).

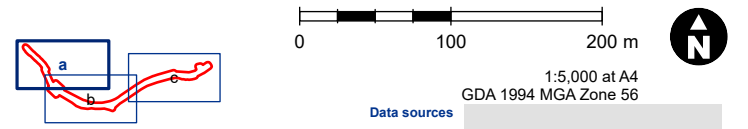
The proposal area from the westernmost boundary to St Helena Close is classified as Category 3, which is considered to be a medium bushfire risk. The proposal is located within close proximity to bushfire prone land classified as Category 1 (high bushfire risk) which is located north of the New England Highway, north east of the westernmost boundary of the proposal.



Red outline: Proposal area

Plant community type

- Dense exotic Olive
- Miscellaneous exotics and scattered trees
- Planted trees



Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Department of Planning and Environment 2022
- Aerometrex 2021

1:5,000 at A4
GDA 1994 MGA Zone 56



Figure 6-4a Vegetation in the proposal area



- Proposal area
- New trunk main

- Plant community type
- Dense exotic Olive
 - Lower Hunter Spotted Gum Ironbark Forest (PCT3444) - Low condition
 - Miscellaneous exotics and scattered trees
 - Planted trees

1:5,000 at A4
GDA 1994 MGA Zone 56

- Data sources
- Jacobs 2022
 - Department of Customer Service 2022
 - Department of Planning and Environment 2022
 - Aerometrex 2021

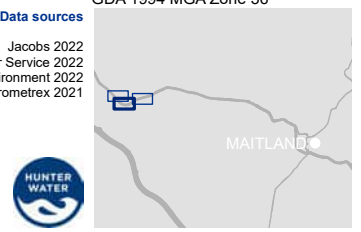


Figure 6-4b Vegetation in the proposal area



- ▭ Proposal area
- New trunk main
- ▭ Plant community type
- ▭ Miscellaneous exotics and scattered trees

Scale: 0 100 200 m

North Arrow

1:5,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Department of Planning and Environment 2022
- Aerometrex 2021



Figure 6-4.c Vegetation in the proposal area



6.3.3 Impact assessment

Construction

Vegetation clearing and habitat loss

The potential impact of vegetation loss has been calculated based on the proposal area. The proposal would potentially impact on:

- Up to 2.3 hectares (ha) of Lower Hunter Spotted Gum – Ironbark forest in low condition
- Up to 11.1 ha of non-native vegetation comprising exotic weeds and planted areas.

The vegetation impacts would remove opportunistic habitat for local fauna species. However, due to the minor nature of the works and the highly disturbed nature of the proposal area, these impacts to species habitat are considered negligible. The works would not increase habitat fragmentation or decrease connectivity.

No impacts are expected to any aquatic habitat.

Spread of weeds, pests and pathogens

During construction, the movement of personnel, plant and equipment has the potential to move weeds, pests and pathogens within and out of the proposal area. Weed species would be avoided or if removal is required, would be removed and disposed of at a suitable licenced facility. With the implementation of management measures, this risk is considered to be minor.

Fauna disturbance

During construction, works have potential to temporarily disturb local fauna from localised impacts of noise, vibration and emissions. However due to the minor and temporary nature of works and the existing noise landscape of the New England Highway, these impacts are considered negligible.

The proposal could result in direct strikes from equipment and indirect impacts including entrapment in trenching or excavated areas. The risk of this occurring would be minimised with covering of excavations when not in use. Furthermore, trenches would be back-filled as the works proceed limiting open excavations at any single time.

Bushfire risk

Bushfire risk may be temporarily increased due to hot works during construction including welding, grinding or cutting of metal and dry concrete metal grinding or cutting.

Hot works would not occur during a total fire ban declared by the NSW Rural Fire Service unless an exemption is provided by the NSW Rural Fire Service.

Operation

No operational impacts to biodiversity or bushfire are expected.

Assessment of Significance

A BC Act Test of Significance (ToS) for Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions concludes that the proposal will not present a significant impact to this TEC (refer to **Appendix E**).

6.3.4 Mitigation measures

The mitigation measures that would be implemented to minimise biodiversity impacts of the proposal are presented in **Table 6-5**.



Table 6-5 Mitigation measures – Biodiversity and bushfire

Impact	Mitigation measure	Timing	Responsibility
Vegetation clearing	During design and construction planning, minimise impacts to the areas mapped as the Lower Hunter Spotted Gum Ironbark Forest (PCT3444) as much as possible.	Detailed design, construction	Design contractor, Construction contractor
Vegetation clearing	The full extent of approved vegetation clearance will be clearly documented and mapped in site CEMP(s). All construction activities, including but not limited to vegetation clearing, is to be strictly confined to the proposal area assessed in the REF.	Prior to works commencing	Contractor
Damage to vegetation	To prevent damage to vegetation outside the boundaries of access tracks/roads and minimise the spread of weeds, vehicles and machinery will be restricted to designated access roads and tracks.	Construction	Contractor
Entrapment of fauna	Excavations not back-filled at the end of the day are to be covered prior to nightfall to avoid presenting an obstacle or trap to fauna. If this is not possible, provide a means by which fauna can escape e.g. branch extending out of trench.	Construction	Contractor
Entrapment of fauna	Check trenches / pits / excavations each morning for trapped fauna.	Construction	Contractor
Spread of weeds	<p>Weed management will be undertaken in accordance with species-specific control measures listed in NSW WeedWise and any applicable Local Control Orders issued under the <i>Biosecurity Act 2016</i> and the following:</p> <ul style="list-style-type: none"> • Ensure plant, equipment and clothing are free of soil and vegetative matter prior to being brought to site. • Check all items are free of soil and vegetative material before moving through un-infested areas and before leaving the site, including machinery, vehicles, tools and footwear. • Control weed propagules by trimming any developing flowers or seed heads and disposing of these appropriately. • Ensure erosion controls are in place to minimise the spread of weeds from run off. <p>Place waste containing seed and vegetative material in bags or on plastic sheeting during weed removal, where practicable.</p>	Construction	Construction contractor
Spread of weeds	<p>All weeds removed from a site(s) will be transported in a sealed container or bag and disposed at a licenced waste disposal facility.</p> <p>This is particularly important for the following species found on site:</p> <ul style="list-style-type: none"> • Coolatai Grass • African Olive 	Construction	Construction contractor



Impact	Mitigation measure	Timing	Responsibility
	<ul style="list-style-type: none"> Cotoneaster. 		
Indirect impacts to fauna	Excavation areas will be managed to minimise the risk of direct and indirect impacts to fauna. Excavated areas will be fenced and covered when not in use.	Construction	Construction contractor
Spread of pathogens	Minimise the spread of pests and pathogens by ensuring all plant, equipment and clothing are clean and free of soil and vegetative matter prior to being brought to site.	Construction	Construction contractor
Impacts to threatened species	If any threatened species (flora or fauna) is discovered during the works, stop work immediately and notify the Project Manager. Work will only recommence once the impact on the species has been assessed and appropriate control measures provided.	Construction	Construction contractor
Bushfire	No hot works during total fire ban.	Construction	Contractor
	Works generating sparks etc will be undertaken utilising a 'Hot Work Permit' or similar process that outlines measures to mitigate potential fire risks. Fire extinguishers will be located within the work sites and/or on machinery/vehicles	Construction	Contractor
	Vegetation within the site will be managed to minimise bushfire risks. It is recommended that Hunter Water continue to regularly manage and maintain the site to ensure the survivability of the structures onsite in the event of a bushfire	Construction	Contractor

6.4 Noise and vibration

A noise and vibration assessment (Jacobs, 2022a) (NVA) has been prepared for the proposal and is provided in **Appendix G**.

6.4.1 Methodology

Construction noise from the proposal was modelled using the SoundPLAN 8.2 acoustic modelling software. Several inputs were used to create the model topography, buildings, ground absorption, noise source and meteorology.

For the purposes of conducting a noise assessment, the works have been separated into construction phases with average and maximum phase sound power levels (SPL) as shown in **Table 6-6**.

Table 6-6 Construction phases and associated works

Construction phase	Works undertaken	Average Phase SWL $L_{Aeq,15min}$ (dB(A))	Instantaneous Maximum Phase SWL L_{AMax} (dB(A))
Phase A1	Trenching, excavating and pipeline laying	114	116
Phase A1-C	Trenching, excavating and pipeline laying through concrete at Lochinvar WTP tie in	119	122



Construction phase	Works undertaken	Average Phase SWL L _{Aeq,15min} (dB(A))	Instantaneous Maximum Phase SWL L _{AMax} (dB(A))
Phase A2	Trenchless pipe construction	112	115
Phase B1	Reservoir - grading	112	113
Phase B2	Reservoir - earthworks	123	126
Phase B3	Reservoir - construction	123	126
Phase B4	Reservoir - demolition of existing reservoir	118	121
Phase C1	Harper Hill lane improvement	111	113
Phase C2	Access road construction	111	113
Phase D1	Mobilisation of temporary ancillary and laydown areas	107	107
Phase D2	Site demobilisation and restoration	108	109

The NVA considered sleep disturbance should OOHWs be required. However, as the proposal is expected to be constructed during standard hours details have not been included here. For the purposes of this noise and vibration assessment, it has been assumed that all construction phases could occur at any time of the day.

6.4.2 Existing environment

The surrounding land use is described in **Section 1.2**. The proposal area is located in a rural environment with generally low ambient noise levels. The major source of noise in the area is from vehicles on the New England Highway.

Based upon the land use of the areas surrounding the proposal, three Noise Catchment Areas (NCAs) divided into subdivisions have been identified to assess potential noise impacts. **Table 6-7** details each NCA and **Figure 6-5** displays the extent of these NCAs and locations of sensitive receivers.

Table 6-7 NCA summary

NCA	Description	Predominant land uses
NCA01	<ul style="list-style-type: none"> Harpers Hill (north of New England Highway) Oswald Windermere Lochinvar (north of New England Highway and outside of township) 	Rural landscape, primary production and residential land
NCA02	<ul style="list-style-type: none"> Harpers Hill (south of New England Highway) Allandale Lochinvar (south of New England Highway and outside of township) 	Rural landscape
NCA03	Lochinvar (main town)	Residential land



Background noise monitoring was not carried out for the proposal. The background noise assessment was determined using the Roads and Maritime Services (RMS) *Construction and Maintenance Estimator Tool* (RMS, 2016) (the CME tool).

The CME tool identified that day noise levels were higher than evening and night noise levels. The New England Highway is the main contributor to noise given the proximity to most receivers in the area. The rating background noise levels (RBL) for each NCA are displayed in **Table 6-8**.

Table 6-8 Assumed RBLs at all receivers

NCA	RBL (L _{A90} dB(A))		
	Day (7:00am to 6:00pm)	Evening (6:00pm to 10:00am)	Night (10:00pm to 7:00am)
NCA01	45	40	35
NCA02	45	40	35
NCA03	45	40	35

Vibration sensitive receivers

The nearest vibration sensitive receivers include two residences (about 85 m north west, and 100 m west of the proposal) and Lochinvar public school located 3.3 km south west of the proposal. No significant sources of vibration or precision industries have been identified in or around the proposal area. One heritage item known as Babworth House is located on St Helena Close. The heritage item is within the easternmost boundary around 45 m from the proposal area (refer to **Section 6.7**).

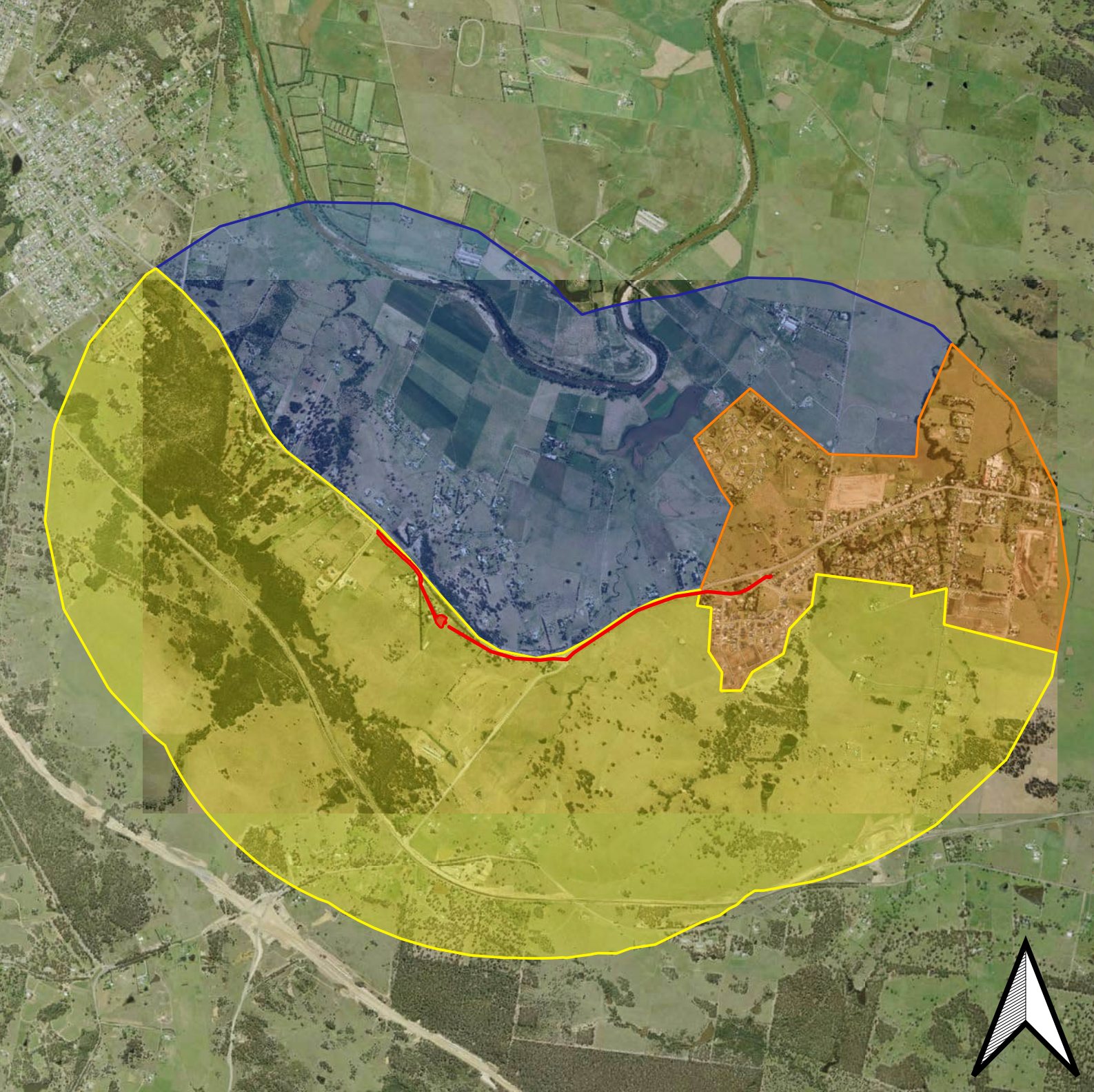
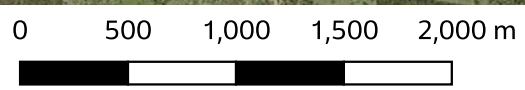


Figure 6.5: Proposal area and NCAs



Legend

- Proposal area
- NCA's
- NCA01
- NCA02
- NCA03

Basemap: NSW SixMap
 Scale: 1:27000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 09/11/2022





6.4.3 Assessment criteria

Construction

Noise management levels (NML)

In NSW, noise impacts arising from construction activities are managed in accordance with the ICNG. The guideline has been developed to assist with the management of noise impacts, rather than to present strict numeric noise criteria for construction activities.

The ICNG recommends establishing NMLs at receiver locations adjacent to the works, using information on the existing background noise level at these locations. Where the NML may be exceeded as a result of the proposal and there is potential for adverse noise impacts to occur, appropriate management measures should be implemented.

Owing to the expected duration of the proposal and the need for the proposal to be completed in standard hours of construction, a quantitative approach was considered for this assessment.

Using the representative background noise levels outlined in **Table 6-8** and guidance from the ICNG, the following NMLs shown in **Table 6-9** were developed to manage noise impacts at nearby residential receivers during construction.

Table 6-9 ICNG guidance for establishing construction NMLs at residential receivers

NCA	NML $L_{eq\ 15\ min}$ dB(A)			
	Day (during standard hours) 7am – 6pm Weekdays, 8am – 1pm Saturdays	Day (outside standard hours) 7am – 8am & 1pm – 6pm Saturdays 8am – 6pm Sundays and Public Holidays	Evening 6pm-10pm Weekdays 6pm – 10pm Saturdays	Night 10pm-7am Weekdays, 10pm – 8am Saturdays 6pm – 7am Sundays and Public Holidays
NCA01	55	50	45	40
NCA02	55	50	45	40
NCA03	55	50	45	40

The ICNG also provides NMLs for non-residential sensitive receivers. Recommended management levels for relevant receiver types within the vicinity of the proposal have been reproduced in **Table 6-10**.

Table 6-10 ICNG NMLs for non-residential receivers during construction

Non-residential receiver type	Noise management level, $L_{Aeq}(15min)$ (applies when properties are being used)
Commercial	External noise level – 70 dB(A)
Industrial	External noise level – 75 dB(A)
Educational facilities	Internal noise level – 45 dB(A)
Hospital / medical	Internal noise level – 45 dB(A)
Library	Internal noise level – 45 dB(A)
Place of worship	Internal noise level – 45 dB(A)



Passive recreation	External noise level – 60 dB(A)
Active recreation	External noise level – 65 dB(A)
Hotel	External noise level – 50 dB(A)

Annoying noise characteristics

Equipment that has the potential to produce a tonal noise, an impulsive noise or any other type of noise defined by the ICNG as ‘particularly annoying’, the noise level for that particular equipment will receive an additional 5 dB(A) penalty.

As per guidance from the Noise Policy for Industry (Environmental Protection Agency, 2017) (NPI), the penalty for impulsive noise (e.g. hammers and packers) would only be applied during night periods and is not discussed further in this section. The penalty for tonal noise (e.g. road saws and grinders) would apply to all periods and makes up part of this assessment.

Traffic noise impacts

Noise resulting from additional traffic generated during construction also requires assessment in NSW. The ICNG refers to the ‘NSW Road Noise Policy’, (RNP [DECCW], 2011) for the assessment of noise from construction traffic on public roads.

Given the limited volumes of additional traffic expected to be generated during construction (refer to **Section 3.1.8**) it is considered unlikely that the proposal would result in increases in overall road traffic noise levels at receivers of more than 2 dB(A). As such traffic noise impacts have not been considered further in the assessment.

Vibration

With respect to human comfort, vibration arising from construction activities must comply with criteria presented in *Assessing Vibration: a technical guideline* (DECC, 2006). Section J4.4.3 of *Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives* and *British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration* [BS7385-2:1993] provides frequency-dependent guide levels for cosmetic damage to structures arising from vibration. Guidance for more sensitive structures is presented in the German standard, *DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3: 2016).

The Construction Noise and Vibration Guideline (CNVG) (RMS, 2016) provides guidance for safe working distances to achieve human comfort and cosmetic building damage criteria for a range of different plant and equipment (refer to **Table 6-11**).

Table 6-11 Recommended safe setback distances

Plant and equipment	Rating / description	Safe working distance (m)	
		Cosmetic building damage (BS7385-2, 1993)	Human comfort (DECC, 2006)
Vibratory roller	<50 kN (typically 1-2 tonne (t))	5 m	15 m to 20 m
	<100 kN (typically 2-4 t)	6 m	20 m
	<200 kN (typically 4-6 t)	12 m	40 m
	<300 kN (typically 7-13 t)	15 m	100 m
		20 m	100 m
		25 m	100 m



Plant and equipment	Rating / description	Safe working distance (m)	
		Cosmetic building damage (BS7385-2, 1993)	Human comfort (DECC, 2006)
	>300 kN (typically 13-18 t) >300 kN (> 18 t)		
Small hydraulic hammer	300 kilogram (kg) – 5 to 12 t excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18 t excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m (nominal)	4 m
Jackhammer	Handheld	1 m (nominal)	2 m
Profiler	Wirtgen W210	4 m	-
Asphalt paver	Vogele Super 1800-3	1 m	-
Steel drum roller	Hamm HD70 (Oscillating mode)	2 m	-
Steel drum roller	Hamm HD70 (Static mode)	1 m	-

Operation

Operational noise criteria for the proposal are determined in accordance with the NPI. The NPI seeks to regulate noise impact from 'industrial activity' pertaining to noise from fixed industry and mechanical plant rather than from road, rail or construction sources.

To define the operational noise criteria for a proposal, the NPI apply two separate noise levels, intrusiveness, and amenity criteria. The more stringent of the two is selected as the proposal noise trigger level, shown in **Table 6-12**.

Table 6-12 Proposal noise criteria

Receiver type	Time of day	Proposal noise intrusiveness criteria (L_{Aeq} dB(A))	Proposal amenity noise level (L_{Aeq} 15 minute dB(A))	Proposal noise trigger level (L_{Aeq} 15 minute dB(A))
Residential receivers	Day (7 am to 6 pm)	50	48	48
	Evening (6 pm to 10 pm)	45	43	43
	Night (10 pm to 7 am)	40	38	38

Criteria for annoying noise during operation exist. However, as these impacts are not expected as part of the proposal they are not discussed further.



6.4.4 Impact assessment

Construction

Construction noise

Estimated noise levels modelled at the NCAs during each construction phase are summarised in Table 6.1 of the NVA provided in **Appendix G**. Noise levels of up to 30dB(A) greater than the standard hours NMLs have been predicted at the nearest residential receivers. Generally, the pipeline works have been predicted to result in the highest number of impacts, primarily as a result of the proximity of these works to the receivers in Lochinvar. Receivers within NCA2 and NCA3 would experience the most exceedances during construction. Given the progressive nature of the work, most noise impacts would decrease in any single location as work progresses down the pipe alignment. The exception of this is at the reservoir site, where nearby receivers may experience high noise levels for a comparatively longer period of time.

All phases would result in exceedances of standard hours NMLs at either NCA2, NCA3 or both. Specifically, Phase A1, A1-C and A2 would result in the greatest number of receivers experiencing exceedances of the respective standard hours NMLs. Up to 68 receivers in Phase A1 would experience noise exceedances of the standard hours NMLs. During Phase A1, up to four receivers have been predicted to be 'Highly Noise Affected.'

Modelling has predicted to a limited extent impacts to non-residential receivers. No non-residential receivers have been predicted to experience noise greater than the NMLs.

Construction vibration

Some items of plant that are expected to be used in construction such as compactors, underboring equipment, hydraulic rock hammer and impact piling rigs are considered to be vibration-generating. One heritage structure is located around 45 m from the compaction works, however is located within the recommended setback distances. There are some receivers that are located within the human comfort and cosmetic damage vibration setback distances. These receivers are located along the pipeline alignment, proposed Harpers Hill Lane access improvement and reservoir site. Mitigation measures to minimise impacts of construction vibration have been provided in **Section 6.4.5**.

No vibration impacts are anticipated on any other heritage items, medical centres, or precision industry due to their distance from the proposal.

Operation

No operational noise impacts are expected from the proposal. The NVA determined that noise produced by the air compressor associated with the reservoir will not produce operational noise levels greater than the noise limits defined by the NPI, nor will the proposal pose any tonal or low frequency noise risks. It is also noted that the air compressor will be located within an enclosure which would further reduce operational noise. Therefore, no operational noise impacts are anticipated.

No vibration impacts are expected during operation.

6.4.5 Mitigation measures

The mitigation measures that would be implemented to minimise noise and vibration impacts of the proposal are presented in **Table 6-13**.



Table 6-13 Mitigation measures – Noise and vibration

Impact	Mitigation measure	Timing	Responsibility
Notification and verification monitoring	<ul style="list-style-type: none"> • Provide at least seven days' notice to the two nearby potentially affected residential receivers prior to starting work • Monitoring will be carried out in response to any complaints, to verify noise levels during construction. 	Seven days prior to works commencing (notification) and during construction (verification monitoring)	Contractor
Work hours	Works will be carried out during standard work hours (i.e. 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday). For any work that is performed outside normal work hours or on Sunday or public holidays, the contractor must complete the Hunter Water OOHW Approval Form and adhere to the OOHW Construction Noise Guideline.	Prior to work commencing outside of standard work hours	Contractor
Noise and vibration	<p>The following measures will be implemented during construction:</p> <ul style="list-style-type: none"> • Personnel will be inducted and trained in noise control measures to reduce impacts on receivers during inductions and toolbox talks • Where possible, quiet and less vibration emitting construction methods will be used • Where possible, noisy activities such as jet blasting and concrete cutting will be limited to standard hours of construction and will be concentrated in one location before moving to another as quickly as possible. The temporary construction of noise barriers for concentrated, noise intensive activities will be considered • Where noisy activities cannot be scheduled to standard hours of construction, noisy activities will take place earlier in the night, during less sensitive time periods • Where possible, the operation of two or more noisy plant close to receivers will be avoided and all vehicles and plant will be turned off when not in use • All stationary and mobile equipment will be fitted with mufflers and in serviceable condition. Generators, if used are to have sound proof enclosures • Construction vehicles including trucks will not be allowed to queue on local roads or if it is required for safety reasons, engines will be switched off • Where possible, all plant is to utilise a broad band reverse alarm with less intrusive alarms and the need to reversing manoeuvres will be minimised. • Deliveries will be scheduled during standard work hours only 	Construction	Contractor



Impact	Mitigation measure	Timing	Responsibility
	<ul style="list-style-type: none"> No dropping of materials from height where practicable and no throwing of metal items Switching off any equipment not in use for extended periods e.g. heavy vehicle engines will be switched off whilst being unloaded Avoiding any unnecessary noise when carrying out manual operations and when operating plant 		
Controlling noise and vibration	<ul style="list-style-type: none"> Choosing alternative, lower-impact equipment or methods wherever possible Sequencing operations so that vibration-causing activities do not occur simultaneously and where possible locating high vibration sources as far away from sensitive receivers as possible Keeping equipment well maintained Wherever possible, avoid the use of vibration intensive plant within the recommended safe setback distances. Where these setbacks can't be maintained, notify receiver(s), conduct inspections and monitoring to verify resulting levels, assess impacts and inform the need to modify works as necessary Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic and heritage building damage. 	Construction	Contractor
Complaints	A complaint management procedure will be developed. Community complaints will be allocated to a responsible contractor representative immediately to facilitate investigation, respond to the complainant, review noise mitigation measures and to implement any corrective actions. The details of the complaint will also be circulated to the applicable construction personnel for action, where required.	Construction	Contractor

6.5 Air quality and energy

6.5.1 Existing environment

Climate

The nearest BoM weather station is located at Cessnock Airport (AWS) (ID 061260) about 12 km south from the proposal area. The mean annual minimum temperature is 10.6 degrees Celsius (°C), while the mean annual maximum temperature is 24.3 °C.

The coldest month is July, with a mean minimum temperature of 4.1 °C and a mean maximum temperature of 17.6 °C.



January is the warmest month with a mean minimum temperature of 17.1 °C and a mean maximum temperature of 30.4 °C.

Seasonal variations occur in rainfall with a greater proportion being received during November to March throughout of the year. The wettest month is February with an average monthly rainfall of about 102 mm out of an annual average of about 738 mm. July is the driest month with an average of about 29 mm.

The average wind speed generally increases throughout the day, ranging from an 9 am average minimum in March of about 8.7 km per hour (km/h) to about 14 km/h in September. The 3 pm average minimum for wind speed is about 14.2 km/h in May to about 19.1 km/h in September. Most common winds occur from the north-east.

Air quality

The Lower Hunter region monitoring region provides the most representative air quality monitoring results for the proposal area. The closest air quality monitoring station with relevant data to the area of interest is located at the DPE Beresfield station, about 25 km southeast of the proposal area. The Department of Planning and Environment (DPE) Beresfield station provides information on meteorology, Nitrogen dioxide (NO₂), PM₁₀, PM_{2.5}. Carbon monoxide (CO) is not measured at the DPE Beresfield station, so these records were obtained from the next nearest station, the DPE Newcastle station, located about 40 km to the southeast of the proposal area.

The following conclusions have been made from the review of local meteorological and ambient air quality monitoring data:

- Wind patterns in the vicinity of the proposal area are characteristic of the Lower Hunter Valley, with the prevailing winds being from the west northwest
- Measured CO and NO₂ concentrations have been consistently below NSW EPA air quality impact assessment criteria
- NO₂ concentrations are typically 68 % of the total nitrogen oxides (NO_x) concentrations, on average. However, the NO₂ percentage decreases with increasing NO_x concentrations and for the very highest NO_x concentrations the NO₂ concentration is less than 20 per cent
- Particle levels (as PM₁₀ and PM_{2.5}) would be influenced by many sources including mining activities, construction works, bushfires and 'burning off', industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollens, moulds, and domestic wood fires. Concentrations increased across NSW from 2017 to 2019 due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH, 2019). These events adversely influenced air quality with multiple days observed when PM₁₀ and PM_{2.5} concentrations exceeded NSW EPA criteria.

A search of the National Pollutant Inventory 31 October 2022 identified two nearby registered facilities. Allandale Quarry (non-metallic mineral, mining, and quarrying) located about 3.1 km southeast of the proposal area and Pacific National Greta (Rail Freight Transport) located about 6 km southeast of the proposal.

Local air quality near the proposal area is likely to be influenced by local sources including local traffic and regional influences arising from agricultural activities and mining. Sensitive receivers in the vicinity of the proposal area are described in **Section 6.4.2** and shown in Error! Reference source not found..

6.5.2 Impact assessment

Construction

Increases in local dust emissions (including particulate matter) present the highest air quality-related risk to the receivers around the proposal area. Without proper management, dust has the potential to cause human health (e.g. eye irritation, respiratory issues) and nuisance (e.g. dust soiling, visibility) impacts.



The risk of particulate matter generation is highest during construction where emissions would arise during vegetation clearing and site establishment activities, excavation, compaction of materials and installation of the trunk main.

Construction equipment may also create air quality impacts. Dust and dust-generating activities may include:

- Vehicle traffic on New England Highway, Allandale Road, Harpers Hill Lane, and local access roads
- Earthworks
- Stockpiling activities
- Reservoir demolition works
- Loading and transfer of material from trucks.

Energy use impacts would occur through fuel used by construction vehicles and plant.

Given the scale of the proposal, air quality and energy use impacts are expected to be minor and intermittent over the construction period. Therefore, it is considered that construction of the proposal would have an insignificant impact on local air quality and energy.

Operation

No air quality or energy impacts are anticipated during operation of the proposal.

6.5.3 Mitigation measures

The mitigation measures that will be implemented to minimise air quality and energy impacts of the proposal are presented in **Table 6-14**.

Table 6-14 Mitigation measures – Air quality and energy

Impact	Mitigation measure	Timing	Responsibility
Dust	<ul style="list-style-type: none"> • Visually monitor dust and where necessary: • Apply water (or alternate measures) to exposed surfaces that are generating dust • Appropriately cover loads on trucks transporting material to and from the construction site • Securely fix tailgates of road transport trucks prior to loading and immediately after unloading • Avoid dust generating works during strong winds • Prevent where possible, or remove, mud and dirt being tracked onto sealed road surfaces. 	Construction	Contractor
	Stabilise long term stockpiles by covering, or with soil binders such as polyvinyl acetate (PVA) or latex sprays.	Construction	Contractor
Complaints	Air pollutant emission complaints will be dealt with promptly and the source will be eliminated wherever practicable.	Construction	Contractor
Reporting	Contractors are required to report in the 'Contract Environmental Management Report' monthly energy usage information to Hunter Water	Construction (monthly)	Contractor

6.6 Aboriginal heritage

An Aboriginal Heritage Due Diligence Report (Jacobs, 2022b) has been prepared for the proposal and is provided in **Appendix F**.



6.6.1 Existing environment

Environmental context

The proposal is located within the Mindaribba Local Aboriginal Land Council area.

Kaludah Creek and Lochinvar Creek are located within 330 m of the proposal. The waterways are first and second order ephemeral creeks that drain into the Hunter River. The waterways have been highly modified through the construction of culverts for the New England Highway.

The majority of the proposal would be located on modified landform where disturbance has occurred predominantly from land clearing for pastoral and agricultural uses and highways and local road construction, including the waterways that are crossed. Any Aboriginal cultural heritage present within the proposal area or immediate vicinity is likely to have been highly disturbed.

There are no Native Title Claims within the proposal area.

Register searches

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) undertaken on 9 June 2022 and updated on 27 October 2022. The searches identified 122 listed Aboriginal sites with a 500 m buffer of the proposal area. The majority of these sites are artefact scatters, isolated finds and Potential Archaeological Deposits (PADs) and are mostly located along the roads and waterways.

One of the AHIMS registered sites (#37-6-3810) is located at the eastern end of the proposal, adjacent to the existing Lochinvar WPS, as shown in **Figure 6-6**. The registered site is an isolated artefact, potentially introduced with fill during the Lochinvar WPS construction.

The AHIMS searches did not indicate any registered Aboriginal Places within the proposal area.

Summary of previously completed archaeological assessments

The proposal area has previously been subject to archaeological investigation and assessment as part of the high level of development in the Hunter Valley.

Assessments previously completed by SKM (2010) and South East Archaeology (2010) identified stone artefact sites. Stone artefacts appear to be common site types, and if the landforms consist of alluvial deposits, there is potential for further stone artefacts to occur within the subsurface. Other sites comprised of grinding grooves.

Surveys completed by Umwelt (2005) identified larger concentrations of artefacts on waterholes along creek lines, particularly on the high side of creeks and creek confluences.

Visual inspection

A visual inspection of the proposal area at Harpers Hill was undertaken via vehicle and pedestrian survey on 10 June 2022. The proposal area is highly modified due a high level of development in the area. The western end of the proposal area, on the crest near the existing reservoir, the land is sloped and was disturbed during previous construction activities. The area is described as low archaeological potential because there is little potential for retaining deposits. The central portion of the proposal area is highly modified by previous highway construction and service installation activities. The eastern end of the proposal area is highly modified and consists of the footprint of the existing Lochinvar WPS 2, including infrastructure and landscaping.

The visual inspection indicated a very low likelihood of Aboriginal objects occurring within the proposal area, with the exception of site #37-6-3810 located adjacent to the proposal area, near the existing Lochinvar WPS. It is considered unlikely that any other unidentified Aboriginal objects are present and if so, would be of low archaeological potential.



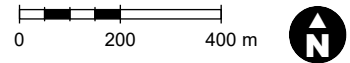
Aboriginal heritage due diligence

The Aboriginal Heritage Due Diligence assessment concluded that the proposal area is highly disturbed, and it is highly unlikely that Aboriginal objects are present, except for one AHIMS registered site (#37-6-3810) located within close proximity of the proposal. However, the AHIMS site is not within the proposal area and is likely to have been introduced as fill during the construction of the Lochinvar WPS.

No further Aboriginal investigations are required.



- Proposal area
- * AHIMS site
- Railway
- New trunk main
- Local heritage - EPI
- Item - General
- Item - Archaeological
- Item - Landscape



1:15,000 at A4
GDA 1994 MGA Zone 56

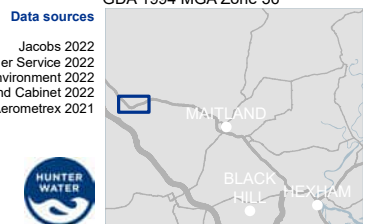


Figure 6-6 Heritage



6.6.2 Impact assessment

The proposal would include vegetation removal across the proposal area (as discussed in **Section 6.3**), and disturbance of surface and subsurface soils due to the earthworks associated with the installation of the new trunk main, the new reservoir, and access road improvements. However, the proposal area does not contain any known Aboriginal objects or culturally modified trees and therefore is unlikely to impact Aboriginal objects.

6.6.3 Mitigation measures

The environmental mitigation measures that will be implemented to minimise Aboriginal heritage impacts of the proposal are presented in **Table 6-15**.

Table 6-15 Mitigation measures – Aboriginal heritage

Impact	Mitigation measure	Timing	Responsibility
Existing AHIMS site (#37-6-3180)	High visibility fencing will be installed around the AHIMS registered site (#37-6-3180) and buffer area during works to prevent impacts. All personnel involved in the works will be informed about the designated no-go area.	Construction	Constructor
Unexpected finds	In the event that an Aboriginal object (or objects) is uncovered during the proposed works the Unexpected Finds Protocol in Appendix F will be followed. Ground disturbance works will cease within 20 m of the object(s) and the Hunter Water Archaeologist will be contacted. The Hunter Water Archaeologist will advise the Heritage Office and the relevant Aboriginal parties so that appropriate management strategies can be identified.	Construction	Contractor/ Hunter water
Unexpected finds	In the unlikely event that human skeletal material is uncovered during the proposed construction works the Unexpected Finds Protocol as provided in Appendix D will be followed. All works will cease within 20 m of the skeletal remains. Should the remains be verified as human, the NSW Police and Department of Planning and Environment (DPE) will be contacted. No works will proceed within the vicinity of the skeletal remains until an appropriate course of action has been determined in consultation with NSW Police, DPE and Aboriginal parties (if the remains are identified as Aboriginal).	Construction	Contractor/ Hunter water

6.7 Non-Aboriginal heritage

6.7.1 Existing environment

The following database searches were undertaken on 1 November 2022 and determine the presence of heritage items in the existing environment:

- State Heritage Inventory
- Search for NSW Heritage
- Commonwealth Heritage List.

No Commonwealth or local listed heritage items are located within 500 m of the proposal area. Three State Heritage Inventory items were identified within 1 km of the proposal as shown in **Figure 6-6**, these include:



- The General Cemetery (I223) on Oswald Road approximately 500 m north of the proposal
- Kaludah (I102) is located approximately 800 m north of the proposal
- Babworth House - building (I103) is situated on St Helena Close within the easternmost boundary of the proposal area.

6.7.2 Impact assessment

The proposal would not impact any known non-Aboriginal heritage items during construction or operation. While Babworth House-building is on the boundary of the proposal area it would not be impacted by the proposal.

6.7.3 Mitigation measures

The mitigation measures that would be implemented to minimise non-Aboriginal heritage impacts of the proposal are presented in **Table 6-16**.

Table 6-16 Mitigation measures – Non-Aboriginal heritage

Impact	Mitigation measure	Timing	Responsibility
Unexpected heritage	If non-Aboriginal heritage items are discovered during the course of the proposal, all work will cease in the area and the Contractor will inform the Hunter Water Project Manager and Archaeologist as soon as possible. Hunter Water will determine the preferred management approach and the local council and/or NSW Heritage Office will be notified via the Hunter Water Project Manager if required.	Construction	Contractor
Impacts to a heritage item	<ul style="list-style-type: none">• Care will be exercised to ensure that the Babworth House - building is not subject to indirect or accidental direct impacts during construction• Exclusion tape will be utilised to delineate the work area to prevent accidental damage to Babworth House - building.	Construction	Contractor / Hunter Water

6.8 Visual amenity

6.8.1 Existing environment

As described in **Section 1.2**, the proposal area is surrounded predominantly by RU2 (Rural Landscape) land with the closest residential property located approximately 80 m from the proposal. The easternmost section of the proposal area encompasses St Helena Close, Lochinvar which is zoned as R1 (General Residential).

The proposal area would be located in the suburb of Harpers Hill around 11 km north west of Maitland. The New England Highway runs adjacent to the proposal for 3.4 km with the westernmost extent from Harpers Hill Lane and the easternmost extent from St Helena Close, Lochinvar.

Existing infrastructure owned by Hunter Water includes a 0.9 ML reservoir which would be situated nearby the proposed additional reservoir. The existing reservoir is visible to the neighbouring property located west of the reservoir, however the existing reservoir is generally not visible from New England Highway due to vegetation and topography. Hunter Water owns the Lochinvar WPS, located off Terriere Drive, in Lochinvar. The pumping station is screened from New England Highway with vegetation.



6.8.2 Impact assessment

Construction

During construction, there would be impacts on visual amenity from the vegetation clearing and construction activities (such as earthworks, ancillary laydown areas and demolition of existing reservoir) with plant, equipment and materials visible to receivers. These impacts would occur throughout the construction period.

Construction activities have potential to create short term negative impact from removal of vegetation, excavations, excavated and demolition material and the movement and storage of plant and equipment. The visual impact is considered to be low. Trenching for the new water trunk main would occur predominantly within existing cleared land near or within the existing Hunter Water easement and is likely to have minimal visual impact provided the trench is backfilled and stabilised with ground cover as soon as practicable.

Operation

The new reservoir would be substantially larger than the existing reservoir (about double the size). It would be about 50 m closer to the neighbouring dwelling and would be more visible than the existing reservoir. Although the new reservoir would be painted a similar colour to the existing reservoir, visual impacts are expected to be greater at the neighbouring dwelling as a result of the proposal. Visual impacts would be reduced through screening vegetation planted in accordance with the Potable Water Reservoir Specification STS409 (Hunter Water, 2009).

The new reservoir is located close to the existing reservoir location, and accordingly the glimpses of the reservoir available to passing motorists and far-off receivers would be similar to the existing reservoir. Glimpses of the new reservoir by motorists would be temporary and fleeting. Although the new reservoir would be larger than the existing, visual impacts to far-off receivers are expected to be minor due to distance between the receiver and the reservoir.

The water trunk main and connections to the reservoir would generally be located underground and not visible to nearby residences.

6.8.3 Mitigation measures

The environmental mitigation measures that would be implemented to minimise visual impacts of the proposal are presented in **Table 6-17**.

Table 6-17 Mitigation measures – Visual amenity

Impact	Mitigation measure	Timing	Responsibility
Visual impact during construction	Restore work sites as close to their original condition as possible at completion of the works On completion of the works, all vehicles, construction equipment, materials, and refuse relating to the works will be removed from the work site(s) and any adjacent affected areas Work areas will be maintained, kept free of rubbish and cleaned up at the end of each working day.	Construction	Contractor
Visual impact during operation	Clear the minimum amount of vegetation necessary and undertake replacement planting in accordance with the Potable Water Reservoir Specification STS409 (Hunter Water, 2009).	Construction	Contractor



6.9 Traffic and access

6.9.1 Existing environment

Roads located near the proposal area include the New England Highway, which is a classified road, local roads and the private road providing access from the New England Highway to the reservoir site (refer to **Figure 1-2**). Roads within and near to the proposal area include:

- New England Highway – a classified road which catering for large volumes of east-west traffic. The speed limit of the New England Highway is 90 km/h alongside the proposal area
- Terriere Drive, Lochinvar – a local road providing access from the New England Highway to a residential area south of the New England Highway
- St Helena Close, Lochinvar – a local road coming off Terriere Drive, running roughly parallel to the New England Highway
- Allandale Road, Allandale – a local road connecting the New England Highway with Lovedale Road in Allandale. Allandale Road has a U-turn facility directly to the south of New England Highway
- Harpers Hill Lane – a local road providing access to properties to the south of New England Highway. The reservoir site can also be accessed from this road, however for about 50 m on the eastern end of Harpers Hill Lane, the track is heavily vegetated and is only suitable for high clearance vehicles such as 4WDs or trucks
- Private road – A private road providing access between New England Highway and the reservoir site. This road joins New England Highway at an acute angle, requiring vehicles to take a sharp left turn from New England Highway westbound.

Both Harpers Hill Lane and the private road are located within the road reserve for the New England Highway; however, the road is maintained by MCC.

There are no formal pedestrian paths in the vicinity of the proposal and due to its rural location pedestrian traffic is generally limited to local residents. No formal parking facilities are located near or within the proposal.

New England Highway directly north of the proposal is used by a number of local and regional bus services. The bus stop directly opposite the Harpers Hill Lane intersection with New England Highway is the closest bus stop to the proposal.

6.9.2 Impact assessment

Construction

Access to the reservoir site would be via Harpers Hill Lane and the private access road. Access to the proposal area would be restricted to construction personnel and vehicles. The majority of construction crew vehicles would be parked within the ancillary laydown areas as shown in **Figure 1-2**. A site office and compound would be located on the reservoir site for the duration of construction works. The reservoir site would be fenced with temporary fencing, restricting access to construction personnel only.

A portion of Harpers Hill Lane, between the eastern portion of Harpers Hill Road and the private road, would be closed during the construction works. However, given that the eastern portion of this road is currently unformed and is unusable by all except high clearance vehicles, it is unlikely that local traffic or property access would be significantly impacted due to closure of this portion of the road. The road improvements would be within the TfNSW road reserve for the New England Highway, however there are no significant impacts anticipated by the proposal.

MCC has indicated that it would be responsible for maintaining Harpers Hill Lane if the road is spray sealed twice, has a 3.5 m width, and a barricade is constructed between the lane extension



and the New England Highway. Hunter Water would be responsible for the Harpers Hill Lane extension and the private access road.

Incremental open trenching alongside St Helena Close on the road shoulder may require restriction of the road at that area (including construction speed limits and/or temporary closure to a single lane). Where trenchless construction is required at Allandale Road and Terriere Drive, impacts to traffic and disturbance to road users are expected to be minimal. A Traffic Management Plan (TMP) would be developed and implemented to minimise the impacts on local traffic. Alternative informal pedestrian access would be made available as required at each construction location. Notification would be provided to local residents in advance of any obstruction of access.

During construction, the proposal is expected to generate the following additional vehicle movements on the local road network:

- Heavy vehicle movements (up to 20 per day) for delivery of construction materials, removal of waste and movement of spoil
- Delivery of plant (excavators, rollers), which would remain on the construction site during construction and moved around as the trenching works progress
- Light vehicles ((up to 20 per day) for construction workers during the construction period.

The final number and nature of vehicle movements is dependent on how the contractors carry out the work and the source location of material, plant, and construction workers.

Construction vehicles would access the site via arterial roads wherever possible. Impacts to New England Highway from turning construction vehicles are expected to be limited due to the presence of dedicated turning lanes into Terriere Drive, Allandale Road and Harpers Hill Lane from both directions.

The most noticeable increase in traffic activity on surrounding local roads and would be at the start and end of shifts when construction workers are travelling to/from the proposal. This is expected to be a localised impact only. The proposal is not expected to strain the overall capacity of local and arterial roads nor result in significant traffic impacts to road users (including buses).

Access to driveways and the private road to the reservoir site would be maintained as far as practicable throughout construction. Vehicular access to some properties may be restricted for short periods during construction. As the proposal would be constructed progressively, this would minimise the duration of time that access would be impacted at any location. During construction, alternative informal pedestrian access would be made available at each construction location as required.

Operation

The proposal would provide safer access to the reservoir following the access improvements to Harpers Hill Lane. No other traffic or access impacts are expected.

6.9.3 Mitigation measures

The mitigation measures that would be implemented to minimise traffic and access impacts of the proposal, along with the responsibility and timing for those measures are presented in **Table 6-18**.

Table 6-18 Mitigation measures – Traffic and access

Impact	Mitigation measure	Timing	Responsibility
Access to private property	Access to private properties will be maintained as far as practicable throughout construction.	Prior to construction	Contractor



Impact	Mitigation measure	Timing	Responsibility
	The use of private driveways and access roads will be in agreement and consultation with the landowner.		
Traffic and transport	<ul style="list-style-type: none"> • Appropriate exclusion barriers, signage and site supervision will be employed at all times to ensure that the work site is controlled, and that unauthorised vehicles and pedestrians are excluded from the works area. • Movements of heavy vehicles will be restricted to standard work hours (i.e 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday) • Where possible, parking of light vehicles will be within the ancillary laydown areas and site compound to minimise interference with vehicle movements of local residents. 	Construction	Contractor
Impacts to access roads	Alternative access will be provided, where possible, where construction works affect paths, access ways and roads.	Construction	Contractor
	Where there are road restrictions or closures, a TMP will be prepared. Should work on public roads be required then consultation with the relevant traffic authority(s) will be undertaken.	Prior to construction	Contractor
Impacts to private road and Harpers Hill Lane extension	Hunter Water will be responsible for the maintenance of the Harpers Hill Lane extension and private access road within the western boundary of the proposal area.	During and post construction	Hunter Water

6.10 Land uses and services

6.10.1 Existing environment

The proposal area is situated in an area predominantly zoned as RU2 (Rural Landscape). The easternmost boundary of the proposal in Lochinvar encompasses St Helena Close, which is zoned as General Residential (R1). Harpers Hill Lane within the westernmost boundary of the proposal is currently zoned as SP2 (Road) – Infrastructure. The proposal passes through mostly rural areas, intersects road infrastructure, and crosses perennial creeks.

Existing infrastructure within and near the proposal area includes, but is not limited to:

- Private property, including fences and driveways that would be crossed by the proposal
- Existing 250 mm pipeline
- Existing below ground utilities (in particular, fibre optic, gas, water and power)
- Overhead power poles and lines
- Existing roads, including the New England Highway which is a State road, local roads (including Terriere Drive, St Helena Close, Allandale Road and Harpers Hill Lane) and private road to the reservoir site (further discussed in **Section 6.9.1**).

6.10.2 Impact assessment

Construction

Construction of the reservoir would be carried out on land owned by Hunter Water and would not impact on the surrounding land use. During construction, access to the reservoir site would be



restricted to construction personnel with the use of temporary fencing. A site office and compound would be located on the reservoir site for the duration of construction works.

As discussed in **Section 6.9**, the eastern portion of Harpers Hill Lane, between the eastern portion of Harpers Hill Road and the private access road, will be closed during the construction works. However, given that the eastern portion of this road is currently unformed and is unusable by all except high clearance vehicles, it is unlikely that land use would be significantly impacted due to closure of this portion of the road.

As discussed in **Section 3.1.9**, no property acquisitions or leases would be required for the proposal. However, the current easement alignment would be adjusted to incorporate the new trunk main. The width of the current easement would remain the same and no acquisition of private land would be required. Hunter Water would continue to consult with landowners regarding access, road closures or traffic management as discussed in **Section 5.1**.

The proposal would also have a minor impact on existing land uses during construction. The residential properties and other sensitive receivers near the proposal area would have minor short-term disturbance including noise, dust, and traffic during construction of the proposal. Following construction, all private land such as private driveways and front lawns would be reinstated to prior condition. The proposed impacts on Traffic and Access (including private access) have been assessed in **Section 6.9**.

The proposal has been designed to avoid existing services such that no adjustments to utilities are required. However, if impacts to existing utilities are unavoidable, the existing utilities would be relocated in consultation with the utility provider.

A 'Before You Dig' search would be undertaken prior to any works commencing in order to confirm the location of buried services. Where works are to be undertaken below power lines, the Ausgrid Guidelines NS 209 Operating Cranes and Plant in Proximity to Power Line would be referred to. Telstra would be contacted if works are to be undertaken within the vicinity of Telstra pits.

Operation

The proposal would result in negligible changes to land use during operation as the trunk main would be located underground and would not affect any residential, recreational or environmental activities on the adjacent properties. In addition, as there is an existing reservoir on the proposed reservoir site, operation of the proposal would not affect land use at the reservoir site. All temporary fencing would be removed following the completion of construction works. It is not proposed that the reservoir site be fenced, thereby allowing continued access to the site by the adjacent landowners.

The improvements of the eastern portion of Harpers Hill Lane would have a positive impact on land use as the proposal would improve the condition of this portion of the road and provide improved access to neighbouring properties. The access road would enable provision of a safer access route to the reservoir site and surrounding private properties via the western Harpers Hill Lane / New England Highway intersection, which would be significantly less hazardous than the current access arrangements.

The proposal is likely to have a positive impact to Hunter Water's existing service on a local and regional scale by providing additional storage and improving water security to address current and future demands. There would not be any impact on land use from operation of the scour / overflow main.



6.10.3 Mitigation measures

The mitigation measures that would be implemented to minimise impacts to land uses and services nearby the proposal are presented in **Table 6-19**.

Table 6-19 Mitigation measures – Land use and services

Impact	Mitigation measure	Timing	Responsibility
Impacts on private property	Land subject to temporary use for the proposal including the construction corridor and ancillary and laydown area and access will be rehabilitated as soon as practicable to an appropriate condition in agreement with the landowner.	Prior to construction	Hunter Water
Consultation	Provide at least seven days' notice to affected receivers prior to starting work unless it is emergency works or it is discussed with the affected receivers face-to-face. Include the following information in notification letters: <ul style="list-style-type: none"> • A description of the works and why they are being undertaken • Details of the works that will be noisy • Work hours and expected duration • What is being done to minimise the impacts (e.g. respite periods) • 24 hour contact number. 	Seven days prior to works commencing	Contractor
Consultation	<ul style="list-style-type: none"> • Where entry to private property is required, a notice of entry letter will be provided at least 14 days in advance • Maintain a complaints register and respond to any complaints and notify the Hunter Water Project Manager as soon as possible within 24 hours • The contractor will personally contact the occupant when they enter a private property to notify of their presence and what works are intended • Any accidental damage to property occurred by the works must be immediately reported to the Hunter Water Project Manager and repaired in consultation with the owner • Erect signage containing project information and contact details in a prominent location. 	Prior to construction / during construction	Contractor
Impacts on private property	Land subject to temporary use will be rehabilitated as soon as practicable to an appropriate condition in agreement with the landowner.	Construction	Contractor
Land uses and services	All services in the vicinity of the works will be located in the field and 'pegged-out' and noted in the Environmental Management Plan and/or work plans prior to excavation works – "Before You Dig".	Prior to ground penetrating work or work	Contractor



Impact	Mitigation measure	Timing	Responsibility
		under power lines	

6.11 Waste generation

6.11.1 Existing environment

The existing reservoir, Lochinvar WPS and trunk main generate minimal waste.

6.11.2 Impact assessment

Construction

The construction of the proposal would potentially generate a range of waste streams including:

- Excess spoil generated during excavation activities. Excess spoil not used onsite would be classified in accordance with the *NSW EPA Waste Classification Guidelines 2014* (NSW EPA, 2014) and disposed of at a registered waste management facility or reused for maintenance activities where there is suitable classification
- Building material waste including metals, plastic and concrete
- Demolition waste, including steel, concrete and potentially hazardous material (asbestos, lead pipework and lead paint on the existing reservoir)
- Domestic waste including food scraps, aluminium cans, glass bottles, plastic and paper containers and putrescible waste generated by site construction personnel
- Weeds would be appropriately treated (spot sprayed) and manually removed (where applicable), bagged and disposed of at an appropriately licenced landfill facility.

Operation

The proposal would not result in changes to operational waste management arrangements.

6.11.3 Mitigation measures

The environmental mitigation measures that would be implemented to minimise waste generation impacts of the proposal are presented in **Table 6-20**.

Table 6-20 Mitigation measures – Waste generation

Impact	Mitigation measure	Timing	Responsibility
Waste generation	The Contractor's recycling and reuse proposal will be detailed in the CEMP following the resource management hierarchy principles (in accordance with the <i>Waste Avoidance & Resource Recovery Act 2001</i>): <ul style="list-style-type: none"> • Avoid unnecessary resource consumption as a priority • Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) • Disposal is undertaken as a last resort. 	Prior to construction	Contractor
Waste generation	Dispose of all excess material (that cannot be reused or recycled) as soon as practicable, to a facility licensed to accept the waste as per the waste	Construction	Contractor



Impact	Mitigation measure	Timing	Responsibility
	classification results (tested by a suitably qualified person in accordance with the NSW Waste Classification Guidelines 2014). Retain disposal receipts and provide to Hunter Water contract manager on request.		
Waste generation	Segregate and label waste to improve recycling opportunities, avoid cross contamination and reduce disposal costs.	Construction	Contractor
Waste generation	Cover waste receptacles and locate away from drainage lines.	Construction	Contractor
Waste generation	All vessels used for contaminated or hazardous waste (including lead) will be sealed, labelled according to their contents, and stored within bunded areas until their removal from the work site.	Construction	Contractor
Waste generation	Any fuel, lubricant or hydraulic fluid spillages will be collected using absorbent material and the contaminated material disposed of at a licensed waste facility.	Construction	Contractor
Waste generation	Where there is potential for asbestos to occur, an Asbestos Management Plan will be prepared prior to the commencement of the works.	Prior to construction	Contractor

6.12 Cumulative and consequential impacts

The following websites were searched on 27 October 2022 for recent or proposed developments that could interact with the proposal:

- NSW DPE Major Projects Register
- NSW Planning Portal
- Transport for NSW
- MCC.

There are no proposed developments occurring within a 5 km vicinity of the site which are expected to contribute to cumulative impacts.

If any projects become known within the vicinity of the proposal area the mitigation measures in **Table 6-21** would apply.

6.12.1 Mitigation measures

The mitigation measures that would be implemented to minimise cumulative and consequential impacts of the proposal are presented in **Table 6-21**.

Table 6-21 Mitigation measures – Cumulative and consequential impacts

Impact	Mitigation measure	Timing	Responsibility
Cumulative if other projects occurring at the same time	Consult and coordinate with proponents of nearby projects to assess and manage cumulative impacts. Revise the CEMP to address these impacts as they become known.	Prior to and during construction	Contractor



7 SUMMARY OF MITIGATION MEASURES

Construction would occur in accordance with a site-specific Construction Environment Management Plan (CEMP) that would outline mitigation measures, roles and responsibilities, contact details, unexpected finds protocols and emergency and incident response. Mitigation measures presented in **Table 7-1** would be included in the CEMP.

Table 7-1 Mitigation measures

Aspect	Mitigation measure	Timing	Responsibility
Topography, geology, soils and contamination	The Construction Soil and Water Management Plan (CSWMP) will include as a minimum, type and location of sediment/erosion controls to be used.	Prior to construction	Contractor
	Erosion and sediment controls are to be implemented and maintained consistent with <i>Managing Urban Stormwater: Soils and Construction. Fourth Edition ed. Sydney (NSW) (Landcom, 2004) (the Blue Book)</i> . Controls include: <ul style="list-style-type: none"> • Be installed prior to disturbance commencing • Prevent sediment moving off-site and sediment laden water entering any watercourse, drainage line, or drain inlets • Divert clean surface flow around exposed areas and stockpiles • Reduce water velocity and capture sediment • Minimise the amount of material tracked onto paved surfaces Be cleaned out before 30% capacity of controls is reached.	Prior to construction/ construction	Contractor
	Disturbed areas will be stabilised as soon as practical after completion of works. Erosion and sediment controls will not be removed until suitable ground cover is achieved in accordance with the Blue Book.	Construction	Contractor
	The natural landform of the site will be restored as closely as possible to the pre-works condition.	Construction	Contractor
	If during construction activities, contaminated soils are uncovered or are suspected to have been uncovered due to odour or discolouration of soils works will cease immediately, the Hunter Water Project Manager will be contacted, and the appropriate management requirements determined.	Construction	Contractor
	Any spoil storage areas or stockpiles (including within its stability limits) will have appropriate erosion control devices installed to control runoff and prevent sedimentation.	Construction	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	Contaminated solid wastes will be transferred to a registered waste management facility. Contaminated materials will be classified in accordance with the Waste Classification Guidelines to support appropriate disposal, selection of facilities and disposal cost. The CEMP will include protocols for unexpected finds and handling of contaminated soil.	Prior to and during construction	Contractor
Hydrology, flooding and water quality	An Incident Management Plan (IMP) will be prepared as part of the Contractor's CEMP and will include a contingency plan and emergency procedures for dealing with the potential spillage of fuel or other environmental incidents that may occur on the work site. The IMP should also contain procedures dealing with the unexpected onset of rainfall during the work period.	Prior to construction	Contractor
	The storage and handling of fuels and chemicals will comply with Australian Standard (AS) AS1940. This includes the provision of a 'spill kit' to be kept on site at all times for potential chemical or fuel spills. All staff are to be made aware of the location of the spill kit and trained in its use.	Prior to construction/ construction	Contractor
	No chemicals, fuels, and/or waste will be stored or collected for disposal within or adjacent to drainage lines or unsealed surfaces.	Construction	Contractor
	Refuelling, fuel decanting and vehicle maintenance work will take place in a designated area on an impermeable surface.	Construction	Contractor
	Daily checks of vehicles working on the construction works will be conducted to ensure that no oils or fuels are leaking.	Construction	Contractor
	Should groundwater extraction be required during construction, a Water Supply Work Approval will be sought from DPE - Water. Where greater than three ML in a financial year, a WAL would also be required. Any dewatering of groundwater should be undertaken in accordance with an approved dewatering management plan (DMP), which may include water quality requirements and discharge locations.	Prior to dewatering during construction	Contractor / Hunter Water
	Water from trench/pits de-watering will be pumped and either collected in tanks for appropriate disposal or filtered through geotextile fabric onto grass filter areas. Groundwater volumes removed are to be reported to Hunter Water monthly. Any affected property owners will be consulted, and work agreed to before dewatering commences.	Construction	Contractor
	Water from excavations would be prevented from entering areas of native vegetation. The soil and water management measures would minimise any	Construction	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	water runoff from dewatering activities. In addition, the area of soil surface disturbed and wetted would be kept to the minimum amount necessary to complete the works.		
Ecology and bushfire	During design and construction planning, minimise impacts to the areas mapped as the Lower Hunter Spotted Gum Ironbark Forest (PCT3444) as much as possible.	Detailed design, construction	Design contractor, Construction contractor
	The full extent of approved vegetation clearance will be clearly documented and mapped in site CEMP(s). All construction activities, including but not limited to vegetation clearing, is to be strictly confined to the proposal area assessed in the REF.	Prior to works commencing	Contractor
	To prevent damage to vegetation outside the boundaries of access tracks/roads and minimise the spread of weeds, vehicles and machinery will be restricted to designated access roads and tracks.	Construction	Contractor
	Excavations not back-filled at the end of the day are to be covered prior to nightfall to avoid presenting an obstacle or trap to fauna. If this is not possible, provide a means by which fauna can escape e.g. branch extending out of trench.	Construction	Contractor
	Check trenches / pits / excavations each morning for trapped fauna.	Construction	Contractor
	<p>Weed management will be undertaken in accordance with species-specific control measures listed in NSW WeedWise and any applicable Local Control Orders issued under the <i>Biosecurity Act 2016</i> and the following:</p> <ul style="list-style-type: none"> • Ensure plant, equipment and clothing are free of soil and vegetative matter prior to being brought to site • Check all items are free of soil and vegetative material before moving through un-infested areas and before leaving the site, including machinery, vehicles, tools and footwear • Control weed propagules by trimming any developing flowers or seed heads and disposing of these appropriately • Ensure erosion controls are in place to minimise the spread of weeds from run off. <p>Place waste containing seed and vegetative material in bags or on plastic sheeting during weed removal, where practicable.</p>	Construction	Construction contractor
	All weeds removed from a site(s) will be transported in a sealed container or bag and disposed at a licenced waste disposal facility.	Construction	Construction contractor



Aspect	Mitigation measure	Timing	Responsibility
	<p>This is particularly important for the following species found on site:</p> <ul style="list-style-type: none"> • Coolatai Grass • African Olive • Cotoneaster. 		
	<p>Excavation areas will be managed to minimise the risk of direct and indirect impacts to fauna. Excavated areas will be fenced and covered when not in use.</p>	Construction	Construction contractor
	<p>Minimise the spread of pests and pathogens by ensuring all plant, equipment and clothing are clean and free of soil and vegetative matter prior to being brought to site.</p>	Construction	Construction contractor
	<p>If any threatened species (flora or fauna) is discovered during the works, stop work immediately and notify the Project Manager. Work will only recommence once the impact on the species has been assessed and appropriate control measures provided.</p>	Construction	Construction contractor
	<p>No hot works during total fire ban.</p>	Construction	Contractor
	<p>Works generating sparks etc will be undertaken utilising a 'Hot Work Permit' or similar process that outlines measures to mitigate potential fire risks. Fire extinguishers will be located within the work sites and/or on machinery/vehicles</p>	Construction	Contractor
	<p>Vegetation within the site will be managed to minimise bushfire risks. It is recommended that Hunter Water continue to regularly manage and maintain the site to ensure the survivability of the structures onsite in the event of a bushfire</p>	Construction	Contractor
Noise and vibration	<ul style="list-style-type: none"> • Provide at least seven days' notice to the two nearby potentially affected residential receivers prior to starting work • Monitoring will be carried out in response to any complaints, to verify noise levels during construction. 	Seven days prior to works commencing (notification) and during construction (verification monitoring)	Contractor
	<p>Works will be carried out during standard work hours (i.e. 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday). For any work that is performed outside normal work hours or on Sunday or public holidays, the contractor must complete the Hunter Water OOHW Approval Form and adhere to the OOHW Construction Noise Guideline.</p>	Prior to work commencing outside of standard work hours	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	<p>The following measures will be implemented during construction:</p> <ul style="list-style-type: none"> • Personnel will be inducted and trained in noise control measures to reduce impacts on receivers during inductions and toolbox talks • Where possible, quiet and less vibration emitting construction methods will be used • Where possible, noisy activities such as jet blasting and concrete cutting will be limited to standard hours of construction and will be concentrated in one location before moving to another as quickly as possible. The temporary construction of noise barriers for concentrated, noise intensive activities will be considered • Where noisy activities cannot be scheduled to standard hours of construction, noisy activities will take place earlier in the night, during less sensitive time periods • Where possible, the operation of two or more noisy plant close to receivers will be avoided and all vehicles and plant will be turned off when not in use • All stationary and mobile equipment will be fitted with mufflers and in serviceable condition. Generators, if used are to have sound proof enclosures • Construction vehicles including trucks will not be allowed to queue on local roads or if it is required for safety reasons, engines will be switched off • Where possible, all plant is to utilise a broad band reverse alarm with less intrusive alarms and the need to reversing manoeuvres will be minimised. • Deliveries will be scheduled during standard work hours only • No dropping of materials from height where practicable and no throwing of metal items • Switching off any equipment not in use for extended periods e.g. heavy vehicle engines will be switched off whilst being unloaded • Avoiding any unnecessary noise when carrying out manual operations and when operating plant 	Construction	Contractor
	<ul style="list-style-type: none"> • Choosing alternative, lower-impact equipment or methods wherever possible • Sequencing operations so that vibration-causing activities do not occur simultaneously and where possible locating high vibration sources as far away from sensitive receivers as possible • Keeping equipment well maintained • Wherever possible, avoid the use of vibration intensive plant within the recommended safe setback distances. Where these setbacks can't be maintained, notify receiver(s), conduct 	Construction	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	<p>inspections and monitoring to verify resulting levels, assess impacts and inform the need to modify works as necessary</p> <p>Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic and heritage building damage.</p>		
	A complaint management procedure will be developed. Community complaints will be allocated to a responsible contractor representative immediately to facilitate investigation, respond to the complainant, review noise mitigation measures and to implement any corrective actions. The details of the complaint will also be circulated to the applicable construction personnel for action, where required.	Construction	Contractor
Air quality and energy	<ul style="list-style-type: none"> • Visually monitor dust and where necessary: • Apply water (or alternate measures) to exposed surfaces that are generating dust • Appropriately cover loads on trucks transporting material to and from the construction site • Securely fix tailgates of road transport trucks prior to loading and immediately after unloading • Avoid dust generating works during strong winds. <p>Prevent where possible, or remove, mud and dirt being tracked onto sealed road surfaces.</p>	Construction	Contractor
	Stabilise long term stockpiles by covering, or with soil binders such as polyvinyl acetate (PVA) or latex sprays.	Construction	Contractor
	Air pollutant emission complaints will be dealt with promptly and the source will be eliminated wherever practicable.	Construction	Contractor
	Contractors are required to report in the 'Contract Environmental Management Report' monthly energy usage information to Hunter Water	Construction (monthly)	Contractor
Aboriginal heritage	High visibility fencing will be installed around the AHIMS registered site (#37-6-3180) and buffer area during works to prevent impacts. All personnel involved in the works will be informed about the designated no-go area.	Construction	Constructor
	In the event that an Aboriginal object (or objects) is uncovered during the proposed works the Unexpected Finds Protocol in Appendix F will be followed. Ground disturbance works will cease within 20 m of the object(s) and the Hunter Water Archaeologist will be contacted. The Hunter Water	Construction	Contractor/ Hunter water



Aspect	Mitigation measure	Timing	Responsibility
	<p>Archaeologist will advise the Heritage Office and the relevant Aboriginal parties so that appropriate management strategies can be identified.</p>		
	<p>In the unlikely event that human skeletal material is uncovered during the proposed construction works the Unexpected Finds Protocol as provided in Appendix D will be followed. All works will cease within 20 m of the skeletal remains. Should the remains be verified as human, the NSW Police and Department of Planning and Environment (DPE) will be contacted. No works will proceed within the vicinity of the skeletal remains until an appropriate course of action has been determined in consultation with NSW Police, DPE and Aboriginal parties (if the remains are identified as Aboriginal).</p>	Construction	Contractor/ Hunter water
Non-Aboriginal heritage	<p>If non-Aboriginal heritage items are discovered during the course of the proposal, all work will cease in the area and the Contractor will inform the Hunter Water Project Manager and Archaeologist as soon as possible. Hunter Water will determine the preferred management approach and the local council and/or NSW Heritage Office will be notified via the Hunter Water Project Manager if required.</p>	Construction	Contractor
	<ul style="list-style-type: none"> • Care will be exercised to ensure that the Babworth House - building is not subject to indirect or accidental direct impacts during construction • Exclusion tape will be utilised to delineate the work area to prevent accidental damage to Babworth House - building. 	Construction	Contractor / Hunter Water
Visual amenity	<p>Restore work sites as close to their original condition as possible at completion of the works</p> <p>On completion of the works, all vehicles, construction equipment, materials, and refuse relating to the works will be removed from the work site(s) and any adjacent affected areas.</p> <p>Work areas will be maintained, kept free of rubbish and cleaned up at the end of each working day.</p>	Construction	Contractor
	<p>Clear the minimum amount of vegetation necessary and undertake replacement planting in accordance with the Potable Water Reservoir Specification STS409 (Hunter Water, 2009).</p>	Construction	Contractor
Traffic and access	<p>Access to private properties will be maintained as far as practicable throughout construction.</p> <p>The use of private driveways and access roads will be in agreement and consultation with the landowner.</p>	Prior to construction	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	<ul style="list-style-type: none"> • Appropriate exclusion barriers, signage and site supervision will be employed at all times to ensure that the work site is controlled, and that unauthorised vehicles and pedestrians are excluded from the works area • Movements of heavy vehicles will be restricted to standard work hours (i.e. 7:00 am to 6:00 pm Monday to Friday and 8:00 am to 1:00 pm Saturday) • Where possible, parking of light vehicles will be within the ancillary laydown areas and site compound to minimise interference with vehicle movements of local residents. 	Construction	Contractor
	Alternative access will be provided, where possible, where construction works affect paths, access ways and roads.	Construction	Contractor
	Where there are road restrictions or closures, a TMP will be prepared. Should work on public roads be required then consultation with the relevant traffic authority(s) will be undertaken.	Prior to construction	Contractor
	Hunter Water will be responsible for the maintenance of the Harpers Hill Lane extension and private access road within the western boundary of the proposal area.	During and post construction	Hunter Water
Land use and services	Land subject to temporary use for the proposal including the construction corridor and ancillary and laydown area and access will be rehabilitated as soon as practicable to an appropriate condition in agreement with the landowner.	Prior to construction	Hunter Water
	<p>Provide at least seven days' notice to affected receivers prior to starting work unless it is emergency works or it is discussed with the affected receivers face-to-face. Include the following information in notification letters:</p> <ul style="list-style-type: none"> • A description of the works and why they are being undertaken • Details of the works that will be noisy • Work hours and expected duration • What is being done to minimise the impacts (e.g. respite periods) • 24 hour contact number. 	Seven days prior to works commencing	Contractor
	<ul style="list-style-type: none"> • Where entry to private property is required, a notice of entry letter will be provided at least 14 days in advance. • Maintain a complaints register and respond to any complaints and notify the Hunter Water 	Prior to construction / during construction	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	<p>Project Manager as soon as possible within 24 hours</p> <ul style="list-style-type: none"> The contractor will personally contact the occupant when they enter a private property to notify of their presence and what works are intended Any accidental damage to property occurred by the works must be immediately reported to the Hunter Water Project Manager and repaired in consultation with the owner Erect signage containing project information and contact details in a prominent location. 		
	<p>Land subject to temporary use will be rehabilitated as soon as practicable to an appropriate condition in agreement with the landowner.</p>	Construction	Contractor
	<p>All services in the vicinity of the works will be located in the field and 'pegged-out' and noted in the Environmental Management Plan and/or work plans prior to excavation works – "Before You Dig".</p>	Prior to ground penetrating work or work under power lines	Contractor
Waste generation	<p>The Contractor's recycling and reuse proposal will be detailed in the CEMP following the resource management hierarchy principles (in accordance with the <i>Waste Avoidance & Resource Recovery Act 2001</i>):</p> <ul style="list-style-type: none"> Avoid unnecessary resource consumption as a priority Avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery) <p>Disposal is undertaken as a last resort.</p>	Prior to construction	Contractor
	<p>Dispose of all excess material (that cannot be reused or recycled) as soon as practicable, to a facility licensed to accept the waste as per the waste classification results (tested by a suitably qualified person in accordance with the NSW Waste Classification Guidelines 2014). Retain disposal receipts and provide to Hunter Water contract manager on request.</p>	Construction	Contractor
	<p>Segregate and label waste to improve recycling opportunities, avoid cross contamination and reduce disposal costs.</p>	Construction	Contractor
	<p>Cover waste receptacles and locate away from drainage lines.</p>	Construction	Contractor
	<p>All vessels used for contaminated or hazardous waste (including lead) will be sealed, labelled</p>	Construction	Contractor



Aspect	Mitigation measure	Timing	Responsibility
	according to their contents, and stored within bunded areas until their removal from the work site.		
	Any fuel, lubricant or hydraulic fluid spillages will be collected using absorbent material and the contaminated material disposed of at a licensed waste facility.	Construction	Contractor
	Where there is potential for asbestos to occur, an Asbestos Management Plan will be prepared prior to the commencement of the works.	Prior to construction	Contractor
Cumulative impacts	Consult and coordinate with proponents of nearby projects to assess and manage cumulative impacts. Revise the CEMP to address these impacts as they become known.	Prior to and during construction	Contractor



8 CONCLUSION

8.1 Justification

The Maitland / North Rothbury water supply system currently supplies water to the majority of the Maitland LGA. The Maitland / North Rothbury water supply system have had several operational issues including storage and pumping capacity and risk of asset failure.

The proposal would replace the existing 0.9 ML reservoir with a new five megalitre (ML) potable water reservoir at Harpers Hill and duplicate the trunk main between the new reservoir and the Lochinvar WPS. This approach would reduce the risk of supply interruption. It would also increase storage and pumping capacity of the network to cater for current and future increased demand in surrounding areas.

The principles of ESD are discussed in **Section 8.3** and the social, biophysical and economic considerations are as follows:

- Social factors: Long-term positive social impacts would arise from proposal as it would ensure storage and boost capacity for increased future water demands
- Biophysical factors: Adverse biophysical impacts would mostly occur during the construction phase of the proposal due to the required vegetation removal. The proposal would involve vegetation clearing of about 2.3 ha of Lower Hunter Spotted Gum – Ironbark Forest (PCT3444) TEC
- Economic factors: The workforce used to build the proposal would contribute to the local and regional economy during the construction phase that would see workers utilise local services and amenities
- Public interest: The public interest is best served through the equitable distribution of resources, and investment in public infrastructure that fulfils the needs of the majority. The proposal represents an investment in public water infrastructure that would provide security and ensure current and future demand is met.

Although the proposal would result in some short-term impacts on amenity (noise and vibration), biodiversity, erosion and sedimentation and potentially water quality during construction, these impacts would be outweighed by the long-term benefits once the proposal is operational. As a result, the proposal is considered to be in the public interest.

8.2 Objects of the EP&A Act

Table 8-1 summarises the objects of the EP&A Act in relation to the proposal.

Table 8-1 EP&A objects

Object	Consistency
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal would improve the social and economic welfare of the community by improving the security and capacity of water supply to meet current and future demand within the proposal local area.
1.3(b) To facilitate ESD by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	ESD is considered in Section 8.3 below.
1.3(c) To promote the orderly and economic use and development of land.	The proposal has considered and is responding to anticipated growth within the area.



Object	Consistency
1.3(d) To promote the delivery and maintenance of affordable housing.	The proposal would provide improved water infrastructure for current and future populations.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal would require the removal of about 2.3 ha of native vegetation listed as a TEC under the BC Act. The proposal is unlikely to have a significant impact of biodiversity, refer to Section 6.3 .
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	The proposal is not expected to impact on any known Aboriginal or non-Aboriginal heritage items, Section 6.6 and 6.7 .
1.3(g) To promote good design and amenity of the built environment.	Not relevant to the proposal.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the proposal.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the proposal.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	The community would be advised of proposed construction and timing.

8.3 Ecological Sustainable Development

ESD is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD were an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD and how the project responds to these principles are discussed below.

Precautionary principle

The proposal has sought to take a precautionary approach to minimising environmental impact. This has been applied through the development of a range of environmental mitigation measures, as summarised in **Chapter 7**. These mitigation measures would be implemented during construction and operation of the proposal.

No mitigation measures have been postponed as a result of lack of scientific certainty or as a result of a lack of information. The selected construction contractor would be required to prepare a CEMP before commencing construction.

Intergenerational equity

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations. The proposal would benefit future generations by improving the water infrastructure for current and future populations. While



the proposal would have some adverse impacts, they are not considered to be of a nature that would result in disadvantage to any specific section of the community or to future generations.

Conservation of biological diversity and ecological integrity

The proposal is generally located in an area that has previously been modified as a result of the construction of the existing trunk main, the New England Highway and agricultural activities.

Conservation of biological diversity and ecological integrity has been considered during all stages of the proposal's development. Potential impacts have been avoided where possible and mitigation measures have been included where necessary. The biodiversity assessment (refer to **Section 6.3**) concluded that the proposal would not have a significant impact on any existing flora and fauna species, biodiversity communities or the overall biological integrity of the proposal and nearby areas. The findings of the biodiversity assessment indicate that the potential impacts would be acceptable and minimised through the proposed mitigation measures (refer to **Section 6.3.4**).

Improved valuation, pricing and incentive mechanisms

Environmental and social issues were considered in the planning and establishment of the need for the proposal, and in consideration of various proposal options. The value placed on environmental resources is evident in the extent of the planning and environmental investigations, and in the design of the proposed mitigation measures. Implementation of these mitigation measures would result in an economic cost to Hunter Water, which would be included in both the capital and operating cost of the proposal.

8.4 Conclusion

The proposal is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and extensively considered all matters affecting or likely to affect the environment by reason of the proposed activity.

Potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal as described in the REF best meets the proposal objectives but would still result in some amenity (noise and vibration impacts), biodiversity, soils and sedimentation and potentially water quality.

Mitigation measures as detailed in this REF would mitigate or minimise these expected and as such the proposal is not likely to have a significant environmental impact.

The proposal would improve the storage and capacity of water infrastructure for current and future demands.

Significance of impact under NSW legislation

The proposal is not likely to cause a significant impact on the environment. Therefore, it is not necessary for an EIS to be prepared and approval to be sought from the Minister for Planning and Homes under Division 5.2 of the EP&A Act. A BDAR or SIS is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from MCC is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on MNES or the environment of Commonwealth land within the meaning of the EPBC Act. A referral to the DCCEEW is not required.



9 DECLARATION

This Review of Environmental Factors provides a true and fair review of the activity in relation to its likely impact on the environment. It addresses to the fullest extent possible, all the factors listed in Section 171 of the *Environmental Planning and Assessment Regulation 2021* (as amended) and the EPBC Act (as amended).

Signed:

Name: Adeline Reid

Position: Graduate Environmental Consultant

Date: 24 January 2023



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APPENDIX A. SECTION 171 OF EP&A REGULATION 2021 ENVIRONMENTAL FACTORS CHECKLIST

The table below demonstrates Hunter Water's consideration of the specific factors of Section 171(2) of the EP&A Regulation 2021 in determining whether the proposal would have a significant impact on the environment.

Has the REF considered the following points?	Positive/Negative	Impact
(a) the environmental impact on a community	Positive	Long-term and minor
(b) the transformation of a locality	N/A	Nil
(c) the environmental impact on the ecosystems of a locality	N/A	Nil
(d) reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality	Negative	Long-term and minor
(e) the effects on a locality, place or building that has – <ol style="list-style-type: none"> 1. aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or 2. other special value for present or future generations 	N/A	Nil
(f) the impact on the habitat of protected animals (within the meaning of the <i>BC Act</i>)	N/A	Nil
(g) the endangering of a species of animal, plant or other form of life, whether living on land, in water or in the air	N/A	Nil
(h) long-term effects on the environment	Negative	Long-term and minor
(i) degradation of the quality of the environment	Negative	Long-term and minor
(j) risk to the safety of the environment	Negative	Long-term and minor
(k) reduction in the range of beneficial uses of the environment	N/A	Nil
(l) pollution of the environment	N/A	Nil
(m) environmental problems associated with the disposal of waste	Negative	Short term and minor
(n) increased demands on natural or other resources that are, or are likely to become, in short supply	N/A	Nil



Has the REF considered the following points?	Positive/Negative	Impact
(o) the cumulative environmental effect with other existing or likely future activities	N/A	Nil
(p) the impact on coastal processes and coastal hazards, including those under projected climate change conditions	N/A	Nil
(q) applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1	N/A	Nil
(r) other relevant environmental factors	N/A	Nil



APPENDIX B. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES) CHECKLIST

Under the environmental assessment provisions of the EPBC Act, the following MNES and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the DCCEE.

A referral is not required for proposed actions that may affect nationally listed threatened species, TECs and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government's significant impact criteria and taking into account relevant guidelines and policies.

Significance matter	Yes / No	Relevant details
Listed threatened species and communities	Yes	A biodiversity assessment concluded that the proposal would be unlikely to have a significant impact on threatened species or ecological communities (refer to Section 6.3). The proposal would not impact any nationally threatened species, ecological communities or listed migratory species.
Listed migratory species	No	
Ramsar wetlands of international importance	No	There would be no impact to wetlands of international importance by the proposal.
Commonwealth marine environment	No	There would be no impact to Commonwealth marine areas by the proposal.
World heritage properties	No	No declared World Heritage properties are located within or in close proximity to the proposal.
National heritage places	No	There would be no impact to National Heritage places by the proposal.
The Great Barrier Reef Marine Park	No	There would be no impact on the Great Barrier Reef Marine Park.
Nuclear actions	No	The proposal does not involve a nuclear action (including uranium mining).
A water resource, in relation to coal seam gas development and large coal mining development	No	The proposal would not impact on a water resource, in relation to coal.



APPENDIX C. AGENCY CONSULTATION



Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657
enquiries@hunterwater.com.au
hunterwater.com.au

24 November 2022

Our Ref: HW2018-25/5/18.003

The Manager
Maitland City Council
PO Box 220
Maitland NSW 2320

Dear Sir/Madam,

Consultation regarding the proposed Harpers Hill reservoir and new trunk main

Hunter Water Corporation (Hunter Water) owns a large and complex water supply network, including reservoirs, pumping stations and water mains.

To improve water supply performance of the Maitland / North Rothbury water supply system, Hunter Water is proposing:

- A new 5 megalitre (ML) reservoir at Harpers Hill
- A new trunk main from the Lochinvar 2 Water Pump Station to the reservoir
- An access road to link the eastern portion of the Harpers Hill Lane with the private road to the reservoir site to provide safer access for construction and operation staff accessing the reservoir site.

Attachment A and **Attachment B** provide further information on this proposal.

A Review of Environmental Factors (REF) is currently being prepared by Jacobs on behalf of Hunter Water. The purpose of the REF is to assess the likely impacts associated with the proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

Consultation under the State Environmental Planning Policy (Transport and Infrastructure 2021)

Under the *State Environmental Planning Policy (Transport and Infrastructure) 2021*, Hunter Water is required to consult with Maitland City Council under Division 1, clause 2.10 due to the potential impacts of the proposal on Council road infrastructure.

Consultation regarding the access road from Harpers Hill Lane to the reservoir private road

Hunter Water and Jacobs have commenced consultation with Maitland City Council about the proposed Harpers Hill Lane extension to the reservoir site private road. Council responded on 26 October 2022 specifying that the private road needs to include a 3.5 metre (m) width and a two coat spray seal, that there needs to be barricading between the lane extension and the New England Highway, and that the lane extension would be Hunter Water's responsibility to maintain.

Further communication with Maitland City Council is required to confirm the construction arrangements, maintenance responsibilities and approval process for the access improvement.

Consultation regarding crossing Terriere Drive

Hunter Water and Jacobs have commenced consultation with Maitland City Council about the proposed crossing of Terriere Drive. Council responded on 19 October 2022 specifying that the road crossing must be trenchless, with a preference for non-destructive methods such as underboring.

Further communication with Maitland City Council is required to confirm the construction arrangements, maintenance responsibilities and approval process for the access improvement.

Response timeframe

It would be appreciated if you could provide any comments about this proposal within 21 calendar days from the date of this letter. Any response from Maitland City Council within this period would be taken into consideration of the proposal by Hunter Water.

Hunter Water would be pleased to provide further information if required. In this regard, please contact Daniel Spinaze by email at Daniel.spinaze@hunterwater.com.au

Yours sincerely,

Daniel Spinaze
Project Manager
Hunter Water Corporation

Attachment A: Proposal description

Background

The Maitland/North Rothbury water supply system currently experiences a number of operational issues, including storage, pumping capacity and low-pressure problems. The existing 0.9 megalitre (ML) reservoir has been identified as being in poor structural condition and does not meet Hunter Water's security of supply requirements.

Hunter Water proposes to construct a new 5 ML reservoir and approximately 2.4 kilometres (km) of water trunk main from the Lochinvar 2 Water Pumping Station (WPS) – refer to Attachment B.

Key elements of the proposal include:

- Constructing and operating a new 5 ML potable water reservoir
- Constructing and operating 2.4 km of new 375 millimetre (mm) water main between Lochinvar WPS and the new reservoir which would operate in parallel with the existing 250 mm water trunk main
- Constructing underground pipework at the new reservoir, including inlet, outlet, scour, overflow and connecting to existing outlet pipework
- Cutting and filling earthworks to create an even surface below the new reservoir and access road
- Harpers Hill Lane access improvement, comprising:
 - Upgrading the eastern portion of Harpers Hill Lane
 - Constructing an access road to connect the eastern portion of Harpers Hill Lane and the private road used to access the reservoir site
- Demolishing the existing 0.9 ML Harpers Hill 1 Reservoir (the existing reservoir).

The proposal stretches about 3.5 km through the suburbs of Harpers Hill, Allandale and Lochinvar within the Maitland Local Government Area (LGA). It is located about 15 km to the northeast of Cessnock and 11 km to the northwest of Maitland.

The proposal is not located within a Flood Planning Area. However, the proposal lies about 150 metres (m) south of a Flood Planning Area associated with Kaludah Creek, as identified in the *Maitland Local Environmental Plan 2011*.

Construction methodology

The works would be conducted within a construction corridor of up to 25 m wide along the trunk main and 125 m wide at the reservoir. The majority of the new trunk main would be installed via open trenched method with the exception of the trunk main crossing Allandale and Terriere Road. The trunk main across Allandale Road would be installed by underboring by horizontal directional drilling. Harper Hill Lane access improvement would involve grading, laying of road base and road surface sufficient to allow 12.5 m vehicles to access the reservoir site.

Construction methodology details would be confirmed by the construction contractor.

Timing

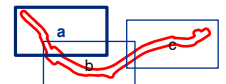
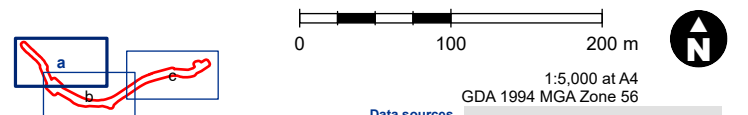
The construction of the proposal has been anticipated to commence in late 2023 and would take up to 12 months to complete (weather permitting).

Where possible, the proposal would be carried out during standard construction hours.

Stakeholders potentially impacted by the proposal, including local residents and businesses, would be contacted before work begins in accordance with the Hunter Water out of hours work procedures.



- Proposal area
- Laydown area
- Harpers Hill Lane access improvement



1:5,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Aerometrex 2021

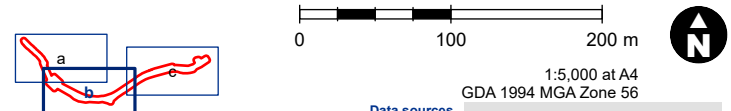
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Attachment B-1 The proposal

Photo: Imagery provided by Google Earth Pro, 2022.08.15. Date: 20/10/2022. Created by: ACI | GDA by: GDA



- Proposal area
- Entry/exit pit
- New trunk main
- Laydown area



Data sources

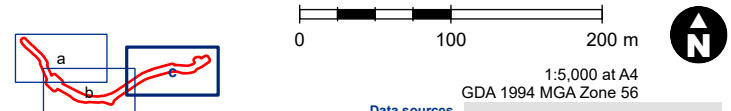
- Jacobs 2022
- Department of Customer Service 2022
- Aerometrex 2021

1:5,000 at A4
GDA 1994 MGA Zone 56

Attachment B-2 The proposal



- Proposal area
- Entry/exit pit
- New trunk main
- Laydown area



Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Aerometrex 2021



Attachment B-3 The proposal



Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657
enquiries@hunterwater.com.au
hunterwater.com.au

24 November 2022

Our Ref: HW2018-25/5/18.003

The Manager
Transport for New South Wales
231 Elizabeth Street
Sydney NSW 2000

Dear Sir/Madam,

Consultation regarding the proposed Harpers Hill reservoir and new trunk main

Hunter Water Corporation (Hunter Water) owns a large and complex water supply network, including reservoirs, pumping stations and water mains.

To improve water supply performance of the Maitland/North Rothbury water supply system, Hunter Water is proposing:

- a new 5 megalitre (ML) reservoir at Harpers Hill
- a new trunk main from the Lochinvar 2 Water Pump Station to the reservoir
- an access road to link the eastern portion of the Harpers Hill Lane with the private road to the reservoir site to provide safer access for construction and operation staff accessing the reservoir site.

Attachment A and **Attachment B** provide further information on this proposal.

A Review of Environmental Factors (REF) is currently being prepared by Jacobs on behalf of Hunter Water. The purpose of the REF is to assess the likely impacts associated with the proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

Consultation regarding the access road from Harpers Hill Lane to the reservoir private road

The proposed Harpers Hill Lane extension would occur within the New England Highway road reserve. Accordingly, this letter is to consult with Transport for New South Wales (TfNSW) under Section 138 of the *Roads Act 1993*. While consultation has been ongoing with TfNSW, further communication is required to confirm the delineation between the Harpers Hill Lane extension and the New England Highway, barricading requirements and the approval process for the access improvement.

Response timeframe

It would be appreciated if you could provide any comments about this proposal within 21 calendar days from the date of this letter. Any response from TfNSW within this period would be taken into consideration of the proposal by Hunter Water.

Hunter Water would be pleased to provide further information if required. In this regard, please contact Daniel Spinaze by email at Daniel.spinaze@hunterwater.com.au

Yours sincerely,

Daniel Spinaze
Project Manager
Hunter Water Corporation

Attachment A: Proposal description

Background

The Maitland/North Rothbury water supply system currently experiences a number of operational issues, including storage, pumping capacity and low-pressure problems. The existing 0.9 megalitre (ML) reservoir has been identified as being in poor structural condition and does not meet Hunter Water's security of supply requirements.

Hunter Water proposes to construct a new 5 ML reservoir and approximately 2.4 kilometres (km) of water trunk main from the Lochinvar 2 Water Pumping Station (WPS) – refer to **Attachment B**.

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Timing

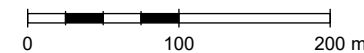
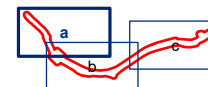
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Where possible, the proposal would be carried out during standard construction hours.

Stakeholders potentially impacted by the proposal, including local residents and businesses, would be contacted before work begins in accordance with the Hunter Water out of hours work procedures.



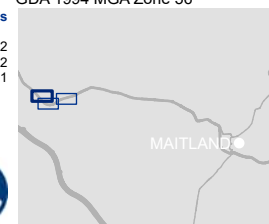
- Proposal area
- Laydown area
- Harpers Hill Lane access improvement



1:5,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Aerometrex 2021

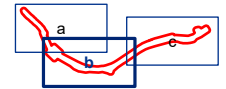
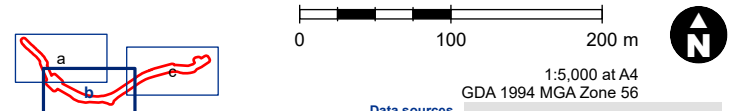


Attachment B-1 The proposal

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- Proposal area
- Laydown area
- New trunk main
- Entry/exit pit



Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Aerometrex 2021

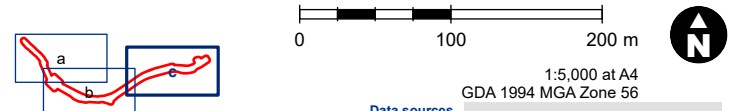


Attachment B-2 The proposal

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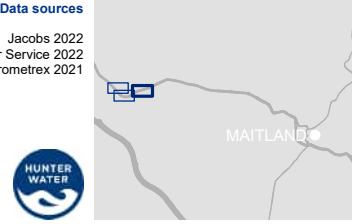


- Proposal area
- Entry/exit pit
- New trunk main
- Laydown area



1:5,000 at A4
GDA 1994 MGA Zone 56

Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Aerometrex 2021



Attachment B-3 The proposal



Hunter Water Corporation
ABN 46 228 513 446

PO Box 5171
HRMC NSW 2310
36 Honeysuckle Drive
NEWCASTLE NSW 2300
1300 657 657
enquiries@hunterwater.com.au
hunterwater.com.au

24 November 2022

Our Ref: HW2018-25/5/18.003

Regional Manager - Hunter Fisheries Office
Department of Primary Industries – Fisheries
Taylors Beach Road
Taylors Beach NSW 2316

Dear Sir/Madam,

Consultation regarding the proposed Harpers Hill reservoir and new trunk main

Hunter Water Corporation (Hunter Water) owns a large and complex water network including pumping stations, water treatment plants and trunk mains.

To improve water supply performance of in the Maitland / North Rothbury water supply system, Hunter Water is proposing:

- A new 5 megalitre (ML) reservoir at Harpers Hill
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Attachment A and **Attachment B** provide further information on this proposal.

A Review of Environmental Factors (REF) is currently being prepared by Jacobs on behalf of Hunter Water. The purpose of the REF is to assess the likely impacts associated with the proposal under Part 5, Division 5.1 of the *Environmental Planning and Assessment Act 1979*.

The scope of works includes trenching works within Kaludah Creek and an unnamed stream. A search of Geoscience Australia identified these waterways as being non-perennial (ephemeral) creeks. The creeks do not appear to contain key habitat including marine vegetation and snags. Aerial imagery and photos are provided in **Attachment D** to **F** which show the location of the creeks and proposed works.

Under section 199 of the *Fisheries Management Act 1994*, Hunter Water must give the Department of Primary Industry - Fisheries written notice before carrying out or authorising dredging or reclamation work. Hunter Water invites your organisation to provide comment and advise of any interests, concerns or statutory requirements relating to the proposed works. Comments received will be considered in preparing the REF.

Mitigation measures have been identified in the REF and would be implemented to avoid or minimise environmental impacts during construction and operation of the proposal.

It would be appreciated if you could provide any comments about this proposal within 21 calendar days from the date of this letter. Any response from the Department of Primary Industry - Fisheries within this period would be taken into consideration of the proposal by Hunter Water.

Hunter Water would be pleased to provide further information if required. In this regard, please contact Daniel Spinaze by email at Daniel.Spinaze@hunterwater.com.au

Yours Sincerely,

Daniel Spinaze
Project Manager
Hunter Water Corporation

Attachment A: Proposal description

Background

The Maitland / North Rothbury water supply system currently experiences a number of operational issues, including storage, pumping capacity and low-pressure problems. The existing 0.9 megalitre (ML) reservoir has been identified as being in poor structural condition and does not meet Hunter Water's security of supply requirements.

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The proposal is not located within a Flood Planning Area. However, the proposal lies about 150 metres (m) south of a Flood Planning Area associated with Kaludah Creek, as identified in the Maitland Local Environmental Plan 2011.

Construction methodology

The works would be conducted within a construction corridor of up to 25 m wide along the trunk main and 125 m wide at the reservoir. The majority of the trunk main would be installed via open trenched method. This includes trenching through Kaludah Creek and an unnamed stream.

A Construction Environmental Management Plan (CEMP) would be prepared and implemented to mitigate potential environmental risks. A Soil and Water Management Plan would form part of the CEMP and would include erosion and sediment control measures and measures to manage and mitigate trenching impacts on soil and water.

Timing

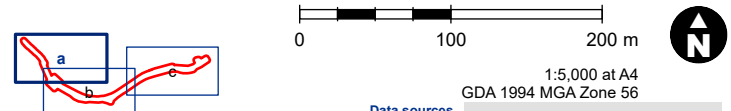
The construction of the proposal has been anticipated to commence in late 2023 and would take up to 12 months to complete (weather permitting).

The proposal would be carried out during standard construction hours.

Stakeholders potentially impacted by the proposal, including local residents and businesses, would be contacted before work begins in accordance with the Hunter Water out of hours work procedures.



- Proposal area
- Laydown area
- Harpers Hill Lane access improvement



1:5,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Aerometrex 2021

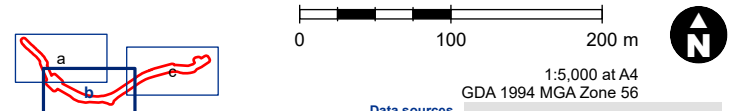



Attachment B-1 The proposal

Photo: Imagery provided by Google Earth Pro, 2022.08.10. 10:00 AM. Location: 33.111111, 151.111111. Date: 2022/08/10. Created by: ACI | GDA 1994 MGA Zone 56



- Proposal area
- Laydown area
- New trunk main
- Entry/exit pit



Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Aerometrex 2021

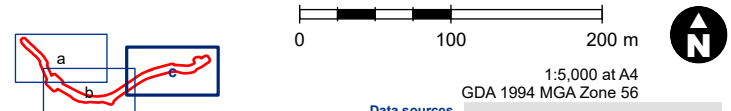


Attachment B-2 The proposal

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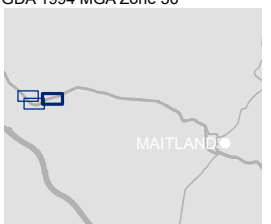


- Proposal area
- Entry/exit pit
- New trunk main
- Laydown area



1:5,000 at A4
GDA 1994 MGA Zone 56

Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Aerometrex 2021



Attachment B-3 The proposal



APPENDIX D. BACKGROUND SEARCH OF THREATENED SPECIES RECORDED IN THE LOCALITY

Scientific Name	Common Name	BC Act	EPBC Act	Records	Source
<i>Fauna</i>					
<i>Birds</i>					
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1,P		1	Bionet
<i>Circus assimilis</i>	Spotted Harrier	V,P		1	Bionet
<i>Falco subniger</i>	Black Falcon	V,P		2	Bionet
<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	1	Bionet, PMST
<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		2	Bionet
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V,P		1	Bionet
<i>Chthonicola sagittata</i>	Speckled Warbler	V,P		2	Bionet
<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	3	Bionet, PMST
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V,P		34	Bionet
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V,P		1	Bionet
<i>Numenius madagascariensis</i>	Eastern Curlew		CE, M		PMST
<i>Calidris ferruginea</i>	Curlew Sandpiper		CE, M		PMST
<i>Hirundapus caudacutus</i>	White-throated Needletail		V, M		PMST
<i>Mammals</i>					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	1	Bionet, PMST
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V,P		4	Bionet
<i>Phascolarctos cinereus</i>	Koala	E1,P	E	1	Bionet, PMST



Scientific Name	Common Name	BC Act	EPBC Act	Records	Source
<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		8	Bionet
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	123	Bionet, PMST
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V,P		2	Bionet
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		4	Bionet
<i>Myotis macropus</i>	Southern Myotis	V,P		3	Bionet
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		4	Bionet
<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		5	Bionet
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V,P		14	Bionet
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	1	Bionet, PMST
Flora					
<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	1	Bionet, PMST
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		1	Bionet
<i>Eucalyptus camaldulensis</i>	Eucalyptus camaldulensis population in the Hunter catchment	E2		1	Bionet
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	59	Bionet, PMST
<i>Eucalyptus parramattensis subsp. decadens</i>		V	V	1	Bionet, PMST
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	1	Bionet, PMST
<i>Cymbidium canaliculatum</i>	Cymbidium canaliculatum population in the Hunter Catchment	E2,P,2		1	Bionet
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E1,P,2	E	1	Bionet, PMST



Scientific Name	Common Name	BC Act	EPBC Act	Records	Source
<i>Grevillea parviflora</i> <i>subsp. parviflora</i>	Small-flower Grevillea	V	V	1	Bionet, PMST
<i>Persoonia pauciflora</i>	North Rothbury Persoonia	E4A,P, 3	CE	1	Bionet, PMST

P: Protected, *V*: Vulnerable, *V2*: Vulnerable Ecological Community, *E1*: Endangered, *CE*: Critically Endangered, *E2*: Endangered Population, *E3*: Threatened Ecological Community, *E4*: Critically Threatened Ecological Community
Bionet (DPE, 2022), PMST (DCCEEW, 2022)



APPENDIX E. ASSESSMENT OF SIGNIFICANCE (BC ACT)

Threatened entities requiring assessment of significance

Threatened entity	Justification	Assessment of Significance
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (BC Act TEC)	The works would remove up to 1.7 ha of low condition vegetation.	Yes, see below
<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)	No suitable wetland habitat present at the site	No
<i>Circus assimilis</i> (Spotted Harrier)	Marginal habitat present, the lack of maturity, fragmented nature and low condition of the habitat suggests this species would not be dependent on this habitat	No
<i>Falco subniger</i> (Black Falcon)	Marginal habitat present, the lack of maturity, fragmented nature and low condition of the habitat suggests this species would not be dependent on this habitat	No
<i>Lathamus discolor</i> (Swift Parrot)	Proposal area does not intersect a mapped area of important habitat for Swift Parrot	No
<i>Tyto novaehollandiae</i> (Masked Owl)	Marginal habitat present, the lack of maturity, fragmented nature and low condition of the habitat suggests this species would not be dependent on this habitat	No
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Chthonicola sagittata</i> (Speckled Warbler)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Anthochaera phrygia</i> (Regent Honeyeater)	Proposal area does not intersect a mapped area of important habitat for Regent Honeyeater	No
<i>Pomatostomus temporalis temporalis</i> (Grey-crowned Babbler (eastern subspecies))	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Numenius madagascariensis</i> (Eastern Curlew)	No suitable wetland habitat present at the site	No
<i>Calidris ferruginea</i> (Curlew Sandpiper)	No suitable wetland habitat present at the site	No
<i>Hirundapus caudacutus</i> (White-throated Needletail)	Suitable low condition aerial foraging habitat is present in the woodland areas, flyover and opportunistic foraging is possible. However, no important habitat is present in the site.	No
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No



Threatened entity	Justification	Assessment of Significance
<i>Phascolarctos cinereus</i> (Koala)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Petaurus norfolcensis</i> (Squirrel Glider)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	Marginal foraging resources present in a heavily fragmented landscape, considered unlikely to be important foraging habitat, and no roost camps present at the site	No
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Micronomus norfolkensis</i> (Eastern Coastal Free-tailed Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Myotis macropus</i> (Southern Myotis)	No suitable foraging or roosting habitat present	No
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Miniopterus australis</i> (Little Bent-winged Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Rutidosia heterogama</i> (Heath Wrinklewort)	Not recorded during the field surveys, and suitable habitat and soil types not present	No
<i>Acacia bynoeana</i> (Bynoe's Wattle)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Eucalyptus camaldulensis</i> (Eucalyptus camaldulensis population in the Hunter catchment)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Eucalyptus glaucina</i> (Slaty Red Gum)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Cymbidium canaliculatum</i> (<i>Cymbidium canaliculatum</i> population in the Hunter Catchment)	Not recorded during the field surveys. Although it is outside the survey period, no similar species or mistakable were observed. Considered not present in the site.	No
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	Not recorded during the field surveys. Although it is outside the survey period, no similar species or mistakable were observed. Considered not present in the site due to dense exotic grass cover.	No



Threatened entity	Justification	Assessment of Significance
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (Small-flower Grevillea)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Persoonia pauciflora</i> (North Rothbury Persoonia)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population	Not recorded during the field surveys. Although it is outside the survey period, no similar species or mistakable were observed. Considered not present in the site.	No
<i>Pimelea spicata</i> (Spiked Rice Flower)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>)	No suitable habitat within the site due to the frequent inundation and weed prevalence.	No
Eastern Coastal Free-tailed Bat (<i>Micronomus norfolkensis</i>)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No

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

Under Part 7, Division 1 of the BC Act, the test of significance is to be taken into account for the purposes of determining whether a proposed activity or activity is likely to significantly affect threatened species, populations or communities, or their habitats. This test should be applied to species, populations and communities listed under the BC Act that are likely or known to occur on site and where potential or known habitat has not been avoided and/ or indirect impacts are likely regardless of the minimisation or mitigation measures proposed. The tests of significance have been completed as according to the Threatened Species Test of Significance Guidelines (OEH, 2018).

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

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is the name given to the ecological community that occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures. The community is strongly associated with, though not restricted to, the yellow podsolc and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991). These substrates are said to produce ‘moderately fertile’ soils (Kovac and Lawrie 1991).

Lower Hunter Spotted Gum – Ironbark Forest is dominated by *Corymbia maculata*, (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), while *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark) occur occasionally. A number of other eucalypt species occur at low frequency, but may be locally common in the community. The understorey is marked by the tall shrub, *Acacia parvipinnula*, and by the prickly shrubs, *Daviesia ulicifolia*, *Bursaria spinosa*, *Melaleuca nodosa* and *Lissanthe strigosa*. Other shrubs include *Persoonia linearis*, *Maytenus silvestris* and *Breynia oblongifolia*. The ground layer is diverse; frequent species include *Cheilanthes sieberi*, *Cymbopogon refractus*, *Dianella revoluta*, *Entolasia stricta*, *Glycine clandestina*, *Lepidosperma laterale*, *Lomandra multiflora*, *Microlaena stipoides*, *Pomax umbellata*, *Pratia purpurascens*, *Themeda australis* and *Phyllanthus hirtellus* (NPWS 2000, Hill 2003, Bell 2004).

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area in the Central and Lower Hunter Valley (NPWS 2000). Within this range, the community was once widespread. A fragmented core



of the community still occurs between Cessnock and Beresfield. Remnants occur within the LGAs of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.

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

Not applicable.

2. in the case of a TEC or critically TEC, 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**
- 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**

The proposal area has been defined by an outer site boundary in which the pipeline and associated infrastructure will be sited within. The potential impact of vegetation loss has been calculated based on this broader proposal area as a worst-case scenario. The actual micro-siting of the pipeline and the construction footprint for the proposal is expected to be smaller than the proposal area calculated. On a worst-case basis the proposal would potentially impact on:

- Up to 2.3 ha of Lower Hunter Spotted Gum – Ironbark forest in low condition

The community is identified as low condition due to the notable absence of midstorey and groundcover native species. The vegetation is recognised by a number of canopy tree species, however the remaining strata have been modified and grazed for a considerable time resulting in very low native species presence and abundance. Furthermore, the patches on the site occur as isolated fragments. The extent of this clearing and impact would not place the local occurrence at risk of extinction due to its minor size, poor condition, and fragmentation.

3. 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**
- 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**
- 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 area has been defined by an outer site boundary in which the pipeline and associated infrastructure will be sited within. The potential impact of vegetation loss has been calculated based on this broader proposal area as a worst-case scenario. The actual micro-siting of the pipeline and the construction footprint for the proposal is expected to be smaller than the proposal area calculated. On a worst-case basis the proposal would potentially impact on:

- Up to 2.3 ha of Lower Hunter Spotted Gum – Ironbark forest in low condition

This generally comprises a range of young and mature trees with an exotic dominated understorey. As this vegetation is located in an isolated area with no connectivity, it would not increase fragmentation within the patch or to nearby patches. The clearing would not impact the movement of genetic material or natural regeneration.

The habitat being removed is in low condition. There is generally a mature canopy with an understorey dominated by exotics, including woody and herbaceous weeds. The works would not remove the natural



soil profile and seed bank present. As such, the works would not fragment or remove habitat important for the community's long-term survival in the locality.

4. 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 is not located in any declared area of outstanding biodiversity value.

5. whether the proposed development or activity is or is part of a KTP or is likely to increase the impact of a KTPs.

The BC Act defines a KTP as a process that 'adversely affects threatened species or ecological communities' or 'could cause species or ecological communities that are not threatened to become threatened' (s 4.32). Schedule 4 of the BC Act provides a list of KTPs.

The proposal would require the clearing of up to 2.3 ha of native vegetation in low condition, all of which is the TEC. The clearing of native vegetation is considered a key impact for the community, particularly in urban areas.

Conclusion

Considering the above assessment, the proposal is not likely to have a 'significant impact' on the Lower Hunter Spotted Gum Ironbark Forest community. Consequently, a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR) is not required.



APPENDIX D. BACKGROUND SEARCH OF THREATENED SPECIES RECORDED IN THE LOCALITY

Scientific Name	Common Name	BC Act	EPBC Act	Records	Source
<i>Fauna</i>					
<i>Birds</i>					
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1,P		1	Bionet
<i>Circus assimilis</i>	Spotted Harrier	V,P		1	Bionet
<i>Falco subniger</i>	Black Falcon	V,P		2	Bionet
<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	1	Bionet, PMST
<i>Tyto novaehollandiae</i>	Masked Owl	V,P,3		2	Bionet
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V,P		1	Bionet
<i>Chthonicola sagittata</i>	Speckled Warbler	V,P		2	Bionet
<i>Anthochaera phrygia</i>	Regent Honeyeater	E4A,P	CE	3	Bionet, PMST
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V,P		34	Bionet
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V,P		1	Bionet
<i>Numenius madagascariensis</i>	Eastern Curlew		CE, M		PMST
<i>Calidris ferruginea</i>	Curlew Sandpiper		CE, M		PMST
<i>Hirundapus caudacutus</i>	White-throated Needletail		V, M		PMST
<i>Mammals</i>					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V,P	E	1	Bionet, PMST
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V,P		4	Bionet
<i>Phascolarctos cinereus</i>	Koala	E1,P	E	1	Bionet, PMST



Scientific Name	Common Name	BC Act	EPBC Act	Records	Source
<i>Petaurus norfolcensis</i>	Squirrel Glider	V,P		8	Bionet
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	123	Bionet, PMST
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V,P		2	Bionet
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V,P		4	Bionet
<i>Myotis macropus</i>	Southern Myotis	V,P		3	Bionet
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		4	Bionet
<i>Miniopterus australis</i>	Little Bent-winged Bat	V,P		5	Bionet
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V,P		14	Bionet
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	1	Bionet, PMST
Flora					
<i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V	1	Bionet, PMST
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,3		1	Bionet
<i>Eucalyptus camaldulensis</i>	Eucalyptus camaldulensis population in the Hunter catchment	E2		1	Bionet
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V	59	Bionet, PMST
<i>Eucalyptus parramattensis subsp. decadens</i>		V	V	1	Bionet, PMST
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E1	V	1	Bionet, PMST
<i>Cymbidium canaliculatum</i>	Cymbidium canaliculatum population in the Hunter Catchment	E2,P,2		1	Bionet
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E1,P,2	E	1	Bionet, PMST



Scientific Name	Common Name	BC Act	EPBC Act	Records	Source
<i>Grevillea parviflora</i> <i>subsp. parviflora</i>	Small-flower Grevillea	V	V	1	Bionet, PMST
<i>Persoonia pauciflora</i>	North Rothbury Persoonia	E4A,P, 3	CE	1	Bionet, PMST

P: Protected, V: Vulnerable, V2: Vulnerable Ecological Community, E1: Endangered, CE: Critically Endangered, E2: Endangered Population, E3: Threatened Ecological Community, E4: Critically Threatened Ecological Community
Bionet (DPE, 2022), PMST (DCCEEW, 2022)



APPENDIX E. ASSESSMENT OF SIGNIFICANCE (BC ACT)

Threatened entities requiring assessment of significance

Threatened entity	Justification	Assessment of Significance
Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions (BC Act TEC)	The works would remove up to 1.7 ha of low condition vegetation.	Yes, see below
<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)	No suitable wetland habitat present at the site	No
<i>Circus assimilis</i> (Spotted Harrier)	Marginal habitat present, the lack of maturity, fragmented nature and low condition of the habitat suggests this species would not be dependent on this habitat	No
<i>Falco subniger</i> (Black Falcon)	Marginal habitat present, the lack of maturity, fragmented nature and low condition of the habitat suggests this species would not be dependent on this habitat	No
<i>Lathamus discolor</i> (Swift Parrot)	Proposal area does not intersect a mapped area of important habitat for Swift Parrot	No
<i>Tyto novaehollandiae</i> (Masked Owl)	Marginal habitat present, the lack of maturity, fragmented nature and low condition of the habitat suggests this species would not be dependent on this habitat	No
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Chthonicola sagittata</i> (Speckled Warbler)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Anthochaera phrygia</i> (Regent Honeyeater)	Proposal area does not intersect a mapped area of important habitat for Regent Honeyeater	No
<i>Pomatostomus temporalis temporalis</i> (Grey-crowned Babbler (eastern subspecies))	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Numenius madagascariensis</i> (Eastern Curlew)	No suitable wetland habitat present at the site	No
<i>Calidris ferruginea</i> (Curlew Sandpiper)	No suitable wetland habitat present at the site	No
<i>Hirundapus caudacutus</i> (White-throated Needletail)	Suitable low condition aerial foraging habitat is present in the woodland areas, flyover and opportunistic foraging is possible. However, no important habitat is present in the site.	No
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No



Threatened entity	Justification	Assessment of Significance
<i>Phascolarctos cinereus</i> (Koala)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Petaurus norfolcensis</i> (Squirrel Glider)	No suitable habitat present, and fragmented small patches are not preferred by this species, significant barriers to movement across landscape at this location	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	Marginal foraging resources present in a heavily fragmented landscape, considered unlikely to be important foraging habitat, and no roost camps present at the site	No
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Micronomus norfolkensis</i> (Eastern Coastal Free-tailed Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Myotis macropus</i> (Southern Myotis)	No suitable foraging or roosting habitat present	No
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Miniopterus australis</i> (Little Bent-winged Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
<i>Rutidosia heterogama</i> (Heath Wrinklewort)	Not recorded during the field surveys, and suitable habitat and soil types not present	No
<i>Acacia bynoeana</i> (Bynoe's Wattle)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Callistemon linearifolius</i> (Netted Bottle Brush)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Eucalyptus camaldulensis</i> (Eucalyptus camaldulensis population in the Hunter catchment)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Eucalyptus glaucina</i> (Slaty Red Gum)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Cymbidium canaliculatum</i> (<i>Cymbidium canaliculatum</i> population in the Hunter Catchment)	Not recorded during the field surveys. Although it is outside the survey period, no similar species or mistakable were observed. Considered not present in the site.	No
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	Not recorded during the field surveys. Although it is outside the survey period, no similar species or mistakable were observed. Considered not present in the site due to dense exotic grass cover.	No



Threatened entity	Justification	Assessment of Significance
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (Small-flower Grevillea)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Persoonia pauciflora</i> (North Rothbury Persoonia)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population	Not recorded during the field surveys. Although it is outside the survey period, no similar species or mistakable were observed. Considered not present in the site.	No
<i>Pimelea spicata</i> (Spiked Rice Flower)	Not recorded during the field surveys and observable at the time of survey. Considered not present in the site.	No
Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>)	No suitable habitat within the site due to the frequent inundation and weed prevalence.	No
Eastern Coastal Free-tailed Bat (<i>Micronomus norfolkensis</i>)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)	Suitable aerial foraging habitat is present in the woodland areas, nightly flyover and opportunistic foraging is possible. However, no suitable roosting habitat is present in the site.	No

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

Under Part 7, Division 1 of the BC Act, the test of significance is to be taken into account for the purposes of determining whether a proposed activity or activity is likely to significantly affect threatened species, populations or communities, or their habitats. This test should be applied to species, populations and communities listed under the BC Act that are likely or known to occur on site and where potential or known habitat has not been avoided and/ or indirect impacts are likely regardless of the minimisation or mitigation measures proposed. The tests of significance have been completed as according to the Threatened Species Test of Significance Guidelines (OEH, 2018).

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

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is the name given to the ecological community that occurs principally on Permian geology in the central to lower Hunter Valley. The Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures. The community is strongly associated with, though not restricted to, the yellow podsolc and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (Kovac and Lawrie 1991). These substrates are said to produce ‘moderately fertile’ soils (Kovac and Lawrie 1991).

Lower Hunter Spotted Gum – Ironbark Forest is dominated by *Corymbia maculata*, (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), while *E. punctata* (Grey Gum) and *E. crebra* (Grey Ironbark) occur occasionally. A number of other eucalypt species occur at low frequency, but may be locally common in the community. The understorey is marked by the tall shrub, *Acacia parvipinnula*, and by the prickly shrubs, *Daviesia ulicifolia*, *Bursaria spinosa*, *Melaleuca nodosa* and *Lissanthe strigosa*. Other shrubs include *Persoonia linearis*, *Maytenus silvestris* and *Breynia oblongifolia*. The ground layer is diverse; frequent species include *Cheilanthes sieberi*, *Cymbopogon refractus*, *Dianella revoluta*, *Entolasia stricta*, *Glycine clandestina*, *Lepidosperma laterale*, *Lomandra multiflora*, *Microlaena stipoides*, *Pomax umbellata*, *Pratia purpurascens*, *Themeda australis* and *Phyllanthus hirtellus* (NPWS 2000, Hill 2003, Bell 2004).

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area in the Central and Lower Hunter Valley (NPWS 2000). Within this range, the community was once widespread. A fragmented core



of the community still occurs between Cessnock and Beresfield. Remnants occur within the LGAs of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.

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

Not applicable.

2. in the case of a TEC or critically TEC, 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**
- 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**

The proposal area has been defined by an outer site boundary in which the pipeline and associated infrastructure will be sited within. The potential impact of vegetation loss has been calculated based on this broader proposal area as a worst-case scenario. The actual micro-siting of the pipeline and the construction footprint for the proposal is expected to be smaller than the proposal area calculated. On a worst-case basis the proposal would potentially impact on:

- Up to 2.3 ha of Lower Hunter Spotted Gum – Ironbark forest in low condition

The community is identified as low condition due to the notable absence of midstorey and groundcover native species. The vegetation is recognised by a number of canopy tree species, however the remaining strata have been modified and grazed for a considerable time resulting in very low native species presence and abundance. Furthermore, the patches on the site occur as isolated fragments. The extent of this clearing and impact would not place the local occurrence at risk of extinction due to its minor size, poor condition, and fragmentation.

3. 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**
- 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**
- 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 area has been defined by an outer site boundary in which the pipeline and associated infrastructure will be sited within. The potential impact of vegetation loss has been calculated based on this broader proposal area as a worst-case scenario. The actual micro-siting of the pipeline and the construction footprint for the proposal is expected to be smaller than the proposal area calculated. On a worst-case basis the proposal would potentially impact on:

- Up to 2.3 ha of Lower Hunter Spotted Gum – Ironbark forest in low condition

This generally comprises a range of young and mature trees with an exotic dominated understorey. As this vegetation is located in an isolated area with no connectivity, it would not increase fragmentation within the patch or to nearby patches. The clearing would not impact the movement of genetic material or natural regeneration.

The habitat being removed is in low condition. There is generally a mature canopy with an understorey dominated by exotics, including woody and herbaceous weeds. The works would not remove the natural



soil profile and seed bank present. As such, the works would not fragment or remove habitat important for the community's long-term survival in the locality.

4. 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 is not located in any declared area of outstanding biodiversity value.

5. whether the proposed development or activity is or is part of a KTP or is likely to increase the impact of a KTPs.

The BC Act defines a KTP as a process that 'adversely affects threatened species or ecological communities' or 'could cause species or ecological communities that are not threatened to become threatened' (s 4.32). Schedule 4 of the BC Act provides a list of KTPs.

The proposal would require the clearing of up to 2.3 ha of native vegetation in low condition, all of which is the TEC. The clearing of native vegetation is considered a key impact for the community, particularly in urban areas.

Conclusion

Considering the above assessment, the proposal is not likely to have a 'significant impact' on the Lower Hunter Spotted Gum Ironbark Forest community. Consequently, a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR) is not required.



APPENDIX F. ABORIGINAL HERITAGE DUE DILLIGENCE REPORT

Aboriginal Due Diligence Assessment

Document no: 001

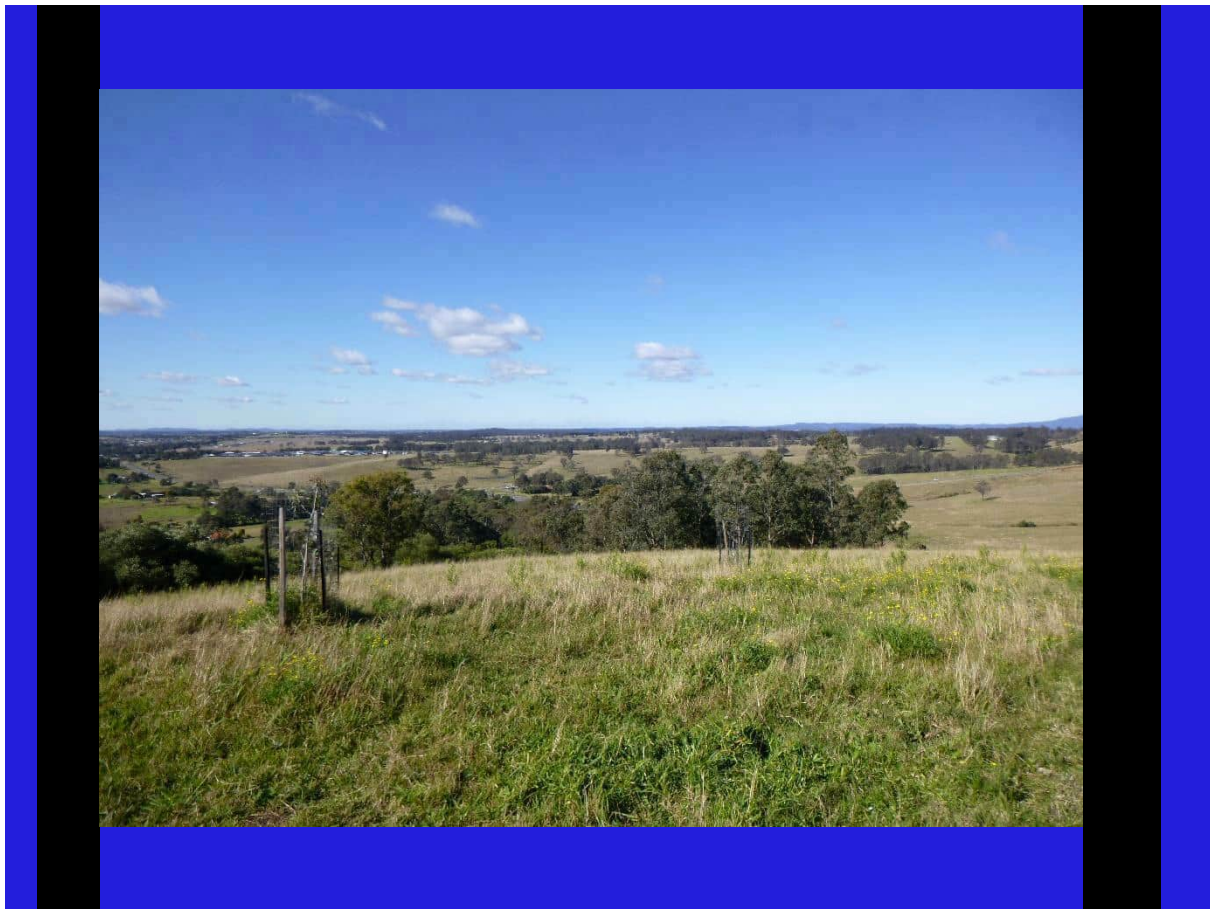
Revision no: 0 0

Hunter Water

HW2018-25/5/18.003

Harpers Hill and Lochinvar Reservoir and Rising Main Upgrade

21 December 2022



Executive summary

Jacobs has been engaged by Hunter Water to undertake a Due Diligence for Aboriginal cultural heritage for the Harpers Hill and Lochinvar Reservoir and Trunk main duplication proposal. Hunter Water proposes to construct and operate a new five megalitre (ML) potable water reservoir at Harpers Hill and new trunk main between the new reservoir and the Lochinvar 2 Water Pump Station (the proposal).

This Due Diligence was undertaken in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change & Water [DECCW] 2010a; hereafter the Due Diligence Code of Practice), within the legislative context of the *National Parks and Wildlife Act 1974* (NPW Act). The details of this assessment are derived from desktop research, a search and review of the Aboriginal Heritage Information Management System (AHIMS) maintained by Heritage NSW and a visual inspection of the study area. The purpose of due diligence is to:

- Identify whether Aboriginal objects are, or are likely to be, present in an area
- Determine whether proposed activities are likely to harm Aboriginal objects if they are present
- Determine whether an AHIP must be in place prior to the commencement of activities

This report found that the proposal area does not contain and is not likely to contain any Aboriginal objects. It is recommended that no further Aboriginal cultural heritage assessment actions are required, and the proposal can proceed with caution. The nearby AHIMS site #37-6-3180 would be avoided by the works. However, the site and buffer area must be fenced with high visibility fencing during works to prevent impacts. All personnel involved in works must be informed that this is a no-go area.

This Due Diligence assessment does not constitute consent to harm Aboriginal objects, nor is it a 'site clearance' mechanism to allow activities to occur in an area where Aboriginal objects are likely or known to be present.

If Aboriginal objects are discovered during the proposed works, works must stop immediately and the Hunter Water Archaeologist must be contacted. An assessment must be undertaken in accordance with Part 6 of the NPW Act.

Consultation with Aboriginal people must be undertaken in accordance with Section 60 of the *National Parks and Wildlife Regulation 2019*, as described in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010b).

The results of the assessment and consultation must be detailed in accordance with the reporting requirements of the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH 2011).

If the proposed proposal cannot avoid harming Aboriginal objects, an Aboriginal Heritage Impact Permit (AHIP) must be in place before any works proceed. All works must comply with the conditions of any AHIP issued.

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1. Introduction

1.1 Purpose

Due Diligence for this proposal to construct a new Harpers Hill and Lochinvar Reservoir and to duplicate a rising main between the new reservoir and the Lochinvar 2 Water Pump Station (Lochinvar WPS) has been undertaken in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change & Water [DECCW] 2010; hereafter the Due Diligence Code of Practice). The Due Diligence Code of Practice sets out the matters which are to be addressed when assessing whether an activity will harm, or has a likelihood of harming, Aboriginal objects. Activities that would or are likely to harm Aboriginal objects require an Aboriginal Heritage Impact Permit (AHIP), which would need to be supported by additional Aboriginal cultural heritage assessment actions.

The Due Diligence Code of Practice sets out reasonable and practicable steps which must be followed to:

- Identify whether Aboriginal objects are, or are likely to be, present in an area
- Determine whether proposed activities are likely to harm Aboriginal objects if present
- Determine whether an AHIP must be in place prior to the commencement of activities

Consultation with the Aboriginal community is not a formal requirement of the Due Diligence process, however, consideration of undertaking some form of consultation should occur, particularly if it will assist in informing any decision-making. If an AHIP will be required, consultation must be undertaken in accordance with the requirements of Section 60 of the *National Parks and Wildlife Regulation 2019*, as described in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010).

1.2 What is Due Diligence

The *National Parks and Wildlife Act 1974* (NPW Act) establishes the strict liability offence of harming Aboriginal objects where they were not known to be present. The Due Diligence process was established to provide a defence to this offence. Therefore, Due Diligence is a legal defence against prosecution where Aboriginal objects are harmed when it was reasonably considered that they would not be present. In effect, following a due diligence process amounts to taking reasonable and practicable steps to protect Aboriginal objects.

The determination of whether Aboriginal objects are present or are likely to be present can be made by following the Due Diligence Code of Practice, in situations where it is appropriate and applicable to do so. Undertaking Due Diligence will allow the identification of where Aboriginal objects are, or are likely to be, whether the proposed activity is likely to harm those objects and determine whether an AHIP is required prior to the commencement of that activity.

Undertaking the Due Diligence does not constitute consent to harm Aboriginal objects, nor is it a 'site clearance' mechanism to allow activities to occur in an area where Aboriginal objects are likely or known to be present. If it is known or considered likely that Aboriginal objects are present, a full assessment must be undertaken and an AHIP granted prior to that activity taking place.

1.3 Appropriateness of the use of Due Diligence for this report

It has been determined that it is appropriate to undertake a Due Diligence assessment for these proposed works by following the flowchart on Page 1 of the Due Diligence Code of Practice (DECCW 2010), as shown in Table 1-1.

Table 1-1 Determination of the suitability of employing a Due Diligence process for this activity

Question	Answer	Comment
Is the activity considered a Major Project under Part 4, Division 4.7 or Part 5, Division 5.2 of the EP&A Act?	No	All provisions of Part 6 of the <i>National Parks and Wildlife Act 1974</i> apply, and it is appropriate that a Due Diligence process can be considered for this activity.
Is the activity exempt from the <i>National Parks and Wildlife Act 1974</i> or <i>Regulation 2019</i> ?	No	No exemptions apply to this activity.
Will the activity involve harm that is trivial or negligible?	No	Examples of trivial or negligible harm include picking up and replacing a stone artefact, crushing or breaking a stone artefact while gardening or walking or similar activities. This does not apply to this activity.
Is the activity in an Aboriginal Place or there are known Aboriginal objects in the project area?	No	There are no known Aboriginal Places or known Aboriginal objects within the activity area.
Is the activity a low impact activity in accordance with the <i>National Parks and Wildlife Regulation 2019</i> ?	No	The activity is not considered a low impact activity.
Do you want to follow an industry specific Code of Practice?	No	There is no industry specific Code of Practice applicable.
Follow the Due Diligence Code of Practice	Yes	Follow and comply with this code to determine the appropriate course of action for this activity.

1.4 Aboriginal cultural values

This report addresses the archaeological potential for Aboriginal objects and places only. It does not include formal consultation with any Aboriginal groups or individuals; therefore, it does not include input from potential Aboriginal stakeholders or cultural knowledge-holders. This due diligence does not include an assessment of Aboriginal cultural values associated with the proposed works area.

1.5 Authorship

This report was authored by Alison Lamond (Senior Archaeologist, Jacobs) with review by Fran Scully (Principal Archaeologist, Jacobs). Mapping was prepared by Noah Tarlo (Geospatial Consultant, Jacobs).

2. Project information

2.1 Project background

Hunter Water Corporation (Hunter Water) proposes to construct and operate a new five megalitre (ML) potable water reservoir at Harpers Hill and new trunk main between the new reservoir and the Lochinvar 2 Water Pump Station (Lochinvar WPS) at Lochinvar (the proposal). Jacobs was tasked to provide Aboriginal Due Diligence advice regarding the proposed works.

2.2 Proposal area

The proposal stretches about 3.5 km through the suburbs of Harpers Hill, Allandale and Lochinvar within the Maitland Local Government Area (LGA). It is located about 15 km to the north east of Cessnock and 11 km to the north west of Maitland. The proposed impacts are located within an existing easement adjacent to the New England Highway and within private property at Harpers Hill and Lochinvar (refer to **Figure 2-1**).

The reservoir site is located to the south of the New England Highway. The reservoir site is currently accessed via a private road off the New England Highway.

2.3 Proposed proposal activity

Key elements of the proposal include:

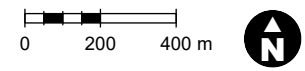
- Constructing and operating a new 5 ML potable water reservoir
- Constructing and operating 2.4 kilometres (km) of new 375 millimetre (mm) water main between Lochinvar WPS and the new reservoir which would operate in parallel with the existing 250 mm water trunk main
- Constructing underground pipework at the new reservoir, including inlet, outlet, scour, overflow and connecting to existing outlet pipework
- Cutting and filling earthworks to create an even surface below the new reservoir and access road
- Harpers Hill Lane access improvement, comprising:
 - Upgrading the eastern portion of Harpers Hill Lane
 - Constructing an access road to connect the eastern portion of Harpers Hill Lane and the private road used to access the reservoir site.
- Demolishing the existing 0.9 ML Harpers Hill 1 Reservoir (the existing reservoir).

The majority of the new trunk main would be installed via open trenched method with the exception of the trunk main crossing Allandale Road and Terriere Drive. The trunk main across Allandale Road and Terriere Drive would be installed by underboring by horizontal directional drilling.

The new reservoir would be located within a Hunter Water owned block of land off the New England Highway at Harper Hill. The reservoir would have a capacity of 5 ML, would be approximately 7 m high and would have a diameter of approximately 38 m.



- Proposal area
- New trunk main
- Railway
- Local Government Area



1:20,000 at A4
GDA 1994 MGA Zone 56

Data sources

- Jacobs 2022
- Department of Customer Service 2022
- Aerometrex 2021

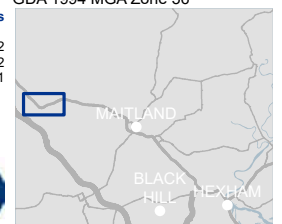


Figure 2-1 Proposal location

3. Legislation

3.1 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) protects Aboriginal heritage within New South Wales (NSW).

An 'Aboriginal object' is defined in Section 5(1) of the NPW Act in the following way:

Aboriginal object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains.

An 'Aboriginal place' is a place gazetted by the Minister, under Section 84 of the NPW Act:

The Minister may, by order published in the Gazette, declare any place specified or described in the order, being a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture, to be an Aboriginal place for the purposes of this Act.

Protection of Aboriginal heritage is outlined in Section 86 of the NPW Act as follows:

- "a person must not harm or desecrate an object that the person knows is an Aboriginal object" (Section 86(1))
- "a person must not harm an Aboriginal object" (Section 86(2))
- "a person must not harm or desecrate an Aboriginal place" (Section 86(4))

Harm is defined in Section 5 of the NPW Act as:

Any act or omission that destroys, defaces, or damages the object or place, or – in relation to an object – moves the object from the land on which it had been situated.

Section 87(1) of the NPW Act provides that it is a defence to these provisions if the harm is authorised by an AHIP.

Section 87(2) of the NPW Act provides that it is a defence to the provisions of Section 86(2) if the defendant exercised due diligence to determine whether an Aboriginal object would be harmed, and reasonably determined that no Aboriginal object would be harmed. That is, a proponent could be found not guilty of the strict liability offence if they can demonstrate that they undertook all reasonable steps to investigate the likelihood of Aboriginal objects and places being present and harmed by the proposed activity.

Due Diligence does not provide a defence to the offence of knowingly harming an Aboriginal object (offences that contravene Section 86(1)).

3.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (NSW; EP&A Act) regulates environmental planning and assessment of NSW. Land use planning requires that environmental impacts are considered as part of the environmental approval assessment for any development. This includes impact or likely impacts to Aboriginal cultural heritage.

There are several development approval mechanisms under the EP&A Act, Major Projects are those that are described as State Significant Development (SSD), considered under Part 4, Division 4.1 of the EP&A Act and State Significant Infrastructure (SSI), considered under Part 5.1 of the EP&A Act. The Department of Planning, Infrastructure and Environment (DPIE) is the determining authority for these projects. Both SSD and SSI were created as a result of the repeal of Part 3A of the EP&A Act in September 2011; however, many of the same conditions apply to these types of projects as did to Part 3A. In relation to the regulation of Aboriginal cultural heritage, this means that for SSD and SSI projects, there is no requirement to obtain an approval for activities under s90 of the *National Parks and Wildlife Act 1974*. It should also be noted that the Due

Diligence Code of Practice specifies that it is not appropriate to undertake a Due Diligence process for Major Projects.

The other approval mechanisms are considered under Part 4, Division 4.3 and Part 5, Division 5.1 of the EP&A Act. Under these approval pathways, the local authority or a Joint Regional Planning Panel (JRPP) is the determining authority. Certain NSW state agencies are self-determining authorities for their own projects, for example, National Parks and Wildlife Service. Under these approval mechanisms, the requirements of s90 of the *National Parks and Wildlife Act 1974* apply. It is appropriate to undertake a Due Diligence process for projects that are approved under these provisions.

Part 3, Division 3.4, deals with the development of Local Environmental Plans (LEPs). Planning decisions within Local Government Areas (LGAs) are guided by LEPs. Each LGA is required to develop and maintain an LEP that includes Aboriginal and historical heritage items which are protected under the EP&A Act and the *Heritage Act 1977*. The proposal area is located within the boundaries of Maitland Local Council and is covered by the *Maitland Local Environmental Plan 2011*.

4. Register searches

Aboriginal objects are recorded on the Aboriginal Heritage Impact Management System (AHIMS) and Aboriginal Places on the Aboriginal Place Atlas. Items of state heritage significance for Aboriginal and shared heritage values are recorded on the State Heritage Inventory.

4.1 AHIMS search

An extensive search of the AHIMS database was undertaken by Noah Tarlo (Geospatial Consultant, Jacobs) on 9 June 2022. The results of the searches are mapped in **Figure 4-1**.

It should be noted that the AHIMS database does not represent an exhaustive list of all Aboriginal objects in NSW. Rather, Aboriginal objects are recorded on AHIMS once they have been identified, usually as a result of an assessment process. A lack of recorded Aboriginal objects within a particular area does not necessarily mean that Aboriginal objects will not be present, just that they have not been previously identified and recorded. Heritage NSW has determined that for the purposes of Due Diligence, the results of an AHIMS search are valid for twelve months from the date of the search.

The AHIMS search included a buffer of approximately 500 m around the proposal area. This buffer distance was selected to provide information on the archaeological context of the study area and to ascertain whether any previously recorded Aboriginal sites are located within the study area.

The area surrounding the proposal area was searched in order to gain information on the archaeological context of the study area and to ascertain whether any previously recorded Aboriginal sites are located within the study area. The details of the AHIMS search parameters are included in Table 4-1.

Table 4-1. AHIMS search parameters

Search Criteria	Parameters		
Datum	GDA		
Zone	56		
Eastings	345415-347798	347691-350657	350165-357270
Northings	6384005-6385970	6381646-6384803	6379407-6381791
Buffer	0	0	0

A total of 122 sites were identified by the extensive AHIMS search. The nature of and location of the registered sites reflects past Aboriginal occupation from which they derive, but is also influenced by historical land-use, and the nature and extent of previous archaeological investigations. Although Aboriginal occupation covered the whole of the landscape, the availability of fresh water, and associated resources, was a significant factor in repeated and long-term occupation of specific areas within the landscape. AHIMS lists 20 standard site features that can be used to describe a site registered with AHIMS, and more than one feature can be used for each site. The frequency of recorded site types is summarised in **Table 4-2**.

Certain site types, such as culturally modified trees, are particularly vulnerable to destruction through historical occupation, while others, such as stone artefacts, are more resilient. The distribution of the recorded sites within the AHIMS search area is shown in **Figure 4-1**. The results of the AHIMS search are included in **Appendix A**.

The majority of the registered AHIMS sites are located along roads and waterways and were likely identified during the heritage assessments prepared for the development of the land. Therefore, additional archaeological resources may be present but have not been identified due to lack of previous archaeological investigations.

Table 4-2. Summary of AHIMS site features

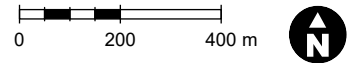
Aboriginal Place Type	Frequency	Per cent (%)
Aboriginal Resource and Gathering	1	0.8
Aboriginal Resource and Gathering and Potential Archaeological Deposit (PAD)	1	0.8
Art (pigment or engraved)	1	0.8
Art (pigment or engraved) and PAD	1	0.8
Artefact Scatter	43	35.3
Isolated Find	60	49.3
Artefact Scatter and PAD	2	1.6
Grinding Grooves	1	0.8
PAD	11	9
Restricted Site	1	0.8
Total components	122	100.00

One site, AHIMS #37-6-3810, is located adjacent to the proposal area, near Lochinvar WPS. This site is an isolated artefact recorded in 2017 after the construction of the wastewater pump station within impact footprint, prior to its revegetation. Therefore, it was assessed as not *in situ*, without associated PAD and potentially introduced with fill.

The proposal area was altered to provide a buffer to the site, thus avoiding any impact.



- Project area
- Harpers Hill Lane project area
- Alignment
- * AHIMS site
- Railway



1:15,000 at A4
GDA 1994 MGA Zone 56

Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Department of Premier and Cabinet 2022

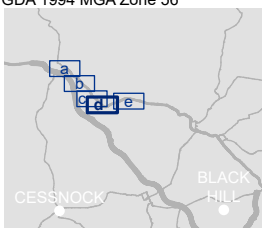
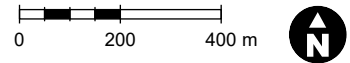


Figure 4.1.a AHIMS



— Project area * AHIMS site
— Alignment



1:15,000 at A4
GDA 1994 MGA Zone 56

Data sources
 Jacobs 2022
 Department of Customer Service 2022
 Department of Premier and Cabinet 2022

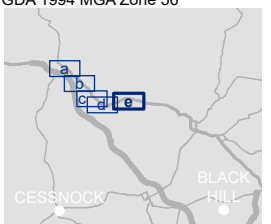


Figure 4.1.b AHIMS

4.2 Aboriginal Place Atlas search

No search of the Aboriginal Place Atlas was undertaken as the extensive AHIMS search did not indicate any registered Aboriginal Places within the search area boundary.

4.3 State Heritage Inventory search

A search of the State Heritage Inventory was completed on 13 September 2022. Babworth House is situated on St Helena Close and is within the easternmost boundary of the proposal area. Potential impacts on Babworth House have been addressed within the non-Aboriginal heritage section of the REF.

5. Archaeological context

5.1 Environmental context

The proposal area is located adjacent to the New England Highway between Harpers Hill and Lochinvar.

Reference to the Newcastle Coalfield 1:100,000 Geological Map indicates that the proposal is underlain by two geological formations. The westernmost boundary of the proposal area to the eastern most portion of Harpers Hill Lane and the private access road is comprised of the Farley formation which typically consists of sandstone and silty sandstone. The reservoir site to the easternmost boundary of the proposal area is comprised of Lochinvar formation which typically consists of basalt, siltstone and sandstone.

The western end of the proposal area to the reservoir is located within the Mountview soil landscape which consists of rolling hills with sediments of silty clay loams overlying clays.

The eastern end is located within the Lochinvar soil landscape which consists of undulating rises. Gently sloping areas typically consist of silty clay loams overlying clays and steeper areas include sandy clay loams overlying clays and sandy clays.

A number of first and second order ephemeral drainage lines traverse the proposal area and flow to the north draining into the Hunter River.

Native forests in the surrounding locality, including the proposal area, have been extensively cleared in the past and are now limited to a small and isolated patches representing Lower Hunter Spotted Gum – Ironbark. These small patches comprise a low density of *Eucalyptus crebra* (Narrow-leaved Ironbark), and *Corymbia maculata* (Spotted Gum) with *Eucalyptus teriticornis* (Forest Red Gum), *Eucalyptus mollucana* (Grey Box), and occasional *Angophora floribunda* (Rough-barked Apple) and *Allocasuarina leuhmanii* (Bulloak). There is a lack of native shrubs and groundcovers, with a predominantly exotic understorey and groundlayer dominated by woody weeds such as African Olive and exotic grasses.

5.2 Historic land use

The proposal area has been subject to pastoral and agricultural uses for a significant period including extensive land clearance. More recently the proposal area has been impacted by the construction and upgrades of the New England Highway and other local roads. The proposal area includes existing water infrastructure with a large reservoir and pump station.

5.3 Summary of previously completed archaeological assessments

As a result of the high level of development in the Hunter Valley, a large number of archaeological assessments have been undertaken. Assessments in the vicinity of Lochinvar have developed a consistent predictive model of archaeological sites for the region.

SKM (2010) assessed the Greta Train Support Facility and identified the most common site type is stone artefact sites. These are typically associated with water, located on adjacent elevated platforms. In the event that these landforms consist of alluvial deposits there is potential for further stone artefacts in a subsurface context. The frequency of these sites reflects the importance of these water sources to Aboriginal people.

Umwelt (2005) identified through surveys for the National Highway Link F3 to Branxton (Hunter Expressway) that larger concentrations of artefacts expected in the vicinity of waterholes along the creek line with higher concentrations on the higher side of the creek and at creek confluences.

South East Archaeology (2010) detailed the assessment of the Maitland to Minimbah third track proposal. Of 92 Aboriginal sites identified, all but one were open stone artefact sites. The other site comprised grinding grooves. While some potential for subsurface artefacts was identified this potential was assessed as low in disturbed landforms. Artefacts in these sites are typically made of tuff (Hunter Valley 'Mudstone') and silcrete.

5.4 Visual inspection

A site inspection was undertaken by Alison Lamond (Senior Archaeologist Jacobs) on 10 June 2022. A combination of vehicle and pedestrian survey was undertaken.

At the western end of the proposal is Harpers Hill lane and the access road to the existing reservoir. Harpers Hill Lane is constructed in areas of cut and fill (refer to **Photo 5-1**) These areas consisted of modified sloping landforms and as a result has been subject to considerable disturbance through road construction and service installation.



Photo 5-1 Harpers Hill Lane, with New England Highway in Cut in background, view to the southeast

The access road to the existing reservoir consists of a gravel track on a slope (refer to **Photo 5-2**). The existing reservoir is located on the crest of Harpers Hill and slope (refer to **Photo 5-3**). The crest area includes the reservoir and was disturbed through its construction with manholes and pipes visible in the surrounding area on the crest. The adjoining slope is steep (refer to **Photo 5-4** **Photo 5-4**). The steeply sloping area and access road has low archaeological potential because it is unlikely to have been used for activities such as camping and has little potential for retaining deposits.



Photo 5-2 Access Road to existing reservoir



Photo 5-3 Lochinvar Reservoir, view to the southeast



Photo 5-4 From Harpers Hill Reservoir, view to the south east

To the east of the reservoir site, the proposal area is located within the road reserve of the New England Highway and St Helena Close. This portion of the New England Highway has been constructed with extensive use of cut and fill techniques. There are also multiple services along the alignment. This area is highly disturbed as a result of previous construction and service installation. This section crosses two minor ephemeral drainage lines which have been highly modified through the construction of culverts for the New England Highway (refer to **Photo 5-5**).



Photo 5-5 New England Highway over culvert, view to the southeast

Similarly, St Helena Close was constructed using cut and fill. There are also multiple services along the alignment including overhead power lines (refer to **Photo 5-6**). These areas consisted of modified sloping landforms and as a result has been subject to considerable disturbance through road construction and service installation.



Photo 5-6 St Helena Close, view to the east

The eastern end of the proposal area consists of the footprint of the existing Lochinvar WPS. The Lochinvar Pump Station area is highly disturbed and includes underground pipes evidenced by manholes (refer to **Photo 5-7**). The surrounding area includes other infrastructure and landscaping.

The location AHIMS site 37-6-3810 is immediately adjacent to the Lochinvar Pump Station and was initially identified soon after its construction (refer to **Section 4.1**). The registered co-ordinates were re-inspected but the site was not re-located, due to dense grass cover (refer to **Photo 5-8**).



Photo 5-7 Buried infrastructure at Lochinvar WPS, view to the north east



Photo 5-8 Registered co-ordinates of AHIMS #37-6-3810, view to the northeast

5.4.1 Results

The proposal area is largely disturbed due to its proximity to roads and existing infrastructure or located within landforms with low archaeological potential. There is a nil to low likelihood of Aboriginal objects being present in the proposal area, with the exception of the registered location of AHIMS #37-6-3810 located adjacent to the proposal area.

6. The Due Diligence process

The Due Diligence Code of Practice provides a series of questions that must be answered to determine the outcome of the Due Diligence process. These questions are addressed in **Table 6-1**.

Table 6-1. Due Diligence questions and responses

Question	Answer	Comment
Will the activity disturb the ground surface or any culturally modified trees?	Yes	Activity will disturb the ground surface. No culturally modified trees were identified during the inspection.
Are there any: <ul style="list-style-type: none"> ▪ Confirmed AHIMS records ▪ Other sources of information ▪ Landscape features 	Yes	One AHIMS site is located in proximity to the proposal (#37-6-3810) but is not <i>in situ</i> and likely introduced with fill. Part of the proposal is located on a ridge, however this area is already substantially disturbed as a result of agricultural practices and the construction of the existing reservoir. The proposal crosses two minor drainage lines within the New England Highway road reserve which is highly disturbed.
Can harm to Aboriginal objects be avoided?	Yes	One AHIMS site is located in proximity to the works (#37-6-3810) but is not within the proposal area.
Does a desktop assessment and visual inspection confirm the presence of Aboriginal objects, or that they are likely to be there?	No	The proposal area is highly disturbed from previous impacts, therefore it is highly unlikely that Aboriginal objects are present.
Is further assessment required?	No	

7. Conclusions and recommendations

The proposal would have a low to nil likelihood of impact on Aboriginal objects. The proposal area has no surface objects (noting the avoidance of the nearby AHIMS site). Additionally, the works are located within highly disturbed areas of road reserve and existing water infrastructure land, which would have removed any Aboriginal objects that may have been present

This Due Diligence report would form a defence to the offence of unknowingly harming Aboriginal objects (Section 86(2) of the NPW Act), should this be required. However, if Aboriginal objects are identified in the proposal area, subsequent to the finalisation of this report, and harmed (knowingly harming objects, Section 86(1) of the NPW Act), the defence of Due Diligence would not apply.

This Due Diligence report does not constitute consent to harm Aboriginal objects, nor is it a 'site clearance' mechanism to allow activities to occur in an area where Aboriginal objects are likely or known to be present. If Aboriginal objects are discovered during the proposed works, works must stop immediately and an assessment must be undertaken in accordance with Part 6 of the NPW Act. If the activity cannot avoid harm to Aboriginal objects, works cannot proceed until an AHIP has been issued.

The following recommendations are made for this proposal:

- That AHIMS #37-6-3180 and buffer area is fenced with high visibility fencing during works to prevent impacts. All personnel involved in works must be informed that this is a no-go area.
- The works can proceed with caution if carried out in accordance with the works description in this document.
- If Aboriginal objects are uncovered during the course of works, activity must stop in the vicinity of the objects and the Hunter Water archaeologist must be contacted. The Unexpected Finds protocol in **Appendix B** must be followed.

8. References

South East Archaeology, 2010. Maitland to Minimbah Third Track Aboriginal Heritage Assessment. A report prepared for Australian Rail Track Corporation.

SKM, 2010. Greta Train Support Facility Aboriginal Cultural Heritage Assessment Report. A report prepared for Pacific National.

Umwelt, 2005. Review of Constraints and Management Recommendations for the Branxton Interchange – Proposed National Highway Link F3 to Branxton. A report prepared for Roads and Traffic Authority.

DECCW, 2010a. *the Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*.

DECCW, 2010b. *Aboriginal Cultural Heritage Consultation Requirements for Proponents*

OEH, 2011. *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales*.

Appendix A. Extensive AHIMS search results



AHIMS Web Services (AWS)

Extensive Search Report - East

Site ID	Site name	Datum	Zone	Easting	Northing	Context	Site status	Primary contact	Site features	Site types	Recorders	Reports	Permits	Longitude GDA94	Latitude GDA94
37-6-280	Allandale Rail 5	GDA	56	350470	6380160	Open site	Valid		Artefact : 1		Mr.Peter Kuskie		3658	151.40	-32.71
37-6-142	Lochinvar 47A	GDA	56	353990	6379510	Open site	Destroyed		Artefact : 1		Mr.Peter Kuskie,MCH - McCardle Cultural Heritage Pty Ltd,Ms.Penny Mccardle	100792	2421,3053	151.44	-32.71
37-6-143	Lochinvar 22/A	GDA	56	354026	6380081	Open site	Destroyed	Searle	Artefact : -		Mrs.Angela Besant,South East Archaeology,Insite Heritage Pty Ltd	100792	2421,3053,4168	151.44	-32.71
37-6-286	Christopher Road Site	GDA	56	355504	6380299	Open site	Destroyed		Artefact : 1		Umwelt (Australia) Pty Limited - Individual users,Mr.Kirwan Williams,Mr.Giles Hamm		3963,4080	151.46	-32.71
37-6-182	East Lochinvar Site 9	GDA	56	356502	6380405	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		4482	151.47	-32.70
37-6-211	Allandale Rail 8	GDA	56	350657	6379822	Open site	Valid		Artefact : 1		South East Archaeology		3658	151.41	-32.71
37-6-386	St Helena 1	GDA	56	353530	6380110	Open site	Destroyed		Artefact : -		Mrs.Angela Besant,Mrs.Angela Besant,Insite Heritage Pty Ltd,Insite Heritage Pty Ltd			151.44	-32.71
37-6-286	Christopher Road Site	GDA	56	355456	6380305	Open site	Partially Destroyed		Artefact : 1		Umwelt (Australia) Pty Limited - Individual users,Mr.Kirwan Williams,Mr.Giles Hamm		3963,4080	151.46	-32.71
37-6-221	Christopher Road 2	GDA	56	355457	6380305	Open site	Partially Destroyed		Artefact : 6		Umwelt (Australia) Pty Limited - Individual users,Mr.Paul Irish,Ms.Mary Dallas,Mr.Kirwan Williams		3963	151.46	-32.71
37-6-211	Allandale Rail 7	GDA	56	350653	6379920	Open site	Valid		Artefact : 1		South East Archaeology		3658	151.41	-32.71
37-6-142	Lochinvar 20/B	GDA	56	353990	6379620	Open site	Destroyed	Searle	Artefact : 1		Mr.Peter Kuskie,MCH - McCardle Cultural Heritage Pty Ltd,Ms.Penny Mccardle	100792	2421,3053	151.44	-32.71
37-6-142	Lochinvar 21/B	AGD	56	353970	6379940	Open site	Valid	Searle	Artefact : 1		Mr.Peter Kuskie	100792	2421,3053	151.44	-32.71
37-6-222	St Helena OC1	AGD	56	354028	6379951	Open site	Valid		Artefact : 2		Mr.Paul Irish,Ms.Mary Dallas			151.44	-32.71
37-6-296	26 Windemere Rd Site	GDA	56	354426	6380945	Open site	Not a Site	Mindaribba Local Aboriginal Land Council	Potential Archaeological Deposit (PAD) : -		Archaeological Risk Assessment Services (ARAS),Ms.Penny Mccardle			151.45	-32.70
37-6-183	East Lochinvar Site 1	GDA	56	355811	6380701	Open site	Valid		Artefact : -		Mr.Giles (dup ID#12832) Hamm		4704	151.46	-32.70
37-6-419	Airds of lochinvar PAD	GDA	56	355909	6379924	Open site	Valid		Potential Archaeological Deposit (PAD) : -		Archaeological Risk Assessment Services (ARAS),Mr.Giles Hamm			151.46	-32.71
37-6-212	Allandale Rail 10	GDA	56	350720	6379697	Open site	Valid		Art (Pigment or Engraved) : 1		South East Archaeology		3658	151.41	-32.71
37-6-167	Greta Village Estate - 7	GDA	56	350206	6379487	Open site	Valid	Searle	Artefact : 1		AECOM Australia Pty Ltd - Sydney	100147	2565,3343	151.40	-32.71
37-6-381	Lochinvar Water Pump	GDA	56	353848	6380436	Open site	Valid		Artefact : -		Umwelt (Australia) Pty Limited - Individual users,Ms.Alison Lamond			151.44	-32.70
37-6-222	LOC1	GDA	56	354091	6380106	Open site	Destroyed		Potential Archaeological Deposit (PAD) : -, Artefact : 11		Umwelt (Australia) Pty Limited - Individual users,MCH - McCardle Cultural Heritage Pty Ltd,MCH - McCardle Cultural Heritage Pty Ltd,Mr.Paul Irish,Ms.Penny Mccardle,Ms.Penny Mccardle,Ms.Mary Dallas,Mr.Kirwan Williams		3963,4168	151.44	-32.71
37-6-222	LOC4	GDA	56	354551	6380185	Open site	Destroyed		Artefact : 3		MCH - McCardle Cultural Heritage Pty Ltd,Mr.Paul Irish,Ms.Penny Mccardle,Ms.Mary Dallas		3963	151.45	-32.71
37-6-183	East Lochinvar Site 4	GDA	56	355955	6379972	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		4482	151.46	-32.71
37-6-182	East Lochinvar Site 6	GDA	56	356724	6380310	Open site	Destroyed		Artefact : -		Umwelt (Australia) Pty Limited - Individual users,Mr.Giles (dup ID#12832) Hamm,Mr.Kirwan Williams		3963	151.47	-32.71
37-6-211	Allandale Rail 9	GDA	56	350705	6379826	Open site	Valid		Artefact : 1		South East Archaeology		3658	151.41	-32.71
37-6-211	Allandale Rail 2	GDA	56	350353	6380225	Open site	Valid		Artefact : 1		South East Archaeology			151.40	-32.71
37-6-211	Allandale Rail 3	GDA	56	350420	6380220	Open site	Valid		Artefact : 1		South East Archaeology		3658	151.40	-32.71
37-6-211	Allandale Rail 6	GDA	56	350514	6380103	Open site	Valid		Artefact : 1		South East Archaeology		3658	151.41	-32.71
37-6-067	Loch-1 (St Helena)	GDA	56	354006	6380291	Open site	Destroyed		Artefact : -	Isolated Find	Iain Stuart,Mrs.Angela Besant,Insite Heritage Pty Ltd	2985,100792,102646	2183,2421,3053,4168	151.44	-32.71
37-6-143	Lochinvar 22/B	AGD	56	353910	6379860	Open site	Valid	S Scanlon	Artefact : 3		South East Archaeology	100792	2421,3053	151.44	-32.71
37-6-142	Lochinvar 21/A	AGD	56	354020	6380020	Open site	Valid	Searle	Artefact : 1		Mr.Peter Kuskie	100792	2421,3053	151.44	-32.71
37-6-386	St Helena 3	GDA	56	354265	6379745	Open site	Destroyed		Artefact : -		Mrs.Angela Besant,Mrs.Angela Besant,Insite Heritage Pty Ltd,Insite Heritage Pty Ltd			151.45	-32.71
37-6-222	Station Lane OC1	GDA	56	355061	6380792	Open site	Valid		Artefact : 1		Mr.Paul Irish,Ms.Mary Dallas			151.45	-32.70
37-6-183	East Lochinvar Site 3	GDA	56	355955	6379972	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		4482	151.46	-32.71
37-6-418	Airds of lochinvar PAD	GDA	56	356670	6380319	Open site	Valid		Potential Archaeological Deposit (PAD) : -		Archaeological Risk Assessment Services (ARAS),Mr.Giles Hamm			151.47	-32.71



AHIMS Web Services (AWS)

Extensive Search Report - East

Site ID	Site name	Datum	Zone	Easting	Northing	Context	Site status	Primary contact	Site features	Site types	Recorders	Reports	Permits	Longitude GDA94	Latitude GDA94
37-6-386	St Helena IF	GDA	56	353670	6379657	Open site	Valid		Artefact : -		Mrs.Angela Besant,Insite Heritage Pty Ltd			151.44	-32.71
37-6-212	Allandale Rail 11	GDA	56	350740	6379684	Open site	Valid		Artefact : 1		South East Archaeology			151.41	-32.71
37-6-212	Allandale Rail 12	GDA	56	350832	6379428	Open site	Valid		Artefact : 1		South East Archaeology			151.41	-32.71
37-6-211	Allandale Rail 4	GDA	56	350402	6380179	Open site	Valid		Artefact : 1		South East Archaeology			151.40	-32.71
37-6-142	Lochinvar 20/A	GDA	56	353960	6379460	Open site	Destroyed	Searle	Artefact : 1		Mr.Peter Kuskie,MCH - McCardle Cultural Heritage Pty Ltd,Ms.Penny Mccardle	100792	2421	151.44	-32.71
37-6-286	Christopher Road Site	GDA	56	354999	6380414	Open site	Valid		Artefact : 1		Mr.Giles Hamm		3963,4080	151.45	-32.70
37-6-160	Lochinvar 1	AGD	56	355515	6380960	Open site	Valid	Searle	Artefact : 2		Ms.Penny Mccardle	99841	2456,3963	151.46	-32.70
37-6-222	LCC1 and PAD	GDA	56	355673	6381234	Open site	Partially Destroyed		Artefact : 15, Potential Archaeological Deposit (PAD) : -		Mrs.Angela Besant,Umwelt (Australia) Pty Limited - Individual users,Mr.Kirwan Williams		3936,3963,4694,4697	151.46	-32.70
37-6-211	Allandale Rail 1	GDA	56	350361	6380283	Open site	Valid		Artefact : 1		South East Archaeology		3658	151.40	-32.71
37-6-211	Annandale Rail 5	GDA	56	350470	6380160	Open site	Valid		Artefact : 1		South East Archaeology			151.40	-32.71
37-6-142	Lochinvar 10/A	GDA	56	353910	6379920	Open site	Destroyed	Searle	Artefact : 1		Mr.Peter Kuskie,Mrs.Angela Besant,Insite Heritage Pty Ltd	100792	2421,3053,4168	151.44	-32.71
37-6-221	LIF3	GDA	56	354627	6380156	Open site	Destroyed		Artefact : 1		MCH - McCardle Cultural Heritage Pty Ltd,Mr.Paul Irish,Ms.Penny Mccardle,Ms.Mary Dallas		3963	151.45	-32.71
37-6-383	SITE 11 LOT 310 LOCI	GDA	56	355523	6380268	Open site	Valid		Artefact : 1		Mr.Giles Hamm	104406	4693	151.46	-32.71
37-6-221	Christopher Road 1	GDA	56	355520	6380800	Open site	Destroyed		Artefact : 2		Umwelt (Australia) Pty Limited - Individual users,Mr.Giles (dup ID#12832) Hamm,Mr.Kirwan Williams		3963	151.46	-32.70
37-6-221	PAD 2 Lochinvar URA	AGD	56	354720	6381415	Open site	Valid		Potential Archaeological Deposit (PAD) : 1		Mr.Paul Irish,Ms.Mary Dallas			151.45	-32.69
37-6-183	East Lochinvar Site 5	GDA	56	356195	6380016	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		4482	151.47	-32.71
37-6-419	Airds of lochinvar PAD	GDA	56	356219	6380015	Open site	Valid		Potential Archaeological Deposit (PAD) : -		Archaeological Risk Assessment Services (ARAS),Mr.Giles Hamm			151.47	-32.71
37-6-182	East Lochinvar Site 10	GDA	56	356400	6380271	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		3963,4482	151.47	-32.71
37-6-419	Airds of lochinvar PAD	GDA	56	356540	6380229	Open site	Valid		Potential Archaeological Deposit (PAD) : -		Archaeological Risk Assessment Services (ARAS),Mr.Giles Hamm			151.47	-32.71
37-6-223	Allandale Rail 22	GDA	56	350465	6380265	Open site	Valid		Artefact : 1		Mr.Peter Kuskie			151.40	-32.71
37-6-142	Lochinvar 4/B	GDA	56	353720	6379450	Open site	Destroyed	Searle	Artefact : 7		Mr.Peter Kuskie,MCH - McCardle Cultural Heritage Pty Ltd,Ms.Penny Mccardle	100792	2421,3053	151.44	-32.71
37-6-143	Lochinvar 22/C	GDA	56	353896	6379771	Open site	Destroyed	S Scanlon	Artefact : 19		Mrs.Angela Besant,South East Archaeology,Insite Heritage Pty Ltd	100792	2421,3053	151.44	-32.71
37-6-386	St Helena 2	GDA	56	354055	6380200	Open site	Destroyed		Artefact : -		Mrs.Angela Besant,Mrs.Angela Besant,Insite Heritage Pty Ltd,Insite Heritage Pty Ltd			151.44	-32.71
37-6-143	Lochinvar 21/C	AGD	56	354010	6379920	Open site	Valid	Searle	Artefact : -		Mr.Peter Kuskie	100792	2421,3053	151.44	-32.71
37-6-296	26 Windemere Rd Site	GDA	56	354305	6381044	Open site	Not a Site	Mindaribba Local	Potential Archaeological Deposit (PAD) : -		Archaeological Risk Assessment Services (ARAS),Ms.Penny Mccardle			151.45	-32.70
37-6-365	Cantwell Rd 1	GDA	56	355173	6381028	Open site	Destroyed		Artefact : -		Umwelt (Australia) Pty Limited - Individual users,Umwelt (Australia) Pty Limited - Individual users,Mr.Kirwan Williams,Miss.Nicola Roche			151.45	-32.70
37-6-183	East Lochinvar Site 2	GDA	56	355928	6380499	Open site	Valid		Artefact : -		Mr.Giles (dup ID#12832) Hamm		4704	151.46	-32.70
37-6-182	East Lochinvar Site 8	GDA	56	356532	6380262	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		3963,4482	151.47	-32.71
37-6-182	East Lochinvar Site 7	GDA	56	356673	6380330	Open site	Destroyed		Artefact : -		Mr.Giles (dup ID#12832) Hamm,RPS Australia East Pty Ltd - York Street Sydney ,Mrs.Amanda Crick		4482	151.47	-32.71



AHIMS Web Services (AWS)



Extensive Search Report - Middle

Site ID	Site name	Datum	Zone	Easting	Northing	Context	Site status	Primary contact	Site features	Recorders	Reports	Permits	Longitude GDA94	Latitude GDA94
37-6-2819	Greta Rail 30	GDA	56	348479	6382461	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Stephen Free			151.38	-32.69
37-6-3955	South Greta IF 1	GDA	56	348655	6382278	Open site	Valid		Artefact : -	Biosis Pty Ltd - Wollongong,Mrs.Samantha Keats		4858	151.39	-32.69
37-6-4201	IF4_Huntlee	GDA	56	347893	6383450	Open site	Destroyed		Artefact : -	Niche Environment and Heritage,Niche Environment and Heritage,Miss.Kate Morris,Miss.Kate Morris			151.38	-32.68
37-6-3809	Anvil Creek Bridge IF (A	GDA	56	348713	6382275	Open site	Valid		Artefact : -	RPS Australia East Pty Ltd - Hamilton,Ms.Jo Nelson			151.39	-32.69
37-6-2165	Sawyers Creek Artefact	GDA	56	348252	6382341	Open site	Valid		Artefact : 125	Mr.Joseph Brooke	101839,102228,102230		151.38	-32.69
37-6-2816	Greta Rail 33	GDA	56	348454	6383139	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Leigh Bate			151.38	-32.68
37-6-2211	Greta Rail 24	GDA	56	348520	6382050	Open site	Valid		Artefact : 1	Mr.Peter Kuskie		3286	151.38	-32.69
37-6-2174	Greta Rail 6	GDA	56	348765	6381887	Open site	Valid		Artefact : 1	South East Archaeology			151.39	-32.69
37-6-1377	South Greta - 1	AGD	56	348724	6382298	Open site	Valid	T Russell	Aboriginal Resource and Gathering : -	Mr.Giles (dup ID#12832) Hamm,Mr.Giles (dup ID#12832) Hamm		2826,2828	151.39	-32.68
37-6-1318	Anvil Creek RTA 16 GG	AGD	56	347603	6381993	Open site	Valid		Grinding Groove : 3	Umwelt (Australia) Pty Limited - Individual users,Leila McAdam			151.38	-32.69
37-6-2781	Branxton AS 1	GDA	56	347699	6383976	Open site	Valid		Artefact : 1	Doctor.Diana Neuweger			151.38	-32.67
37-6-1369	Anvil Creek RTA 28 (For	AGD	56	347968	6382047	Open site	Valid		Potential Archaeological	Umwelt (Australia) Pty Limited - Individual users,Leila McAdam	101116	2096,2562	151.38	-32.69
37-6-3726	Whiteburn PAD	GDA	56	348177	6383807	Open site	Valid		Potential Archaeological	MCH - McCardle Cultural Heritage Pty Ltd,Ms.Penny Mccardle			151.38	-32.67
37-6-2208	Greta Rail 21	GDA	56	348660	6382220	Open site	Valid		Artefact : 1	Mr.Peter Kuskie		3286	151.39	-32.69
37-6-2813	Greta Rail 36	GDA	56	348813	6381828	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Stephen Free		3658	151.39	-32.69
37-6-2212	SawyersCreek Artefact	GDA	56	348326	6382510	Open site	Valid		Art (Pigment or Engraved) : 1, Potential Archaeological Deposit (PAD) : -	Mr.Joseph Brooke			151.38	-32.68
37-6-2815	Greta Rail 34	GDA	56	348390	6383202	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Leigh Bate			151.38	-32.68
37-6-2170	Greta Rail 2	GDA	56	347780	6383705	Open site	Valid		Artefact : 1	South East Archaeology			151.38	-32.67
37-6-2171	Greta Rail 3	GDA	56	348402	6382612	Open site	Valid		Artefact : 1	South East Archaeology		3286	151.38	-32.68
37-6-2821	Greta Rail 28	GDA	56	348575	6382830	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Stephen Free			151.38	-32.68
37-6-2209	Greta Rail 22	GDA	56	348700	6382120	Open site	Valid		Artefact : 1	Mr.Peter Kuskie		3286	151.39	-32.69
37-6-2241	Greta Rail 25	GDA	56	348789	6382090	Open site	Valid		Artefact : 1	Mr.Peter Kuskie			151.39	-32.69
37-6-2820	Greta Rail 29	GDA	56	348649	6382784	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Stephen Free			151.39	-32.68
33-6-0030	Greta Rail 20	GDA	56	348735	6382305	Open site	Valid		Artefact : 1	Mr.Peter Kuskie		3286	151.39	-32.69
37-6-2210	Greta Rail 23	GDA	56	348772	6382155	Open site	Valid		Artefact : 1	Mr.Peter Kuskie			151.39	-32.69
37-6-2172	Greta Rail 4	GDA	56	348243	6382330	Open site	Valid		Artefact : 1	South East Archaeology			151.38	-32.69
37-6-2164	Sawyers Creek Artefact	GDA	56	348326	6382510	Open site	Valid		Artefact : 102	Mr.Joseph Brooke	101839,102230		151.38	-32.68
37-6-2822	Greta Rail 27	GDA	56	348514	6382582	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Stephen Free			151.38	-32.68
37-6-2818	Greta Rail 31	GDA	56	348553	6382459	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Leigh Bate			151.38	-32.69
37-6-2814	Greta Rail 35	GDA	56	348210	6383232	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Leigh Bate			151.38	-32.68
37-6-2736	Greta Rail 2 (GR2)	GDA	56	348345	6382566	Open site	Valid		Artefact : 1	Ms.Penny Mccardle			151.38	-32.68
37-6-4200	AS3_Huntlee	GDA	56	347719	6383641	Open site	Destroyed		Artefact : -	Niche Environment and Heritage,Niche Environment and Heritage,Miss.Kate Morris,Miss.Kate Morris			151.38	-32.67
37-6-2817	Greta Rail 32	GDA	56	348503	6382939	Open site	Valid		Artefact : 1	South East Archaeology,Mr.Leigh Bate			151.38	-32.68
37-6-2173	Greta Rail 5	GDA	56	348600	6382086	Open site	Valid		Artefact : 1	Doctor.Johan Kamminga		3286	151.39	-32.69
37-6-1829	North Greta Site 2	GDA	56	348764	6384683	Open site	Valid		Artefact : -	Mary Dallas Consulting Archaeologists (MDCA),Mr.Giles (dup ID#12832) Hamm,Ms.Tamika Goward			151.39	-32.67
37-6-1378	South Greta - 3	AGD	56	349053	6382177	Open site	Valid	T Russell	Aboriginal Resource and Gathering : -, Potential Archaeological Deposit (PAD) : -	Mr.Giles (dup ID#12832) Hamm,Mr.Giles (dup ID#12832) Hamm		2826,2828	151.39	-32.69
37-6-2737	Greta Rail 1 (GR1)	GDA	56	348309	6382129	Open site	Valid		Artefact : 1	Ms.Penny Mccardle			151.38	-32.69

Report generated by AHIMS Web Service on 09/06/2022 for Ajay Arcot for the following area at Datum :GDA, Zone : 56, Eastings : 347691.2038 - 350657.8319, Northings : 6381646.0926 - 6384803.3475 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 37

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AHIMS Web Services (AWS)

Extensive AHIMS Search - West

<u>Site ID</u>	<u>Site name</u>	<u>Datum</u>	<u>Zone</u>	<u>Easting</u>	<u>Northing</u>	<u>Context</u>	<u>Site status</u>	<u>Primary contact</u>	<u>Site features</u>	<u>Recorders</u>	<u>Reports</u>	<u>Permits</u>	<u>Longitude</u>	<u>Latitude</u>
													<u>GDA94</u>	<u>GDA94</u>
37-6-380	Huntlee 48	GDA	56	345541	6384616	Open site	Valid		Artefact : -	RPS Australia East Pty Ltd - Hamilton,Mr.Ben Slack			151.35	-32.67
37-6-160	Redhouse Creek 1	AGD	56	346462	6384549	Open site	Valid	T Russell	Artefact : 34	Umwelt (Australia) Pty Limited - Individual users	102113	2562	151.36	-32.66
37-6-380	Huntlee 47	GDA	56	345533	6384050	Open site	Destroyed		Artefact : -	RPS Australia East Pty Ltd - Hamilton,RPS Australia East Pty Ltd - Hamilton,Mr.Ben Slack,Mr.Ben Slack	104464		151.35	-32.67
37-6-099	AGL 1	AGD	56	346261	6385543	Open site	Valid		Artefact : -	Junburra Aboriginal Consultancy Services	4749,102113,102646		151.36	-32.66
37-6-216	Branxton Rail 15	GDA	56	347139	6384081	Open site	Valid		Artefact : 1	South East Archaeology			151.37	-32.67
37-6-220	Branxton RW 41/A	GDA	56	345496	6384504	Open site	Valid		Artefact : 1	Mr.Peter Kuskie	102402,104464		151.35	-32.67
37-6-131	Anvil Creek RTA 11 IF	AGD	56	345965	6384253	Open site	Valid		Artefact : 1	Umwelt (Australia) Pty Limited - Individual users,Leila McAdam	102113	2102	151.36	-32.67
37-6-379	Huntlee 50	GDA	56	345538	6384091	Open site	Destroyed		Artefact : -	RPS Australia East Pty Ltd - Hamilton,RPS Australia East Pty Ltd - Hamilton,Mr.Ben Slack,Mr.Ben Slack	104464		151.35	-32.67
37-6-225	Branxton RW 22/A	GDA	56	346147	6385002	Open site	Valid		Artefact : 1	Mr.Peter Kuskie			151.36	-32.66
37-6-160	Anvil Creek 27IF	AGD	56	346521	6384350	Open site	Valid	T Russell	Artefact : 1	Umwelt (Australia) Pty Limited - Individual users	101116,102113	2562	151.36	-32.67
37-6-160	PAD 21, RTA	AGD	56	346711	6384511	Open site	Valid	T Russell	Potential Archaeological Deposit (PAD) : -	Umwelt (Australia) Pty Limited - Individual users	102113	2562	151.37	-32.66
37-6-216	Branxton Rail Grinding Groove 1	GDA	56	347097	6384134	Open site	Valid		Artefact : 1	South East Archaeology			151.37	-32.67
37-6-380	Huntlee 49	GDA	56	345542	6384050	Open site	Destroyed		Artefact : -	RPS Australia East Pty Ltd - Hamilton,RPS Australia East Pty Ltd - Hamilton,Mr.Ben Slack,Mr.Ben Slack	104464		151.35	-32.67
37-6-132	Anvil Creek RTA 20 IF	AGD	56	346377	6383908	Open site	Valid		Artefact : 1	Umwelt (Australia) Pty Limited - Individual users,Leila McAdam		2102	151.36	-32.67
37-6-277	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Closed site	Valid	Mr.Thomas Miller		RPS Australia East Pty Ltd - Hamilton,Mr.Ben Slack,Mr.Balazs Hansel	104464			
37-6-277	Branxton WWTW 8/A	GDA	56	346289	6384967	Open site	Valid		Artefact : 13	Mr.Peter Kuskie,South East Archaeology			151.36	-32.66
37-6-420	AS7_Huntlee	GDA	56	346722	6384277	Open site	Destroyed		Artefact : -	Niche Environment and Heritage,Niche Environment and Heritage,Miss.Kate Morris,Miss.Kate Morris			151.37	-32.67
37-6-225	Branxton WWTW 2/A	GDA	56	346627	6385197	Open site	Valid		Artefact : 1	Mr.Peter Kuskie		3362	151.36	-32.66
37-6-216	Branxton Rail 14	GDA	56	346785	6384241	Open site	Valid		Artefact : 1	South East Archaeology			151.37	-32.67
37-6-132	Anvil Creek RTA 22	AGD	56	345784	6384373	Open site	Valid	T Russell	Artefact : 2	Umwelt (Australia) Pty Limited - Individual users,Leila McAdam	102113,102402,102600	2102	151.36	-32.67
37-6-132	Anvil Creek RTA 21	AGD	56	346233	6383950	Open site	Valid		Artefact : 2	Umwelt (Australia) Pty Limited - Individual users,Leila McAdam		2102	151.36	-32.67
37-6-172	Red House Creek 1b/PAD	GDA	56	346452	6385184	Open site	Not a Site	Searle	Potential Archaeological Deposit (PAD) : -	Doctor.Jodie Benton	100451,100543,102113		151.36	-32.66

Report generated by AHIMS Web Service on 09/06/2022 for Ajay Arcot for the following area at Datum :GDA, Zone : 56, Eastings : 345415.5974 - 347798.4313, Northings : 6384005.0982 - 6385970.9361 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 22
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Appendix B. Unexpected Finds Protocol

B.1 Introduction

This protocol is to be followed if a previously unrecorded or unanticipated Aboriginal object (including objects that are suspected to be Aboriginal objects) are encountered during the proposal.

An Aboriginal object is defined by the National Parks and Wildlife Act 1974 (NSW) as:

any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains.

This definition includes stone artefacts, midden material, rock art, scarred and carved trees, and burials.

Where there is an existing approval to harm Aboriginal objects in place, all actions must occur in accordance with the conditions of that approval. This unexpected finds protocol is only required where there is no existing approval or where any conditions of approval require an unexpected finds protocol to be followed.

The unexpected finds protocol is based on a four-step approach: Stop, Advise, Assess and Manage.

B.2 Non-skeletal remains

B.2.1 Stop

1. All ground-disturbing works in the area of the item must immediately cease and machine operators notified to ensure that no harm occurs to the item
2. Establish an appropriate buffer around the object(s). This buffer should be clearly marked, for example, with high-visibility fencing or tape

B.2.2 Advise

3. Inform the site supervisor and the development proponent of the discovery
4. Inform the proposal archaeologist of the discovery. The proposal archaeologist (or similarly qualified person) will confirm whether the object is an Aboriginal object

B.2.3 Assess

5. Do not further impact the location where the item was found, so it can be assessed by the proposal archaeologist (or other suitably qualified professional)
6. If it is determined that the item is not an Aboriginal object, this protocol no longer needs to be followed. If it is determined that the item is, or is likely to be, an Aboriginal object, the following steps must be followed

B.2.4 Manage

7. The following organisations must be notified:
 - Heritage NSW
 - The Registered Aboriginal Parties (RAPs) associated with the proposal (where appropriate).

8. Clarify and comply with any legal constraints arising from the discovery. This may involve seeking and complying with advice from Heritage NSW. Constraints will include halting all works in the vicinity of the Aboriginal object(s) until a management strategy has been developed and implemented
9. The Aboriginal object(s) must be recorded by the proposal archaeologist (or other suitably qualified professional) in conjunction with the RAPs. The recording will be submitted to the AHIMS database for accessioning as soon as practicable
10. A management strategy comprising appropriate management actions will be determined by the RAPs and the proposal archaeologist (or other suitably qualified professional). The strategy will depend on variables including the assessed significance of the Aboriginal object(s) and the likelihood of further Aboriginal objects being present in the area). Input from Heritage NSW may also occur
11. At a minimum, the management strategy will include information about the following:
 - Description of the Aboriginal object(s), including physical and environmental context
 - Historical and ethnographical information, where available
 - Likely significance of the object(s)
 - Likely impacts from the proposal
 - Regulatory requirements and responsibilities, including any notifications and approvals that will be required
 - Relevance and interactions with other proposal approvals and management plans
 - Ongoing consultation requirements
 - Management and mitigation measures
12. The requirements of the management strategy must be complied with prior to the resumption of works in that area.

B.3 Skeletal remains

If human remains, or suspected human remains, are found during ground disturbing works, the following procedure must be adhered to:

B.3.1 Stop

1. All ground-disturbing works in the area of the item must immediately cease and machine operators notified to ensure that no harm occurs to the item
2. Establish an appropriate buffer around the object(s). This buffer should be clearly marked, for example, with high-visibility fencing or tape

B.3.2 Advise

3. Inform the following people and organisations immediately:
 - Site supervisor and development proponent
 - Project archaeologist
 - NSW Police
 - Heritage NSW

B.3.3 Assess

4. NSW Police will determine if the suspected remains are human and are likely to be Aboriginal Ancestral Remains

B.3.4 Manage

5. If the remains are determined not to be Aboriginal Ancestral Remains, NSW Police will determine the next steps
6. If the remains are likely to be Aboriginal Ancestral Remains, Heritage NSW will manage the next steps, in conjunction with the RAPs for the proposal
7. Either the NSW Police or Heritage NSW will determine when works can recommence in the vicinity of the remains



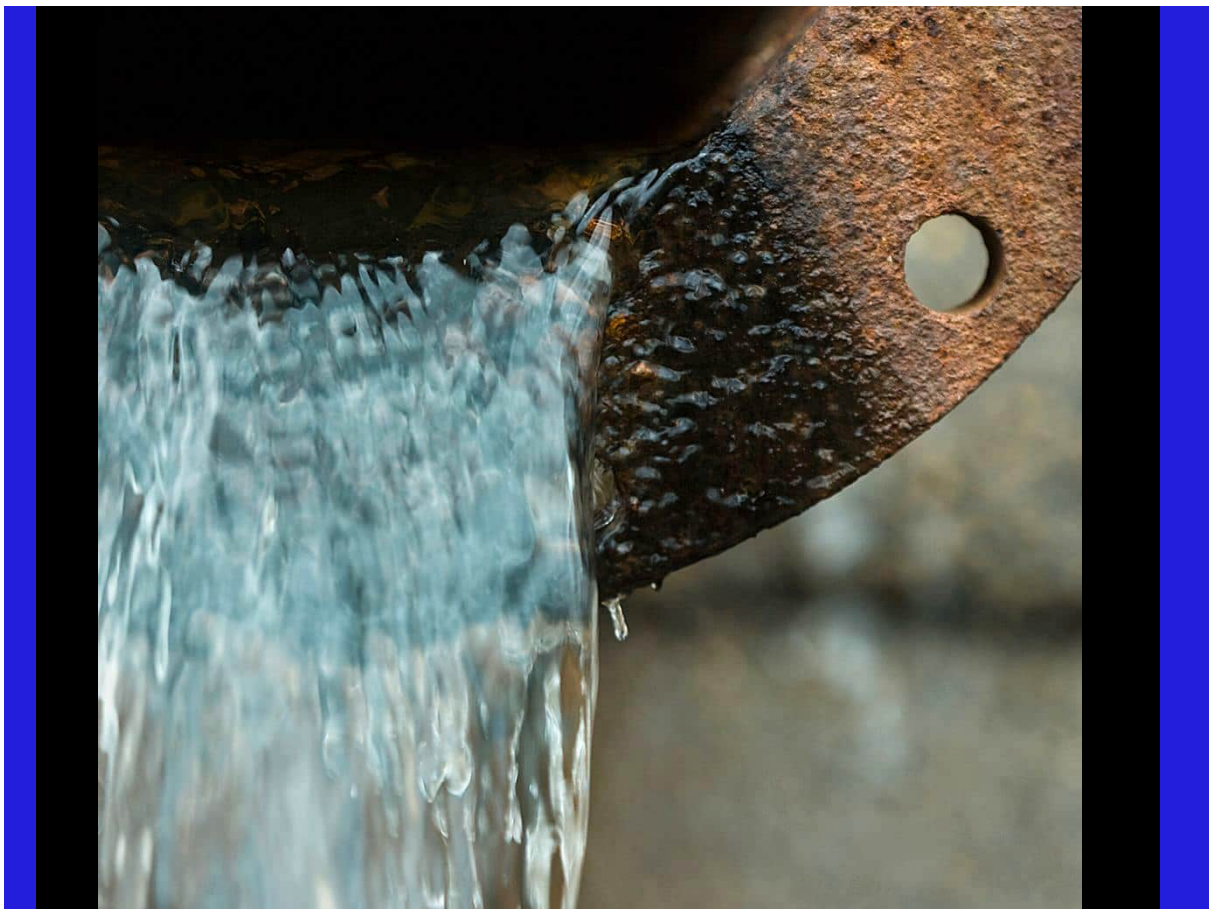
APPENDIX G. NOISE AND VIBRATION ASSESSMENT

Noise and Vibration Impact Assessment

Document no: Rev1
Revision no: 02

Hunter Water

Harpers Hill Reservoir and Lochinvar Rising Main Upgrade
24 January 2023



Executive summary

Introduction

Hunter Water Corporation (Hunter Water) proposes to construct and operate a new five megalitre (ML) potable water reservoir at Harpers Hill and new truck main between the new reservoir and the Lochinvar 2 Water Pump Station (Lochinvar WPS) at Lochinvar (the proposal).

The proposal involves the construction of a new five megalitre (ML) potable water reservoir at Harpers Hill and new truck main between the new reservoir and the Lochinvar WPS at Lochinvar (the proposal).

Key elements of the proposal include:

- Constructing and operating a new 5 ML potable water reservoir
- Constructing and operating 2.4 kilometres (km) of new 375 millimetre (mm) water main between Lochinvar WPS and the new reservoir which would operate in parallel with the existing 250 mm water trunk main
- Constructing underground pipework at the new reservoir, including inlet, outlet, scour, overflow and connecting to existing outlet pipework
- Cutting and filling earthworks to create an even surface below the new reservoir and access road
- Harpers Hill Lane access improvement, comprising:
 - Upgrading the eastern portion of Harpers Hill Lane
 - Constructing an access road to connect the eastern portion of Harpers Hill Lane and the private road used to access the reservoir site.
- Demolishing the existing 0.9 ML Harpers Hill 1 Reservoir (the existing reservoir).

The construction of the proposal would be expected to start in late 2023 and take up to six months (weather permitting) to complete.

Existing environment

The proposal is located at the existing reservoir at Harpers Hill and along the trunk main to Lochinvar WPS from the reservoir. The proposal area spans two land zones, Rural Landscape (RU2) and General Residential (R1), under the *Maitland Environmental Plan 2011*.

Land use surrounding the proposal is described as follows:

- North and south of the proposal area is surrounded predominantly by farmland with residential receivers sparsely distributed
- East of the proposal area is the Lochinvar township, which comprises primarily of residential housing and a relatively smaller number of commercial buildings
- West of the proposal area is also surrounded predominantly by farmland with residential receivers sparsely distributed.

Technical inputs

A number of construction activities would need to be undertaken to facilitate the proposal. These include but are not limited to the construction of a reservoir, a pipeline connecting the reservoir to the Lochinvar WPS, and road upgrades to facilitate access to the reservoir.

Some out of hours work may be required (night and weekends) to order to expedite the proposal. As such, it has been assumed that work phases could be undertaken at any time of day.

The key operational noise source from the proposal was identified as the air compressor used as part of the bubble mixer in the reservoir.

Assessment of impacts

Construction impacts

It was found that the construction works required by the proposal would lead to construction noise impacts. Noise levels of up to 30dB(A) greater than the standard hours Noise Management Levels (NMLs) have been predicted at the nearest residential receivers. Generally, the pipeline works have been predicted to result in the highest number of impacts, primarily as a result of the proximity of these works to the receivers in Lochinvar.

The pipeline works (Phase A1 and Phase A1-C) have been predicted to result in the highest noise levels at a residential receiver, primarily as a result of the proximity of these works to the worst affected receivers. During standard hours, Phase A1-C has been predicted to result in up to 68 residential receivers in NCA03. During night hours this has been predicted to increase to 336 residential receivers in NCA03. Additionally, up to four receivers in NCA03 have been predicted to become 'highly noise affected' during Phase A1.

Construction vibration was predicted to occur at a limited number of receivers along the pipeline works alignment as well as the road upgrade works.

Operation impacts

It was determined that noise produced by the air compressor associated with the reservoir would not produce operational noise levels greater than the noise limits defined by the Noise Policy for Industry (NPI), nor would the proposal pose any tonal or low frequency noise risks. The air compressor would be located within an enclosure which would further reduce operational noise.

Mitigation and further considerations

Due to the extent of noise impacts during the construction phase, noise mitigation measures have been proposed. These noise impacts would need to be carefully managed, particularly during out of hours periods, in order to reduce the noise impacts of the works.

Due to a limited number of receivers predicted to fall within the cosmetic damage vibration setback distances, vibration mitigation measures have been provided to manage vibration risks.

Jacobs recommends that when the final air compressor model is selected, the external noise performance of the unit and enclosure should be verified and confirmed by the supplier to be able to perform to the noise levels of the air compressor presented in this report or better. Likewise, the supplier should also demonstrate that the unit can achieve the noise limit without producing tonal and low frequency noise impacts.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs Group (Australia) Pty Ltd (Jacobs) is to undertake a construction noise and vibration assessment for the Harpers Hill Reservoir and Lochinvar Rising Main Upgrade in accordance with the scope of services set out in the contract between Jacobs and Hunter Water. That scope of services, as described in this report, was developed with Hunter Water.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Hunter Water and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from Hunter Water (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the proposal and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of Hunter Water, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and Hunter Water. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

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1. Introduction

1.1 Proposal background

Hunter Water Corporation (Hunter Water) proposes to construct and operate a new five megalitre (ML) potable water reservoir at Harpers Hill and new truck main between the new reservoir and the Lochinvar 2 Water Pump Station (Lochinvar WPS) at Lochinvar (the proposal).

The proposal is located within an area subject to significant forecast growth and the adequate delivery of water to Harpers Hill reservoir from Lochinvar WPS is vital to continuously meet current and future demand for customers in the supply area. However, the system currently has operational issues relating to loss of supply, low pressure and security of supply. The proposal would help to boost the system capacity for growth and provide security of supply. The purpose of this report is to assess potential noise and vibration impacts associated with the proposal and develop measures to mitigate or otherwise effectively manage these effects. This noise and vibration impact assessment (NVIA) supports the Review of Environmental Factors (REF) prepared for the proposal.

1.2 Proposal location

The proposal stretches about 3.5 km through the suburbs of Harpers Hill, Allandale and Lochinvar within the Maitland Local Government Area (LGA). It is located about 15 km to the north east of Cessnock and 11 km to the north west of Maitland.

The reservoir site is located to the south of the New England Highway. The reservoir site is currently accessed via a private road off the New England Highway. Hunter Water has a right of carriageway on this private road.

The proposal is located on land zoned as RU2 – Rural Landscape and R1 – General Residential. The pipeline is predominately in the RU2 zoning from the reservoir and changes to R1 at St Helena Close. In the vicinity, just north of the proposal, the land is zoned as RU1 – Primary Production. Just west of the Lochinvar WPS some land is zoned as R5 – Large Lot Residential.

1.3 Report structure

The NVIA report structure is as follows:

- **Section 2: Proposal description** – describes the proposal setting, details and potential noise and vibration related risks
- **Section 0: Existing environment** – outlines key features of the existing environment including surrounding receivers and background noise levels
- **Section 4: Policy setting and criteria** – establishes suitable assessment criteria
- **Section 5 Technical inputs** – details the modelling settings adopted for the assessment and details the noise and vibration sources used to perform the assessment
- **Section 6: Assessment of impacts** – predicts the potential for noise and vibration related impacts at the identified surrounding receivers
- **Section 7: Mitigation measures** – recommends mitigation measures based on the impacts predicted.

2. Proposal description

2.1 Proposal overview

The proposal involves the construction of a new five megalitre (ML) potable water reservoir at Harpers Hill and new truck main between the new reservoir and the Lochinvar 2 Water Pump Station (Lochinvar WPS) at Lochinvar (the proposal).

Key elements of the proposal include:

- Constructing and operating a new 5 ML potable water reservoir
- Constructing and operating 2.4 kilometres (km) of new 375 millimetre (mm) water main between Lochinvar WPS and the new reservoir which would operate in parallel with the existing 250 mm water trunk main
- Constructing underground pipework at the new reservoir, including inlet, outlet, scour, overflow and connecting to existing outlet pipework
- Cutting and filling earthworks to create an even surface below the new reservoir and access road
- Harpers Hill Lane access improvement, comprising:
 - Upgrading the eastern portion of Harpers Hill Lane
 - Constructing an access road to connect the eastern portion of Harpers Hill Lane and the private road used to access the reservoir site.
- Demolishing the existing 0.9 ML Harpers Hill 1 Reservoir (the existing reservoir).

The construction of the proposal would be expected to start in late 2023 and take up to six months (weather permitting) to complete.

Work would be primarily undertaken during standard construction working hours as follows:

- 7am to 6pm Monday to Friday
- 8am to 1pm Saturdays
- No work Sundays or public holidays.

It is noted, however, that situations may occur where works will take place outside of standard hours.

2.2 Primary noise and vibration related risks

Noise and vibration related impacts can arise when levels from industry or construction activities result in unacceptable levels at surrounding sensitive receivers. Within this proposal, noise has the potential to be generated throughout the construction, with vibration-generating equipment also intended to be used during construction. The key construction activities with the potential to generate noise and vibration during the proposal include:

- Works undertaken to allow for the installation of proposal infrastructure
- Operation of reservoir infrastructure
- Cumulative impacts with the construction of nearby developments.

In addition to the above activities, noise impacts from additional traffic generated during the construction and operational phases of the proposal have also been considered in this assessment.

3. Existing environment

3.1.1 Sensitive receivers

3.2 Surrounding land use

The proposal is located at the existing reservoir at Harpers Hill and along the trunk main to Lochinvar WPS from the reservoir. The proposal area spans two land zones, Rural Landscape (RU2) and General Residential (R1), under the *Maitland Environmental Plan 2011*.

Land use surrounding the proposal is described as follows:

- North and south of the proposal area is surrounded predominantly by farmland with residential receivers sparsely distributed
- East of the proposal area is the Lochinvar township, which comprises primarily of residential housing and a relatively smaller number of commercial buildings
- West of the proposal area is also surrounded predominantly by farmland with residential receivers sparsely distributed.

Based on the differing land uses between the receivers in Lochinvar to the east of the study area, as well as the influence the New England Highway would have on background noise, the study area has been divided into three 'Noise Catchment Areas' (NCAs). The areas each NCA covers is detailed in **Table 3.1**.

Table 3.1 Noise Catchment Areas

Noise Catchment Area	Areas covered
NCA 1	<ul style="list-style-type: none"> • Harpers Hill (north of New England Highway) • Oswald • Windermere • Lochinvar (north of New England Highway and outside of town)
NCA 2	<ul style="list-style-type: none"> • Harpers Hill (south of New England Highway) • Allandale • Lochinvar (south of New England Highway and outside of town)
NCA 3	<ul style="list-style-type: none"> • Lochinvar (main town)

The locations of the NCAs are displayed in **Figure 3-1**.

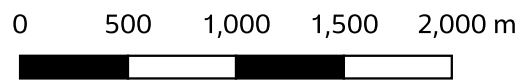
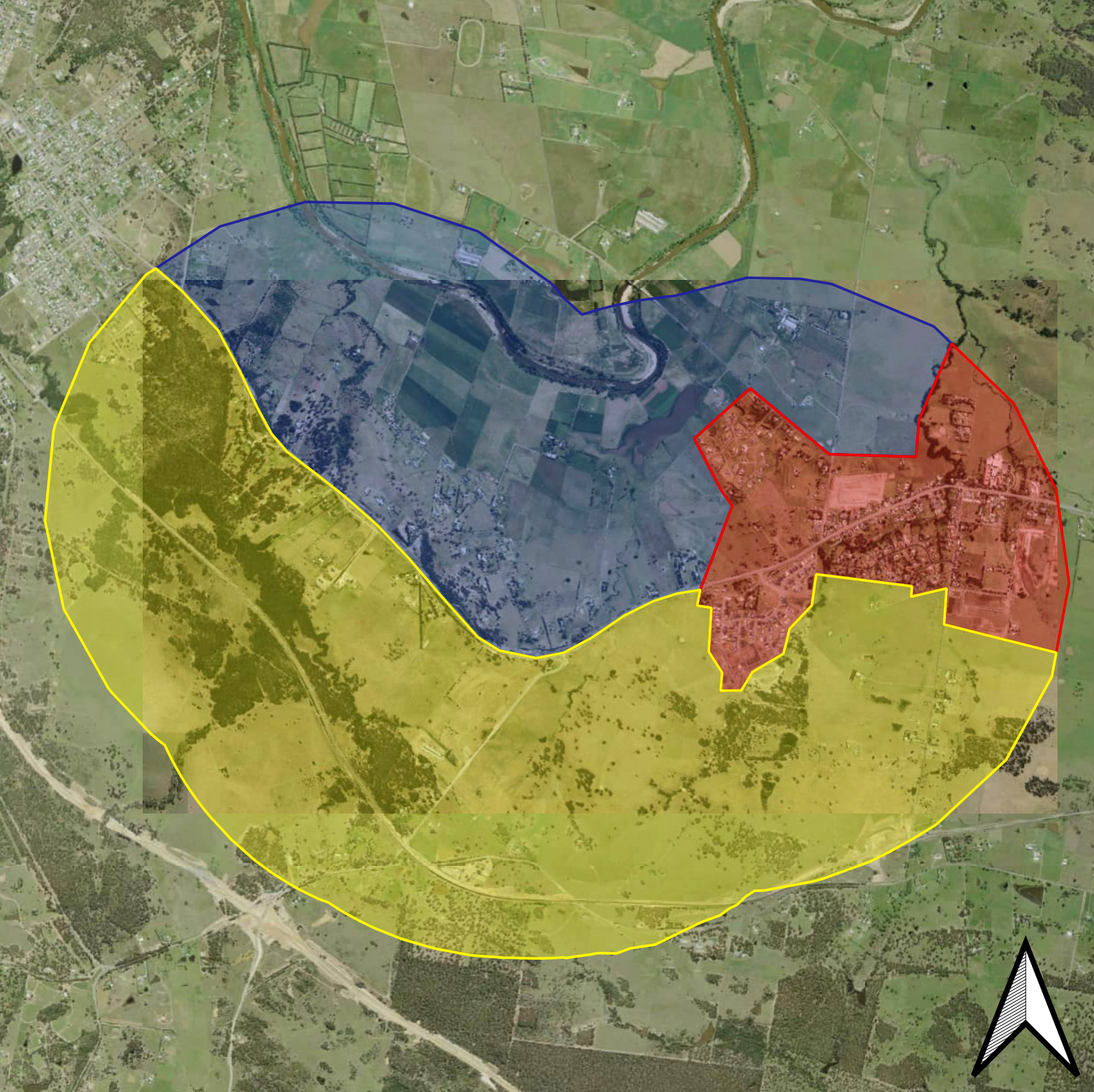




Figure 3.1: Noise Catchment Areas

Legend

-  NCA01
-  NCA02
-  NCA03

Basemap: NSW SixMap
Scale: 1:27000
Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
HarpersHill_GIS | Drawn: AC | Check: LS |
Date: 02/11/2022

3.2.1 Background noise and noise catchment areas

Background noise monitoring was not conducted for the proposal. As such, guidance from the NSW Roads and Maritime Service (RMS) *Construction and Maintenance Estimator Tool (CMNE Tool) ver. FT-150* (RMS, 2016) was adopted to determine the appropriate background noise levels for assessment. The tool contains a number of 'noise area categories' based on typical of Australian residential areas and provides appropriate 'rating background noise levels (RBLs)' based on the typical background noise contributors. In this instance, the noise area category of 'R2' which includes rural and low density residential areas adjacent to major roads and throughfares. Given the proximity of the New England Highway to most receivers in the study area, and that the New England Highway would certainly be a significant contributor of noise in the area, the usage of category 'R2' has been deemed appropriate for all three NCAs.

The adopted rating background noise levels adopted for the assessment are detailed in **Table 3.2**.

Table 3.2 Assumed RBLs at all receivers

Location	Rating background noise level (L_{A90} dB(A))		
	Day (7:00 am to 6:00 pm)	Evening (6:00 pm to 10:00 am)	Night (10:00 pm to 7:00 am)
NCA 1	45	40	35
NCA 2	45	40	35
NCA 3	45	40	35

3.2.2 Vibration sensitive receivers

Certain receivers and structures, such as medical centres, precision industry and heritage structures are typically more susceptible to vibration and are subject to more stringent criteria. A study of the proposal area found one heritage site on the eastmost boundary of the proposal area. The building is located approximately 45 m away from the proposal area. No medical, precision industry or other heritage receivers or structures are located within 200 m of the proposed works.

4. Policy setting and criteria

4.1 Construction noise

4.1.1 Noise management levels

The *Interim Construction Noise Guideline* (ICNG) (Department of Environment and Climate Change [DECC], 2009) provides guidance for assessing noise from construction activities in NSW. It establishes noise management levels (NMLs) for recommended standard construction hours and for outside of the recommended standard hours. Construction is considered to have the potential to cause a noise impact if the predicted noise exceeds the applicable noise management level. **Table 4.1** lists ICNG guidance for establishing construction NMLs at residential receivers.

Table 4.1: ICNG guidance for establishing construction NMLs at residential receivers

Time of day	Management level $L_{Aeq(15min)}$	How to apply
Recommended standard hours (SH): Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays	Noise affected: Rating Background Level (RBL) + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected: 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours (OOH) - All other times including public holidays	Noise affected: RBL + 5 dB(A)	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2 of the ICNG.

Considering the adopted RBLs presented in **Table 4.1**, the NMLs for the identified surrounding residential receivers are presented in **Table 4.2**.

Table 4.2: Construction noise management levels (residential receivers)

NCA	NML $L_{eq, 15 \text{ min}}$ dB(A)			
	Day (during standard hours) 7am – 6pm Weekdays, 8am – 1pm Saturdays	Day (outside standard hours) 7am – 8am & 1pm – 6pm Saturdays 8am – 6pm Sundays and Public Holidays	Evening 6pm-10pm Weekdays 6pm – 10pm Saturdays	Night 10pm-7am Weekdays, 10pm – 8am Saturdays 6pm – 7am Sundays and Public Holidays
NCA 1	55	50	45	40
NCA 2	55	50	45	40
NCA 3	55	50	45	40

The ICNG also provides construction NMLs for non-residential land uses. These are presented in **Table 4.3**.

Table 4.3: ICNG NMLs for non-residential receivers

Non-residential receiver type	Noise management level, $L_{Aeq(15min)}$ (applies when properties are being used)
Commercial	External noise level – 70 dB(A)
Industrial	External noise level – 75 dB(A)
Educational facilities	Internal noise level – 45 dB(A)
Hospital / medical	Internal noise level – 45 dB(A)
Library	Internal noise level – 45 dB(A)
Place of worship	Internal noise level – 45 dB(A)
Passive recreation	External noise level – 60 dB(A)
Active recreation	External noise level – 65 dB(A)
Hotel	External noise level – 50 dB(A)

It should be noted that the NSW EPA is developing a new construction noise guideline, the *Construction Noise Guideline*, which is currently in-draft. When released, the *Construction Noise Guideline* will replace the ICNG.

4.1.2 Sleep disturbance

For premises where night construction (and operations) occurs, the potential for noise levels to lead to sleep disturbance should be considered. Section 4.3 of the ICNG discusses the method for assessing and managing sleep disturbance. This guidance references further information in the *NSW Road Noise Policy (RNP)* (NSW EPA, 2013) that discusses criteria for the assessment of sleep disturbance.

Where noise levels from a construction (or industrial) source at a residential receptor at night exceeds the following, a maximum noise level event assessment should be undertaken:

- $L_{Aeq,15min}$ 40 dB(A) or the RBL + 5 dB(A), whichever is greater, and/or
- L_{AFMax} 52 dB(A) or the RBL +15 dB(A), whichever is greater.

Based on this guidance, **Table 4.4** presents the resultant sleep disturbance screening criterion (SDSC) for the NCAs surrounding the proposal.

Table 4.4: Sleep disturbance criterion

NCA	SDSC	
	L _{eq} 15 min dB(A)	L _{AFMax} dB(A)
NCA 1	40	52
NCA 2	40	52
NCA 3	40	52

4.1.3 Annoying noise characteristics

Equipment that has the potential to produce a tonal noise, an impulsive noise or any other type of noise defined by the ICNG as ‘particularly annoying’, the noise level for that particular equipment will receive an additional 5 dB(A) penalty.

As per guidance from the Noise Policy for Industry (Environmental Protection Agency, 2017) (NPI), the penalty for impulsive noise (e.g., hammers and packers) would only be applied during night periods. The penalty for tonal noise (e.g., road saws and grinders) will apply for all periods.

4.2 Operational noise

4.2.1 Overview

Operational noise criteria for the proposal are determined in accordance with the NPI, which seeks to regulate noise impact from ‘industrial activity’ pertaining to noise from fixed industry and mechanical plant rather than from road, rail or construction sources. To achieve this, the NPI applies two separate noise levels: one aimed at limiting the intrusiveness of the proposal’s noise against the prevailing level of background noise (Intrusiveness Criteria), and the other focused on achieving suitable acoustic amenity for the surrounding land uses from industry (Amenity Criteria). The more stringent of these is used to define the operational noise criteria for the proposal.

4.2.2 Intrusiveness noise level

A noise source will be deemed to be non-intrusive if the monitored L_{Aeq (period)} noise level of the proposal does not exceed the RBL by more than 5 dB(A). Based on the RBLs adopted in **Table 4.5** the following noise intrusiveness criteria would apply.

Table 4.5 Proposal noise intrusiveness level

Receiver type	Time of day	RBL (L ₉₀ dB (A))	Allowance	Noise intrusiveness criteria (L _{Aeq} dB(A))
Residential receivers	Day (7 am to 6 pm)	45	+5 dB(A)	50
	Evening (6 pm to 10 pm)	40		45
	Night (10 pm to 7 am)	35		40

4.2.3 Amenity noise level

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the proposal amenity noise level represents the objective for noise from a single industrial development at a receiver location. To ensure that industrial noise levels remain within the recommended amenity noise levels for an area, the proposal amenity noise levels detailed in **Table 4.6** would apply.

Table 4.6 NPI amenity noise criteria, rural residential receivers

Receiver type	Time of day	Recommended noise level (L_{Aeq} (period) dB(A))	Amenity noise level (L_{Aeq} 15 minute dB(A))
Rural Residential receivers	Day (7 am to 6 pm)	50	48
	Evening (6 pm to 10 pm)	45	43
	Night (10 pm to 7 am)	40	38

The NPI also presents amenity noise levels for non-residential receivers. These have been reproduced below in **Table 4.7**.

Table 4.7 Amenity noise criteria, non-residential receivers

Receiver type	Time of day	Recommended amenity L_{Aeq} 15 minute noise level (dB(A))	Proposal amenity noise level L_{Aeq} 15 minute (dB(A))
Hotels, motels, holiday accommodation, permanent resident caravan parks	Day (7 am to 6 pm)	60	58
	Evening (6 pm to 10 pm)	50	48
	Night (10 pm to 7 am)	45	43
Commercial premises	When in use	65	63
Industrial premises	When in use	70	68
School classroom	When in use	45	43
Place of worship	When in use	50	48
Hospital ward	Noisiest 1-hour	50	48
Industrial premises	When in use	70	68
Passive recreational area	When in use	50	48

4.2.4 Proposal noise trigger level

Based on the development of the proposal intrusiveness and proposal amenity criterion, the more stringent of the two was selected as the proposal noise trigger level. These criteria are displayed in **Table 4.8**.

Table 4.8 NPI Proposal Noise Criteria

Receiver type	Time of day	Proposal noise intrusiveness criteria (L_{Aeq} dB(A))	Proposal amenity noise level (L_{Aeq} 15 minute dB(A))	Proposal noise trigger level (L_{Aeq} 15 minute dB(A))
Residential receivers	Day (7 am to 6 pm)	50	48	48
	Evening (6 pm to 10 pm)	45	43	43
	Night (10 pm to 7 am)	40	38	38

4.2.5 'Annoying' noise characteristics

'Annoying' noise characteristics associated with the operation of industrial facilities are addressed in Fact Sheet C of the NPI. Where an 'annoying' noise characteristic is identified, a positive correction will be applied to the noise levels to account for it. For this assessment, the two most likely 'annoying' noise characteristics are tonality and low frequency noise.

Where a tonal noise is predicted to be generated from a noise source, a one-third octave analysis should be performed using the methodology detailed in *ISO 1996-2:2007 Annex D: Objective Method for Assessing the Audibility of Tones in Noise*. Where the level of one-third octave band exceeds the level of the adjacent bands on both sides by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 hertz (Hz)
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

Then a correction of 5 dB should be applied to the noise source.

Low frequency noise is accounted for using a two-step assessment of the A-weighted and C-weighted noise levels. A correction for low frequency noise will be applied where:

- The C-weighted noise contribution is 15 dB greater than the A-weighted noise source contribution at a noise receiver, **AND**
- Any of the third octave noise levels presented in Table C2 of Fact Sheet C are exceeded at the noise receiver.

Where the exceedance of the third octave noise levels is less than or equal to 5 dB, a correction of 2 dB is applied during the evening and night periods, and where the exceedance of the third octave noise levels is greater than 5 dB, a correction of 5 dB is applied during the evening and night periods.

4.3 Vibration

4.3.1 Overview

Vibration arising from construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two outcomes have different criterion, with the effects of vibration on human comfort having a lower threshold.

4.3.2 Human comfort

With respect to human comfort, vibration arising from construction activities must comply with criteria presented in *Assessing Vibration: a technical guideline* (DECC, 2006). The guideline identifies three different forms of vibration associated with construction activities:

- Continuous: uninterrupted vibration occurring over a defined period
- Impulsive: short-term (typically less than two seconds) bursts of vibration which occurs up to three times over an assessment period
- Intermittent: interrupted periods of continuous or repeated impulsive vibration, or continuous vibration that varies significantly in magnitude.

Continuous vibration may result from steady road traffic or steady use of construction equipment (e.g., generator). Impulsive vibration may arise during the loading or unloading of heavy equipment or materials or infrequent use of hammering equipment. Intermittent vibration may arise from the varied use of construction equipment (i.e., a dump truck moving around a site, idling while being loaded with materials, and then dumping the materials) or repeated high-noise activities such as hammering, piling or cutting.

Preferred and maximum values of human exposure for continuous and impulsive vibrations for the proposal are listed in **Table 4.9**. As per the guideline, daytime is between 7 am and 10 pm, and night is between 10 pm and 7 am.

Table 4.9: Preferred and maximum weighted root mean square values for continuous and impulsive vibration acceleration (m/s²) 1-80 Hz

Location	Assessment period ¹	Preferred values		Maximum values	
		z-axis ²	x and y axis ²	z-axis	x and y axis
Continuous vibration					
Residences	Day	0.010	0.0071	0.020	0.014
	Night	0.007	0.005	0.014	0.010
Impulsive vibration					
Residences	Day	0.30	0.21	0.60	0.42
	Night	0.10	0.071	0.20	0.14

¹ Daytime is 7am to 10pm. Night-time is 10 pm to 7 am

² z-axis refers to vertical vibration, while the x and y axes refer to horizontal vibration.

Intermittent vibration is assessed differently using vibration dose values (VDV). Preferred and maximum VDV for different types of receivers have been reproduced in **Table 4.10** for relative receivers in this assessment.

Table 4.10: Preferred and maximum VDV for intermittent vibration (m/s^{1.75}), (DECC, 2006)

Location	Day time (7 am to 10 pm)		Night-time (10 pm to 7 am)	
	Preferred VDV	Maximum VDV	Preferred VDV	Maximum VDV
Residences	0.20	0.40	0.13	0.26

4.3.3 Buildings and structures

Section J4.4.3 of *Australian Standard AS2187.2 – 2006 Explosives – Storage and use Part 2: Use of explosives* provides frequency-dependent guide levels for cosmetic damage to structures arising from vibration. These levels are adopted from *British Standard BS7385: 1990 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration* [BS7385-2:1993] and are presented in **Table 4.11**.

Table 4.11: Transient vibration guideline values for cosmetic damage

Type of building	Peak particle velocity (PPV) mm/s		
	4 to 15 Hz	15 to 40 Hz	40 Hz and above
Reinforced or framed structures industrial and heavy commercial buildings	50		
Un-reinforced or light-framed structures residential or light commercial type buildings	15 to 20	20 to 50	50

Guidance for more sensitive structures is presented in the German standard, *DIN 4150-3 Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3: 2016). Vibration velocities not exceeding three (millimetres per second (mm/s) at 1 to 10 Hz are recommended in this standard.

4.3.4 Construction noise and vibration guideline

Section 7 of the *Construction Noise and Vibration Guideline* (Roads and Maritime Services, 2016) (CNVG) provides guidance for safe working distances to achieve human comfort (*Assessing Vibration: a technical guideline* (DECC, 2006) and cosmetic building damage (BS7385-2:1993) criteria for a range of different plant and equipment. These safe working distances are relevant for some plant and equipment that may be

used during construction of the proposal, and so this guidance (presented below in **Table 4.12**) was considered.

Table 4.12: Recommended safe setback distances

Plant	Rating / description	Safe working distance (m)	
		Cosmetic damage (Ref: BS7385-2: 1993)	Human response (Ref: DECC, 2006)
Vibratory roller	<50 kN (typically 1-2 tonne)	5 m	15 m to 20 m
	<100 kN (typically 2-4 tonne)	6 m	20 m
	<200 kN (typically 4-6 tonne)	12 m	40 m
	<300 kN (typically 7-13 tonne)	15 m	100 m
	>300 kN (typically 13-18 tonne)	20 m	100 m
	>300 kN (> 18 tonne)	25 m	100 m
Small hydraulic hammer	300 kg – 5 to 12 tonne excavator	2 m	7 m
Medium hydraulic hammer	900 kg – 12 to 18 tonne excavator	7 m	23 m
Large hydraulic hammer	1600 kg – 18 to 34 tonne excavator	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤800 mm	2 m (nominal)	4 m
Jackhammer	Handheld	1 m (nominal)	2 m
Profiler*	Wirtgen W210	4 m	
Asphalt paver*	Vogele Super 1800-3	1 m	
Steel drum roller*	Hamm HD70 (Oscillating Mode)	2 m	
Steel drum roller*	Hamm HD70 (Static Mode)	1 m	

* Human response safe working distance not available in DECC (2006)

5. Technical inputs

5.1 Model setup

Noise from the operation of the proposal was modelled using the SoundPLAN 8.2 acoustic modelling software. Within the noise modelling software, the CONCAWE noise propagation calculation was applied for dB(A) noise calculations. The CONCAWE calculation was selected due to its reliability in assessing industrial noise impacts. CONCAWE considers noise propagation and attenuation by:

- Geometrical spreading
- Atmospheric absorption
- Ground effects
- Meteorological conditions conducive of the propagation of noise
- Barriers
- Topography and distance between the source and receptor.

A number of inputs were used to create the model. These are detailed in **Table 5.1**.

Table 5.1: Noise model input details

Model Input	Details
Topography	Terrain data were derived from NSW Land Property Information (LPI) 10 m resolution bare earth Digital Elevation Model (DEM). The DEM was produced from a standard LiDAR survey conducted by LPI.
Buildings	Footprints for receptor and other buildings in the area surrounding works was determined from aerial photography. Heights and floor numbers were ascertained from Google Street view, or otherwise, assuming a building height of 3 m per floor plus 2 m for the roof.
Ground absorption factor	Water: 0.00 Rural Areas: 0.75
Noise sources	Operational SWLs were set as outlined in Table 5.3 .
Meteorology	'Noise-Enhancing' Meteorological conditions, as defined by the <i>Noise Policy for Industry</i> (EPA, 2017): Air temperature: 10°C Humidity: 70% Air pressure: 1013.3 millibar (mbar) Wind speed: 2 (metres per second (m/s)) Wind direction: Source to receiver Pasquill stability class: F

5.2 Construction emissions

5.2.1 Construction noise

A number of works activities will be undertaken during the construction of the proposal. These activities, the equipment involved and the overall sound power level (SWL) of the works have been detailed in **Table 5.2**. It has been indicated that due to the nature of the work location out of hours work will have to be undertaken. As such, it has been assumed that these phases could be undertaken at any time of day.

Table 5.2 Construction noise inventory

Work phase	Works undertaken	Equipment used	Equipment quantity	Individual SWL (dB(A))	Usage factor (%)	Average Phase SWL LAeq,15min (dB(A))	Instantaneous Maximum Phase SWL LAMax (dB(A))
Phase A1	Trenching, excavating and pipeline laying	Excavator	2	104	50%	114	116
		Compactor	1	108	50%		
		Trencher	1	112	50%		
		Welding equipment	1	97	50%		
		Trucks	2	103	75%		
		Generators	1	95	100%		
		Small tools	1	94	100%		
		Franna	1	100	50%		
		Concrete truck	2	106	50%		
		Dewatering equipment	1	96	100%		
		Light vehicles	1	98	75%		
Phase A1-C	Trenching, excavating and pipeline laying through concrete at WPS tie in	Concrete saw	1	115 + 5*	50%	119	122
		Excavator	2	104	50%		
		Compactor	1	108	50%		
		Trencher	1	112	50%		
		Welding equipment	1	97	50%		
		Trucks	2	103	75%		
		Generators	1	95	100%		
		Small tools	1	94	100%		
		Franna	1	100	50%		
		Concrete truck	2	106	50%		
		Dewatering equipment	1	96	100%		

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Work phase	Works undertaken	Equipment used	Equipment quantity	Individual SWL (dB(A))	Usage factor (%)	Average Phase SWL LAeq,15min (dB(A))	Instantaneous Maximum Phase SWL LAMax (dB(A))
		Light vehicles	1	98	75%		
Phase A2	Trenchless pipe construction	Excavator	2	104	50%	112	115
		Compactor	1	108	50%		
		Welding equipment	1	97	50%		
		Trucks	2	103	75%		
		Generators	1	95	100%		
		Small tools	1	94	100%		
		Franna	1	100	50%		
		Concrete truck	2	106	50%		
		Dewatering equipment	1	96	100%		
		Light vehicles	1	98	75%		
		Horizontal drilling Machine	1	105	50%		
		Pipe jacking equipment	1	98	50%		
Phase B1	Reservoir - grading	Trucks	2	103	75%	112	113
		Small tools	1	94	100%		
		Excavator	2	104	75%		
		Light vehicles	1	98	75%		
		Generators	1	95	100%		
		Bobcat	1	104	75%		
		Grader	1	108	100%		
Phase B2	Reservoir - earthworks	Rock hammer	1	126	50%	123	126
		Trucks	2	103	75%		
		Compactor	1	108	50%		

Noise and Vibration Impact Assessment

Work phase	Works undertaken	Equipment used	Equipment quantity	Individual SWL (dB(A))	Usage factor (%)	Average Phase SWL LAeq,15min (dB(A))	Instantaneous Maximum Phase SWL LAmax (dB(A))
		Small tools	1	94	100%		
		Excavator	2	104	100%		
		Light vehicles	1	98	75%		
		Generators	1	95	100%		
		Dozer	1	110	100%		
		Bobcat	1	104	75%		
Phase B3	Reservoir - construction	Impact piling rig	1	126	50%	123	126
		Trucks	2	103	75%		
		Small tools	1	94	100%		
		Excavator	1	104	50%		
		Concrete truck	2	106	75%		
		Light vehicles	1	98	75%		
		Generators	1	95	100%		
		Bobcat	1	104	50%		
Phase B4	Reservoir – demolition of existing reservoir	Concrete saw	1	120	50%	118	121
		Trucks	2	103	75%		
		Small tools	1	94	100%		
		Excavator	1	104	50%		
		Concrete truck	2	106	75%		
		Light vehicles	1	98	75%		
		Generators	1	95	100%		
		Bobcat	1	104	50%		

Noise and Vibration Impact Assessment

Work phase	Works undertaken	Equipment used	Equipment quantity	Individual SWL (dB(A))	Usage factor (%)	Average Phase SWL LAeq,15min (dB(A))	Instantaneous Maximum Phase SWL LAMax (dB(A))
		Franna	1	100	75%		
		Oxy-torch	1	107	100%		
Phase C1	Harpers Hill Lane upgrade	Excavator	1	104	50%	111	113
		Compactor	1	108	75%		
		Trucks	2	103	75%		
		Generators	1	95	100%		
		Small tools	1	94	100%		
		Concrete truck	1	106	75%		
		Light vehicles	1	98	75%		
Phase C2	Access road construction	Excavator	2	104	75%	111	113
		Compactor	1	108	75%		
		Trucks	2	103	75%		
		Generators	1	95	100%		
		Small tools	1	94	100%		
		Concrete truck	1	106	75%		
		Light vehicles	1	98	75%		
Phase D1	Mobilisation of temporary ancillary and laydown areas	Trucks	2	103	100%	107	107
		Small tools	1	94	100%		
		Light vehicles	1	98	75%		
		Generators	1	95	100%		
Phase D2	Site demobilisation and restoration	Trucks	2	103	100%	108	109
		Small tools	1	94	100%		
		Light vehicles	1	98	75%		

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Work phase	Works undertaken	Equipment used	Equipment quantity	Individual SWL (dB(A))	Usage factor (%)	Average Phase SWL LAeq,15min (dB(A))	Instantaneous Maximum Phase SWL LAMax (dB(A))
		Generators	1	95	100%		
		Excavator	1	104	50%		

** Equipment receives a 5 dB correction for annoying noise characteristics*

5.2.2 Construction traffic noise

The anticipated construction vehicle movements are expected to be significantly lower than existing traffic volumes on the main site access (New England Highway), therefore noise from construction vehicles would not increase road traffic noise levels by more than 2dB(A) on any road. Consequently, noise impact from construction traffic is expected to be negligible.

5.3 Operational emissions

The key noise source during the operation of the proposal was identified as the air compressor used in the bubble mixer within the reservoir. The noise associated with the compressor is displayed in **Table 5.3**.

It is noted that a proposal specific noise level for an air compressor was not available for assessment. Instead, a placeholder noise level for an air compressor has been adopted for assessment. For the most applicable placeholder, the noise levels adopted for assessment were based on air compressors used in water treatment processes. For a conservative assessment the modelling has been performed under the assumption that the air compressor will not be housed in an enclosure.

Table 5.3 Air compressor emissions (sound power levels), dB re 10⁻¹²W

Noise source	SWL (dB(A))	1/1 Octave spectra (dB(Z))								
		31.5Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Air compressor	86 dB(A)	68.4	75.2	81.1	81.6	82.2	81.0	79.8	73.0	66.1

5.4 Construction vibration emissions

From the plant and equipment expected to be used during the construction of the proposal, the equipment identified as producing a potential vibration impact have been identified. These items of equipment, along with their setback distances, have been displayed in **Table 5.4**.

Additionally, as one heritage site is located close to the proposal area, the setback distance for heritage structures for the small compactor has been calculated. The peak particle velocity criteria for heritage buildings is 2.5 mm/s. Using the FTA Guidance Manual for Transit Noise and Vibration Impact Assessment (2006) tool and the setback distance of 15 m below, the heritage setback distance for a small compactor was calculated to be 30 m. This is shown in **Table 5.4**.

Table 5.4 Construction vibration setback distances

Equipment	Work phase	Cosmetic damage (Ref: BS7385-2:1993)	Human response (Ref: DECC, 2006)	Heritage (Ref: DIN 4150)
Small compactor	Phase A1, Phase A1-C, Phase A2, Phase B2, Phase C1, Phase C2	5 m	15 m	30 m
Underboring equipment	Phase A2	2 m	4 m	-
Medium hydraulic hammer	Phase B2	7 m	23 m	-
Impact piling rig	Phase B3	22 m	73 m	-

5.5 Cumulative noise

The following websites were searched in October 2022 for recent or proposed developments that could interact with the proposal:

- NSW DPE Major Projects Register

Noise and Vibration Impact Assessment

- NSW Planning Portal
- Transport for NSW
- City of Maitland.

There are no proposed developments occurring within a 5 km vicinity of the site which are expected to contribute to cumulative noise impacts.

6. Impact assessment

6.1 Construction noise

6.1.1 Construction works

Construction noise levels have been developed based on the construction phases provided in **Table 5.2**.

The predicted noise levels represent worst-case $L_{Aeq(15\text{ minute})}$ noise levels in the hypothetical case when all noise sources are operating at the location in each work area closest to the receiver in question.

Consequently, these predictions represent a worst case $L_{Aeq(15\text{ minute})}$ noise scenario which in practice would be rare, but nevertheless is still valid for the purposes of assessing potential noise impacts.

Table 6.1 displays the highest noise levels predicted to occur as a result of the proposal. Generally, receivers in NCA02 and NCA03 which are located in close proximity to the proposed pipeline, road, reservoir laydown activities have been predicted to be impacted by the greatest noise levels. It should be noted that as the pipeline installation and road construction works will progressively move down the alignment as works progress, the time period in which a single receiver will be affected by noisy works in close proximity will generally be limited. In the case of the reservoir works, on the other hand, the nearby receivers may experience high noise levels for a comparatively longer period of time.

In NCA01, 1366 New England Highway is generally affected most frequently across most phases, while 1351 New England Highway is the most frequently affected receiver in NCA02. The most affected receiver in NCA03 varies based on construction phase, though 14 St Helena Close, 1 Terriere Drive, 37 Johannes Street and 14 Johannes Street are generally the most impacted.

Works Phase	Noise Catchment Area	Address	Predicted Noise Level ($L_{Aeq(15\text{min})}$) (dB(A))	Predicted Noise Level (L_{Amax}) (dB(A))	Noise Management Level (dB(A))											
					Standard Hours	Out of Hours Day	Out of Hours Evening	Out of Hours Night	Highly Noise Affected	Sleep Disturbance	Standard Hours	Out of Hours Day	Out of Hours Evening	Out of Hours Night	Highly Noise Affected	Sleep Disturbance
Stage A1	NCA 1	1158 New England Highway, Lochinvar NSW 2321	68	70	55	50	45	40	75	52	13	18	23	28	-	16
	NCA 2	25 Harpers Hill Lane, Harpers Hill NSW 2321	78	80	55	50	45	40	75	52	23	28	33	38	3	26
	NCA 3	14 St Helena Close, Lochinvar NSW 2321	96	98	55	50	45	40	75	52	41	46	51	56	21	44
Stage A1-C	NCA 1	1120 New England Highway, Lochinvar NSW 2321	56	59	55	50	45	40	75	52	1	6	11	16	-	4
	NCA 2	51 Station Lane, Lochinvar NSW 2321	52	55	55	50	45	40	75	52	-	2	7	12	-	-
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	88	91	55	50	45	40	75	52	33	38	43	48	13	36
Stage A2	NCA 1	1226 New England Highway, Oswald NSW 2321	54	57	55	50	45	40	75	52	-	4	9	14	-	2

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	NCA 2	25 Harpers Hill Lane, Harpers Hill NSW 2321	64	67	5 5	5 0	4 5	4 0	7 5	5 2	9	1 4	1 9	2 4	-	1 2
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	72	75	5 5	5 0	4 5	4 0	7 5	5 2	1 7	2 2	2 7	3 2	-	2 0
Sta ge B1	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	47	48	5 5	5 0	4 5	4 0	7 5	5 2	-	-	2	7	-	-
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	77	78	5 5	5 0	4 5	4 0	7 5	5 2	2 2	2 7	3 2	3 7	2	2 5
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	36	37	5 5	5 0	4 5	4 0	7 5	5 2	-	-	-	-	-	-
Sta ge B2	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	58	61	5 5	5 0	4 5	4 0	7 5	5 2	3	8	1 3	1 8	-	6
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	88	91	5 5	5 0	4 5	4 0	7 5	5 2	3 3	3 8	4 3	4 8	1 3	3 6
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	47	50	5 5	5 0	4 5	4 0	7 5	5 2	-	-	2	7	-	-
Sta ge B3	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	58	61	5 5	5 0	4 5	4 0	7 5	5 2	3	8	1 3	1 8	-	6
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	88	91	5 5	5 0	4 5	4 0	7 5	5 2	3 3	3 8	4 3	4 8	1 3	3 6
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	47	50	5 5	5 0	4 5	4 0	7 5	5 2	-	-	2	7	-	-
Sta ge B4	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	53	56	5 5	5 0	4 5	4 0	7 5	5 2	-	3	8	1 3	-	1
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	76	86	5 5	5 0	4 5	4 0	7 5	5 2	2 1	2 6	3 1	3 6	1	2 4
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	41	45	5 5	5 0	4 5	4 0	7 5	5 2	-	-	-	1	-	-
Sta ge C1	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	58	60	5 5	5 0	4 5	4 0	7 5	5 2	3	8	1 3	1 8	-	6
	NCA 2	1353 New England Highway, Harpers Hill NSW 2321	87	89	5 5	5 0	4 5	4 0	7 5	5 2	3 2	3 7	4 2	4 7	1 2	3 5
	NCA 3	14 Johannes Street, Lochinvar NSW 2321	36	38	5 5	5 0	4 5	4 0	7 5	5 2	-	-	-	-	-	-
Sta ge C2	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	54	55	5 5	5 0	4 5	4 0	7 5	5 2	-	4	9	1 4	-	2
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	79	80	5 5	5 0	4 5	4 0	7 5	5 2	2 4	2 9	3 4	3 9	4	2 7
	NCA 3	14 Johannes Street, Lochinvar NSW 2321	37	38	5 5	5 0	4 5	4 0	7 5	5 2	-	-	-	-	-	-

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Stage D1	NCA 1	1120 New England Highway, Lochinvar NSW 2321	55	55	5 5	5 0	4 5	4 0	7 5	5 2	-	5	1 0	1 5	-	3
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	75	75	5 5	5 0	4 5	4 0	7 5	5 2	2 0	2 5	3 0	3 5	-	2 3
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	78	78	5 5	5 0	4 5	4 0	7 5	5 2	2 3	2 8	3 3	3 8	3	2 6
Stage D2	NCA 1	1120 New England Highway, Lochinvar NSW 2321	56	57	5 5	5 0	4 5	4 0	7 5	5 2	1	6	1 1	1 6	-	4
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	76	77	5 5	5 0	4 5	4 0	7 5	5 2	2 1	2 6	3 1	3 6	1	2 4
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	79	80	5 5	5 0	4 5	4 0	7 5	5 2	2 4	2 9	3 4	3 9	4	2 7

Table 6.2 displays the predicted number of receivers which have been predicted to receive noise levels greater than the respective NMLs. As displayed in the table, phases A1, A1-C and A2, which are closest in proximity to NCA03, have been predicted to experience the greatest number of receivers experiencing noise above the respective NMLs, with up to 68 receivers in phase A1-C predicted to experience noise greater than the standard hours NMLs, increasing to 336 receivers during night hours. During phase A1, up to four receivers have been predicted to be 'Highly Noise Affected', while during Phase A1-C 165 receivers may experience sleep disturbance impacts if works were to be undertaken at night.

Impacts at non-residential receivers have also been predicted from the works, though to a limited extent. No non-residential receivers have been predicted to experience noise greater than the NMLs.

Maps displaying the spatial extend of construction noise have been provided in **Appendix A.1**.

Table 6.1 Highest predicted construction noise level at residential receiver (worst-case maximum $L_{Aeq(15\text{ min})}$, dB(A))

Works Phase	Noise Catchment Area	Address	Predicted Noise Level ($L_{Aeq,15\text{min}}$ dB(A))	Predicted Noise Level ($L_{A\text{Max}}$ dB(A))	Noise Management Level (dB(A))						dB(A) above NML					
					Standard Hours	Out of Hours Day	Out of Hours Evening	Out of Hours Night	Highly Noise Affected	Sleep Disturbance ($L_{A\text{Max}}$)	Standard Hours	Out of Hours Day	Out of Hours Evening	Out of Hours Night	Highly Noise Affected	Sleep Disturbance ($L_{A\text{Max}}$)
Stage A1	NCA 1	1158 New England Highway, Lochinvar NSW 2321	68	70	55	50	45	40	75	52	13	18	23	28	-	16
	NCA 2	25 Harpers Hill Lane, Harpers Hill NSW 2321	78	80	55	50	45	40	75	52	23	28	33	38	3	26
	NCA 3	14 St Helena Close, Lochinvar NSW 2321	96	98	55	50	45	40	75	52	41	46	51	56	21	44
Stage A1-C	NCA 1	1120 New England Highway, Lochinvar NSW 2321	56	59	55	50	45	40	75	52	1	6	11	16	-	4
	NCA 2	51 Station Lane, Lochinvar NSW 2321	52	55	55	50	45	40	75	52	-	2	7	12	-	-
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	88	91	55	50	45	40	75	52	33	38	43	48	13	36
Stage A2	NCA 1	1226 New England Highway, Oswald NSW 2321	54	57	55	50	45	40	75	52	-	4	9	14	-	2
	NCA 2	25 Harpers Hill Lane, Harpers Hill NSW 2321	64	67	55	50	45	40	75	52	9	14	19	24	-	12
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	72	75	55	50	45	40	75	52	17	22	27	32	-	20
Stage B1	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	47	48	55	50	45	40	75	52	-	-	2	7	-	-
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	77	78	55	50	45	40	75	52	22	27	32	37	2	25
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	36	37	55	50	45	40	75	52	-	-	-	-	-	-
Stage B2	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	58	61	55	50	45	40	75	52	3	8	13	18	-	6
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	88	91	55	50	45	40	75	52	33	38	43	48	13	36
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	47	50	55	50	45	40	75	52	-	-	2	7	-	-
Stage B3	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	58	61	55	50	45	40	75	52	3	8	13	18	-	6
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	88	91	55	50	45	40	75	52	33	38	43	48	13	36
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	47	50	55	50	45	40	75	52	-	-	2	7	-	-
Stage B4	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	53	56	55	50	45	40	75	52	-	3	8	13	-	1
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	76	86	55	50	45	40	75	52	21	26	31	36	1	24
	NCA 3	37 Johannes Street, Lochinvar NSW 2321	41	45	55	50	45	40	75	52	-	-	-	1	-	-
Stage C1	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	58	60	55	50	45	40	75	52	3	8	13	18	-	6
	NCA 2	1353 New England Highway, Harpers Hill NSW 2321	87	89	55	50	45	40	75	52	32	37	42	47	12	35
	NCA 3	14 Johannes Street, Lochinvar NSW 2321	36	38	55	50	45	40	75	52	-	-	-	-	-	-
Stage C2	NCA 1	1366 New England Highway, Harpers Hill NSW 2321	54	55	55	50	45	40	75	52	-	4	9	14	-	2
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	79	80	55	50	45	40	75	52	24	29	34	39	4	27
	NCA 3	14 Johannes Street, Lochinvar NSW 2321	37	38	55	50	45	40	75	52	-	-	-	-	-	-
Stage D1	NCA 1	1120 New England Highway, Lochinvar NSW 2321	55	55	55	50	45	40	75	52	-	5	10	15	-	3
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	75	75	55	50	45	40	75	52	20	25	30	35	-	23
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	78	78	55	50	45	40	75	52	23	28	33	38	3	26
Stage D2	NCA 1	1120 New England Highway, Lochinvar NSW 2321	56	57	55	50	45	40	75	52	1	6	11	16	-	4
	NCA 2	1351B New England Highway, Harpers Hill NSW 2321	76	77	55	50	45	40	75	52	21	26	31	36	1	24
	NCA 3	1 Terriere Drive, Lochinvar NSW 2321	79	80	55	50	45	40	75	52	24	29	34	39	4	27

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Table 6.2 Count of residential receivers where predicted construction noise levels are greater than NMLs

Works phase	Noise Catchment Area	Count of receivers where noise is...											
		Standard hours		Out of hours day		Out of hours evening		Out of hours night		Highly noise affected		Sleep Disturbance	
		Lower than NML	Greater than NML	Lower than NML	Greater than NML	Lower than NML	Greater than NML	Lower than NML	Greater than NML	Lower than HNA	Greater than HNA	Lower than SDSC	Greater than SDSC
Stage A1	NCA 1	68	8	62	14	53	23	31	45	76	0	62	14
	NCA 2	56	3	56	3	53	6	34	25	58	1	56	3
	NCA 3	317	59	249	127	187	189	66	310	372	4	249	127
Stage A1-C	NCA 1	75	1	73	3	68	8	37	39	76	0	73	3
	NCA 2	59	0	58	1	57	2	54	5	59	0	58	1
	NCA 3	308	68	230	146	94	282	40	336	374	2	211	165
Stage A2	NCA 1	76	0	71	5	65	11	55	21	76	0	71	5
	NCA 2	58	1	58	1	58	1	55	4	59	0	58	1
	NCA 3	365	11	333	43	280	96	167	209	376	0	324	52
Stage B1	NCA 1	76	0	76	0	75	1	65	11	76	0	76	0
	NCA 2	57	2	57	2	57	2	44	15	57	2	57	2
	NCA 3	376	0	376	0	376	0	376	0	376	0	376	0
Stage B2	NCA 1	75	1	59	17	28	48	16	60	76	0	51	25
	NCA 2	56	3	44	15	33	26	24	35	57	2	42	17
	NCA 3	376	0	376	0	367	9	243	133	376	0	376	0
Stage B3	NCA 1	75	1	59	17	28	48	16	60	76	0	51	25
	NCA 2	56	3	44	15	33	26	24	35	57	2	42	17
	NCA 3	376	0	376	0	367	9	243	133	376	0	376	0
Stage B4	NCA 1	76	0	75	1	72	4	57	19	76	0	72	4
	NCA 2	57	2	57	2	48	11	34	25	57	2	55	4
	NCA 3	376	0	376	0	376	0	373	3	376	0	376	0
Stage C1	NCA 1	73	3	73	3	67	9	48	28	76	0	73	3
	NCA 2	56	3	56	3	47	12	45	14	58	1	56	3
	NCA 3	376	0	376	0	376	0	376	0	376	0	376	0
Stage C2	NCA 1	76	0	74	2	63	13	47	29	76	0	75	1
	NCA 2	54	5	54	5	50	9	43	16	57	2	54	5
	NCA 3	376	0	376	0	376	0	376	0	376	0	376	0
Stage D1	NCA 1	76	0	75	1	65	11	54	22	76	0	75	1
	NCA 2	56	3	56	3	56	3	56	3	59	0	56	3
	NCA 3	364	12	351	25	307	69	237	139	375	1	358	18
Stage D2	NCA 1	75	1	75	1	64	12	51	25	76	0	75	1
	NCA 2	56	3	56	3	56	3	52	7	58	1	56	3
	NCA 3	362	14	346	30	290	86	220	156	375	1	351	25

Table 6.3 Count of non-residential receivers where predicted construction noise levels are greater than NMLs

Works phase	Noise Catchment Area	Type of receiver	Number of receivers predicted to receive noise levels compliant with the receiver noise level	Number of receivers predicted to receive noise levels exceeding the receiver noise level
Stage A1	NCA 2	Commercial	2	0
		Commercial	7	0
	NCA 3	Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
		Place of worship	2	0
Stage A1	NCA 2	Commercial	2	0
		Commercial	7	0
	NCA 3	Industrial	0	1
		Hotel	2	0
		Recreation	0	0
		Education	38	0
		Place of worship	2	0
Stage A2	NCA 2	Commercial	2	0
		Commercial	7	0
	NCA 3	Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
		Place of worship	2	0
Stage B1	NCA 2	Commercial	2	0
		Commercial	7	0
	NCA 3	Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
		Place of worship	2	0
Stage B2	NCA 2	Commercial	2	0
		Commercial	7	0
	NCA 3	Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
		Place of worship	2	0
NCA 2	Commercial	2	0	

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Stage B3	NCA 3	Commercial	7	0
		Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
		Place of worship	2	0
Stage B4	NCA 2	Commercial	2	0
	NCA 3	Commercial	5	2
		Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
Place of worship	2	0		
Stage C1	NCA 2	Commercial	2	0
	NCA 3	Commercial	7	0
		Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
Place of worship	2	0		
Stage C2	NCA 2	Commercial	2	0
	NCA 3	Commercial	7	0
		Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
Place of worship	2	0		
Stage D1	NCA 2	Commercial	2	0
	NCA 3	Commercial	7	0
		Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
Place of worship	2	0		
Stage C2	NCA 2	Commercial	2	0
	NCA 3	Commercial	7	0
		Industrial	0	0
		Hotel	2	0
		Recreation	1	0
		Education	38	0
Place of worship	2	0		

NCA 1 contains no non-residential receivers and as such has not been included in **Table 6.3**.

6.1.2 Construction traffic noise

The anticipated construction vehicle movements are expected to be significantly lower than existing traffic volumes on the main access route, New England Highway. Therefore, noise from construction vehicles would not increase road traffic noise levels by more than 2 dB(A) on any road. Consequently, noise impact from construction traffic is expected to be negligible.

6.2 Operational noise

6.2.1 Comparison of predicted noise levels against criteria

Noise was assessed from the air compressor at all nearby noise sensitive receivers. As the noise source would operate 24 hours per day, the noise has been assessed against the most sensitive time period (night).

The noise modelling indicates that the predicted noise levels from the air compressor would comply with the relevant noise criteria at all adjacent noise sensitive receivers. For reference, noise level measurements at the three nearest noise sensitive receivers have been displayed in **Table 6.4**.

A map displaying the spatial extent of the proposal's operational noise levels is provided in **Section A.2**.

Table 6.4 Predicted noise levels at nearest noise sensitive receivers

Receiver	Time period	Proposal noise trigger level $L_{Aeq(15\text{ min})}$ (dB(A))	Predicted noise level $L_{Aeq(15\text{ min})}$ (dB(A))	Compliance?
39 Oswald Road, Oswald NSW 2321	Day	48	8	Yes
	Evening	43		Yes
	Night	38		Yes
1351A New England Highway, Harpers Hill NSW 2321	Day	40	37	Yes
	Evening	35		Yes
	Night	35		Yes
1351B New England Highway, Harpers Hill NSW 2321	Day	40	38	Yes
	Evening	35		Yes
	Night	35		Yes

6.2.2 Tonality and low frequency noise

As per **Section 4.2.5**, industrial noise can feature tones and low frequency noise, which can be more annoying or impactful to the amenity of an area than regular industrial noise.

6.2.2.1 Tonality

As per **Section 4.2.5**, where a tonal noise is predicted to be generated from a noise source, a one-third octave analysis should be performed using the methodology detailed in *ISO 1996-2:2007 Annex D: Objective Method for Assessing the Audibility of Tones in Noise*. Where the level of one-third octave band exceeds the level of the adjacent bands on both sides by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

Then a correction of 5 dB should be applied to the noise source.

1/3 Octave band sound pressure levels have been predicted at the ground floors of the three nearest receivers and assessed against the above criteria. This is displayed in **Table 6.5**. As displayed in the table, none of the nearest receivers have been predicted to experience any tonal impacts which would require a tonal noise penalty.

Table 6.5 Air Compressor tonal noise assessment

Receiver	Measurement	1/3 Octave band frequencies (dB(Z))																										
		25Hz	31.5Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	40Hz	500Hz	640Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	6.3kHz	8kHz	10kHz
39 Oswald Road, Oswald NSW 2321	Predicted SPL	6.5	1.2	-3.6	10.6	6.6	2.9	10.4	7.4	4.7	5	2.7	0.7	1.8	0.2	-1.1	-0.3	-1.1	-1.7	-3.7	-3.9	-4	-12.6	-12.4	-12	-29.8	-28.8	-27.4
	Level above left neighbour	-	-5.3	-4.8	14.2	-4	-3.7	7.5	-3	-2.7	0.3	-2.3	-2	1.1	-1.6	-1.3	0.8	-0.8	-0.6	-2	-0.2	-0.1	-8.6	0.2	0.4	-17.8	1	1.4
	Level above right neighbour	5.3	4.8	-14	4	3.7	-7.5	3	2.7	-0.3	2.3	2	-1.1	1.6	1.3	-0.8	0.8	0.6	2	0.2	0.1	8.6	-0.2	-0.4	17.8	-1	-1.4	-27.4
	Penalty Triggered?	N/A	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
1351A New England Highway, Harpers Hill NSW 2321	Predicted SPL	22.1	16.8	12	27.6	23.6	19.9	33.3	30.3	27.6	30.5	28.2	26.2	26.7	25.1	23.8	27.4	26.6	26	28	27.8	27.7	20.5	20.7	21.1	10	11	12.4
	Level above left neighbour	-	-5.3	-4.8	15.6	-4	-3.7	13.4	-3	-2.7	2.9	-2.3	-2	0.5	-1.6	-1.3	3.6	-0.8	-0.6	2	-0.2	-0.1	-7.2	0.2	0.4	-11.1	1	1.4
	Level above right neighbour	5.3	4.8	-16	4	3.7	-13	3	2.7	-2.9	2.3	2	-0.5	1.6	1.3	-3.6	0.8	0.6	-2	0.2	0.1	7.2	-0.2	-0.4	11.1	-1	-1.4	12.4
	Penalty Triggered?	N/A	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
1351B New England Highway, Harpers Hill NSW 2321	Predicted SPL	22.3	17	12.2	27.8	23.8	20.1	33.2	30.2	27.5	31.5	29.2	27.2	29.3	27.7	26.4	28.7	27.9	27.3	29	28.8	28.7	20.5	20.7	21.1	10	11	12.4
	Level above left neighbour	-	-5.3	-4.8	15.6	-4	-3.7	13.1	-3	-2.7	4	-2.3	-2	2.1	-1.6	-1.3	2.3	-0.8	-0.6	1.7	-0.2	-0.1	-8.2	0.2	0.4	-11.1	1	1.4
	Level above right neighbour	5.3	4.8	-16	4	3.7	-13	3	2.7	-4	2.3	2	-2.1	1.6	1.3	-2.3	0.8	0.6	-1.7	0.2	0.1	8.2	-0.2	-0.4	11.1	-1	-1.4	12.4
	Penalty Triggered?	N/A	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

6.2.2.2 Low frequency noise

As per **Section 4.2.5**, low frequency noise is accounted for using a two-step assessment of the A-weighted and C-weighted noise levels. A correction for low frequency noise will be applied where:

- 1) The C-weighted noise contribution is 15 dB greater than the A-weighted noise source contribution at a noise receiver, **AND**
- 2) Any of the third octave noise levels presented in Table C2 of Fact Sheet C are exceeded at the noise receiver.

Where the exceedance of the third octave noise levels is less than or equal to 5 dB, a correction of 2 dB is applied during the evening and night periods, and where the exceedance of the third octave noise levels is greater than 5 dB, a correction of 5 dB is applied during the evening and night periods.

The comparison between the predicted dB(A) and dB(C) noise levels are detailed in **Table 6.6**. As displayed in the table, at the ground floor of the nearest three receivers, the C-weighted noise level is not greater than the A-weighted noise level by more than 15 dB. As such, low frequency is not deemed to be a concern and further assessment is not required.

Table 6.6 A-weighted and C-weighted noise level comparison

Noise sensitive receiver	Difference between C and A weighted predicted noise levels $L_{eq,15min}$ dB		
	A-weighted noise level	C-weighted noise level	Requires assessment at the octave band level to determine the level of adjustment due to LFN?
39 Oswald Road, Oswald NSW 2321	8.4	16.2	No
1351A New England Highway, Harpers Hill NSW 2321	37.0	40.0	No
1351B New England Highway, Harpers Hill NSW 2321	38.2	40.9	No

6.3 Construction vibration

As identified in **Table 5.4**, some items of plant that are expected to be used in construction (i.e.; the compactor, underboring equipment, hydraulic rock hammer and impact piling rig) are considered to be vibration-generating. The recommended setback distances for these plant items and the number of vibration-sensitive receivers that fall within those setback distances are shown in **Table 6.7**, with maps displaying the spatial extent of the vibration setbacks provided in **Appendix B**. As shown in the table, some receivers, specifically those along the pipeline installation, road upgrades and reservoir construction may fall within both the human comfort and cosmetic damage setback distances. As such, measures to manage vibration impacts have been provided in **Section 7.1.2** and should be applied where reasonable and feasible.

As stated in **Section 3.2.2**, one heritage building is located approximately 45 m from the compaction works. As shown in **Table 5.4**, the heritage setback distance for a small compactor is 30 m. As the building is 45 m away, no impact is expected. As a precaution, the vibration measures provided in **Section 7.1.2** can be applied to the heritage site where reasonable and feasible.

Table 6.7 Construction vibration impact assessment results

Equipment	Setback distance (m)		Number of impacted receivers within setback distance			
	Human comfort	Cosmetic building damage	Human comfort		Cosmetic building damage	
			Residential Receiver	Non-Residential Receiver	Residential Receiver	Non-Residential Receiver
Small compactor	15 m	5 m	4	1	3	0
Underboring equipment	4 m	2 m	0	0	0	0
Medium hydraulic hammer	7 m	23 m	0	0	0	0
Impact piling rig	22 m	73 m	2	0	2	0

7. Mitigation and management

7.1 Construction

7.1.1 Noise

A number of construction noise impacts have been predicted at the nearest residential receivers, in worst cases up to 30 dB(A) greater than the standard hours NMLs. Mitigation measures adopted from the CNVG to address these impacts and assure that construction noise levels remain below relevant criterion have been provided in **Table 7.1** and should be applied where reasonable and feasible.

Table 7.1 Noise mitigation measures during construction

Reference	Mitigation measure	Timing
NVIA1	Wherever possible and safe, limit works, particularly activities such as jet blasting and concrete cutting, to standard hours of construction.	During construction
NVIA2	Where noisy activities cannot be scheduled to standard construction hours, noisy activities should be scheduled to take place earlier in the night, during less sensitive time periods.	During construction
NVIA3	Notification within seven days prior to works detailing proposed dates, alternative dates for wet weather and hourly activity plan for night works.	Prior to and during construction
NVIA4	Select low-noise plant and equipment. Ensure equipment mufflers operate in a proper and efficient manner.	Prior to and during construction
NVIA5	Where possible, use quieter and less vibration emitting construction methods.	During construction
NVIA6	Only have necessary equipment on-site and turn off when not in use.	During construction
NVIA7	Where possible, concentrate noisy activities at one location and move to another as quickly as possible.	During construction
NVIA8	Vehicle movements, including deliveries outside standard hours, should be minimised and avoided where possible.	During construction
NVIA9	All plant and equipment is to be well maintained and where possible, fitted with silencing devices.	Prior to and during construction
NVIA10	Use only the necessary size and powered equipment for tasks.	During construction
NVIA11	Implement training to induct staff on noise sensitivities.	Prior to and during construction
NVIA12	Where possible, consider the application of less intrusive alternatives to reverse beepers such as 'squawker' or 'broadband' alarms.	During construction
NVIA13	Consider the installation of temporary construction noise barriers for concentrated, noise-intensive activities.	During construction
NVIA14	Where practicable, install enclosures around noisy mobile and stationary equipment as necessary.	During construction
NVIA15	Where possible, avoid simultaneous operation of two or more noisy plant close to receivers. The offset distance between noisy plant and sensitive receivers should be maximised.	During construction

Reference	Mitigation measure	Timing
NVIA16	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements.	Prior to and during construction
NVIA17	Complete routine monitoring to evaluate construction noise levels and evaluate whether the mitigation measures in place are adequate or require revision.	During construction

7.1.2 Vibration

Vibration impacts have been predicted to result from the use of a compactor. As such, mitigation measures should be adopted to address these impacts.

Assessing Vibration: a technical guideline, (DECC, 2006) provides general guidance for limiting vibration impacts during construction. These measures could be adopted where reasonable and feasible to further control vibration impacts. These are displayed in **Table 7.2**.

Table 7.2 Vibration mitigation measures during construction

Reference	Mitigation measure	Timing
NVIA16	Choosing alternative, lower-impact equipment or methods wherever possible.	Prior to and during construction
NVIA17	Scheduling the use of vibration-causing equipment at the least sensitive times of the day (wherever possible).	Prior to and during construction
NVIA18	Locating high vibration sources as far away from sensitive receiver areas as possible.	During construction
NVIA19	Sequencing operations so that vibration-causing activities do not occur simultaneously.	During construction
NVIA20	Keeping equipment well maintained.	During construction
NVIA21	Do not conduct vibration intensive works within the recommended safe setback distances.	During construction
NVIA22	Informing nearby receivers about the nature of construction phases and the vibration-generating activities.	Prior to and during construction
NVIA23	Where required attended vibration measurements should be undertaken at the commencement of vibration generating activities to confirm that vibration levels are within the acceptable range to prevent cosmetic and heritage building damage.	Prior to and during construction
NVIA24	Pre-construction surveys of the structural integrity of vibration sensitive buildings may be warranted maintaining the setback distances cannot be achieved.	Prior to and during construction

7.2 Operational noise mitigation

As displayed in **Section 6.2**, the operational noise impacts from the air compressor have not been predicted to result in noise impacts greater than the proposal noise trigger levels at any of the nearby receivers during the most noise sensitive time periods. It is also noted that the air compressor will be located within an enclosure which would further reduce operational noise. However, to assure that noise impacts would not occur from the air compressor, it should be confirmed with the supplier that the compressor and enclosure will perform to the noise levels presented in **Table 5.3** or better.

Table 7.3 Noise mitigation measures for the air compressor

Reference	Mitigation measure	Timing
NVIA25	Seek from the supplier demonstrated evidence that the selected air compressor and enclosure can perform to an external maximum Sound Power Level of 86 dB(A) at all times, factoring in potential noise variation as a result of operational variations. Also seek evidence that the selected air compressor does not exhibit noise-enhancing effects (i.e. tonality or low frequency noise penalties).	Design phase

8. Conclusion and considerations

A noise and vibration impact assessment has been undertaken for the proposal in accordance with the NSW ICNG, the NPI and other relevant policies and guidelines.

8.1 Construction

It was found that the construction works required by the proposal would lead to construction noise impacts. Noise levels of up to 30dB(A) greater than the standard hours NMLs have been predicted at the nearest residential receivers. Generally, the pipeline works have been predicted to result in the highest number of impacts, primarily as a result of the proximity of these works to the receivers in Lochinvar.

The pipeline works (Phase A1 and Phase A1-C) have been predicted to result in the highest noise levels at a residential receiver, primarily as a result of the proximity of these works to the worst affected receivers. During standard hours, phase A1-C has been predicted to result in up to 68 residential receivers in NCA03. During night hours this has been predicted to increase to 336 residential receivers in NCA03. Additionally, up to four receivers in NCA03 have been predicted to become 'highly noise affected' during phase A1.

Construction vibration was predicted to occur at a limited number of receivers along the pipeline works alignment as well as the road upgrade works. Due to this vibration should be managed to prevent any damage to the structure.

Construction vehicle movements are expected to be significantly lower than existing traffic volumes on the main site access (New England Highway), as such, noise impacts from construction traffic are expected to be negligible.

To manage construction noise levels, works should be done during standard hours where possible, use quieter and less vibration emitting construction methods and equipment and consider the installation of temporary construction noise barriers for concentrated noise intensive activities. Similarly, to manage vibration, alternative, lower impact equipment or methods should be chosen wherever possible, sequencing operations so vibration-causing activities do not occur simultaneously and informing nearby receivers about the nature of construction phases and the vibration-generating activities. Further measures, which are equally important, to mitigate both noise and vibration are outlined in **Section 7.1**.

8.2 Operation

It was determined that noise produced by the air compressor associated with the reservoir will not produce operational noise levels greater than the noise limits defined by the NPI, nor will the proposal pose any tonal or low frequency noise risks. It is also noted that the air compressor will be located within an enclosure which would further reduce operational noise.

As such, Jacobs recommends that when the final air compressor model is selected, the external noise performance of the unit and enclosure should be verified and confirmed by the supplier to be able to perform to the noise levels of the air compressor presented in this report or better. Likewise, the supplier should also demonstrate that the unit can achieve the noise limit without producing tonal and low frequency noise impacts.

9. References

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Appendix A. Noise contour maps

A.1 Construction noise maps

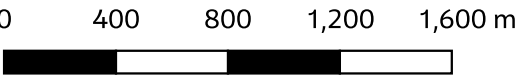
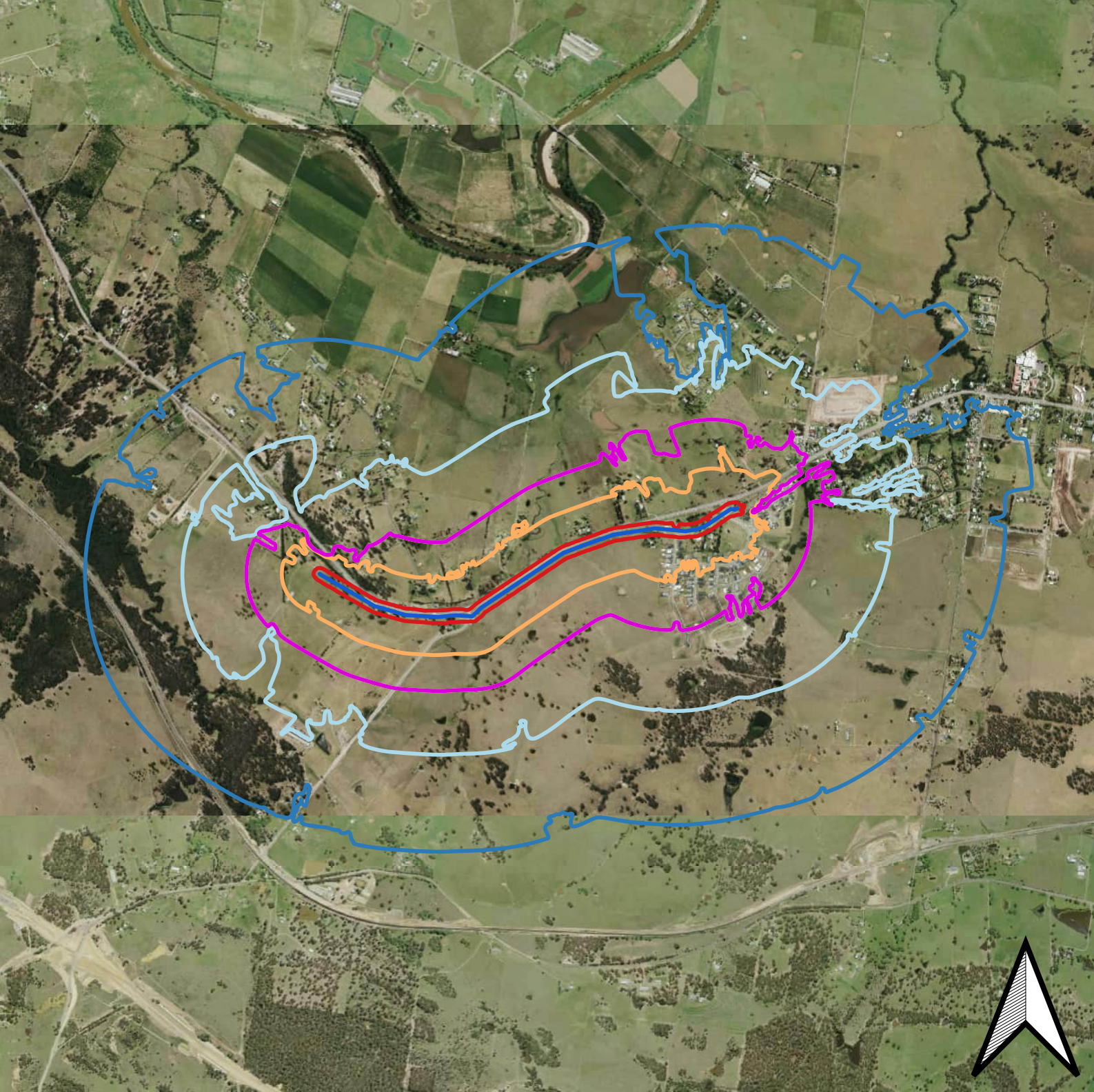









Figure A.1.1: Phase A1 Predicted Noise Impact, dB(A)

Legend

- | | |
|--|--|
|  Phase A1 Construction Works |  40 dB(A) |
|  Phase A1 LAMax - 52 dB(A) |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

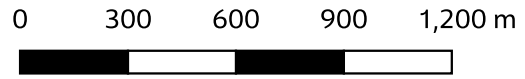
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 Scale: 1:27000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 03/11/2022












Figure A.1.2: Phase A1-C Predicted Noise Impact, dB(A)



Legend

- | | |
|---|--|
|  Phase A1-C Construction Works |  40 dB(A) |
|  Phase A1-C LAMax - 52 dB(A) |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:21000
 Noise Contours Predicted at 1.5m

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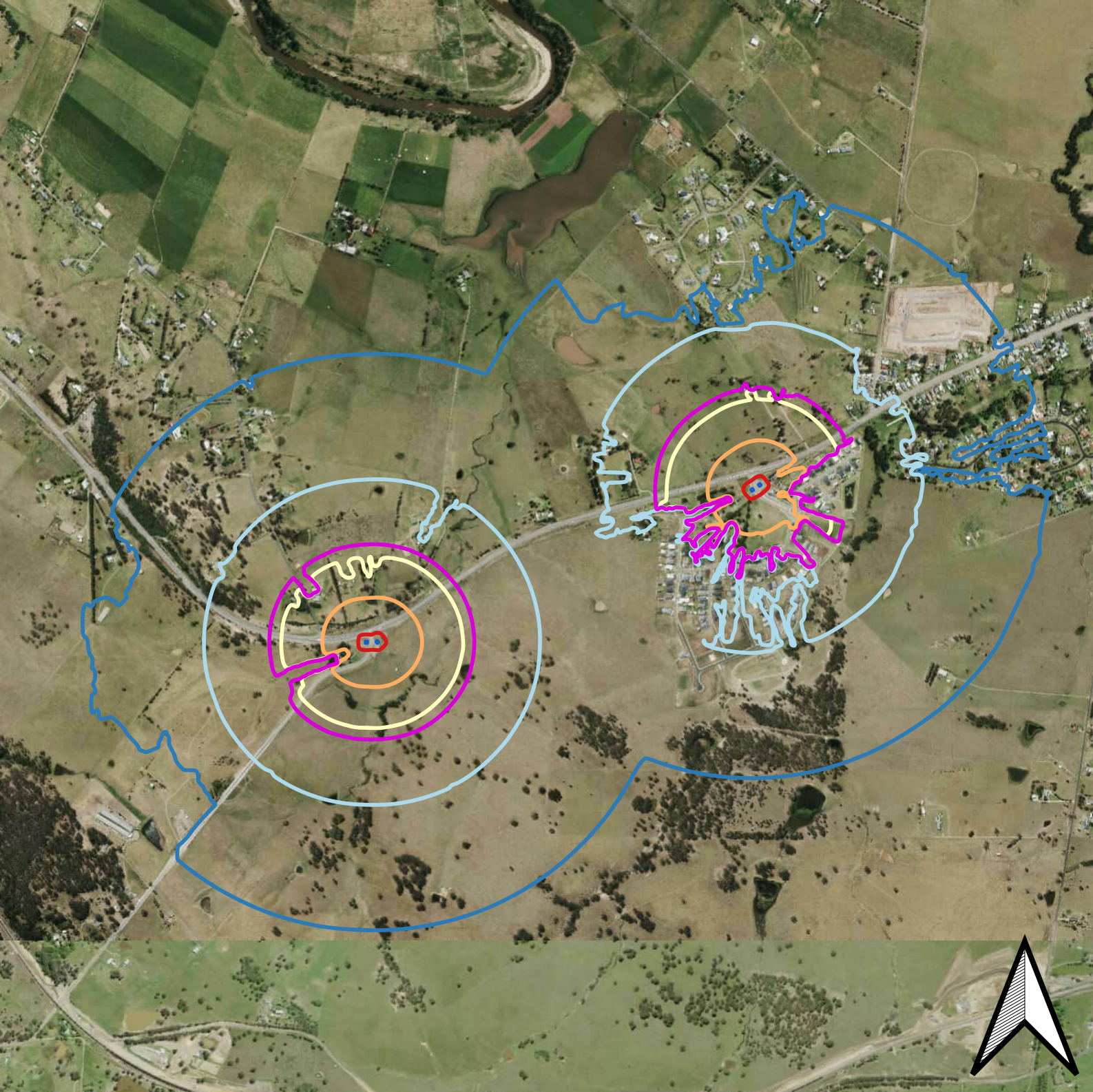
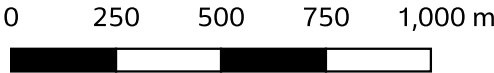


Figure A.1.3: Phase A2 Predicted Noise Impact, dB(A)



Legend

- | | |
|-----------------------------|---|
| Phase A2 Construction Works | Phase A2 Predicted Noise Levels (LAeq) 40 dB(A) |
| Phase A2 LAMax - 52 dB(A) | 45 dB(A) |
| | 50 dB(A) |
| | 55 dB(A) |
| | 75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:18000
 Noise Contours Predicted at 1.5m

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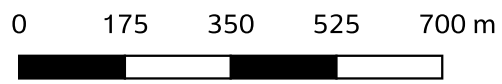
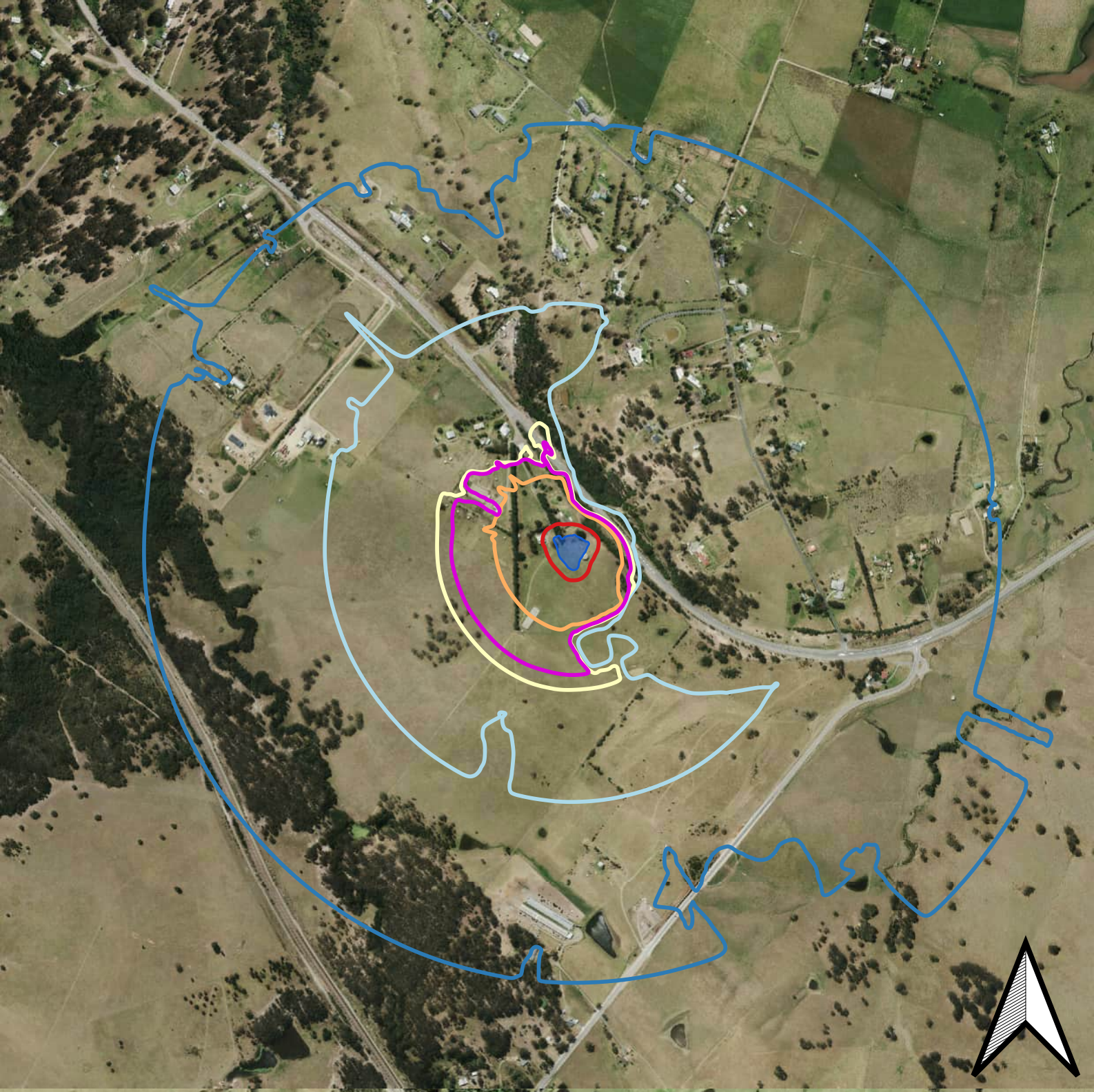









Figure A.1.4: Phase B1 Predicted Noise Impact, dB(A)

Legend

- | | |
|--|--|
|  Phase B1 Construction Works |  40 dB(A) |
|  Phase B1 L _{Amax} - 52 dB(A) |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:12500
 Noise Contours Predicted at 1.5m

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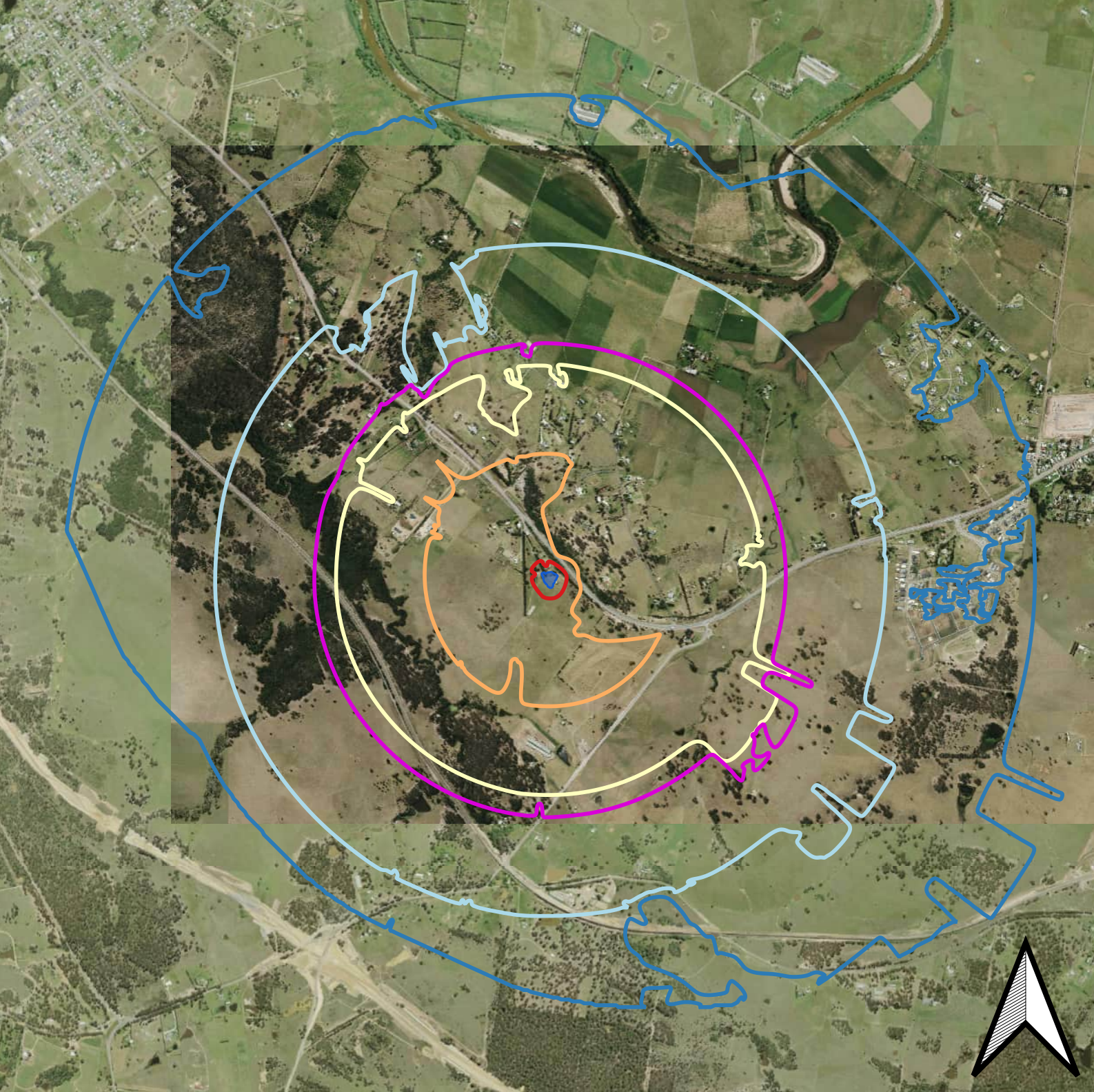
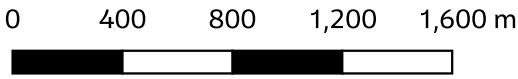









Figure A.1.5: Phase B2 Predicted Noise Impact, dB(A)



Legend

- | | |
|---|--|
|  Phase B2 Construction Works |  40 dB(A) |
|  Phase B2 LAmax - 52 dB(A) |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:27500
 Noise Contours Predicted at 1.5m

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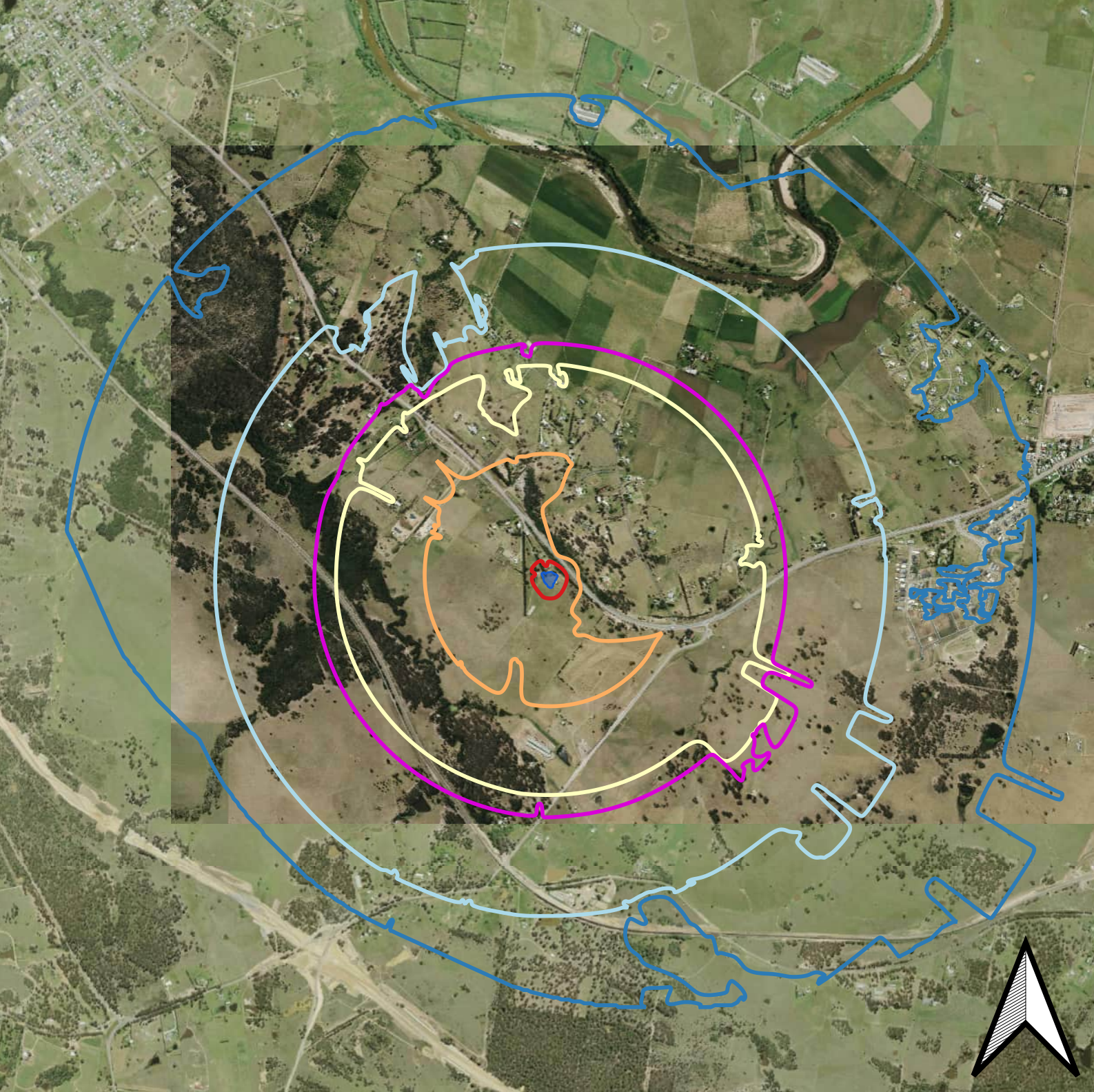
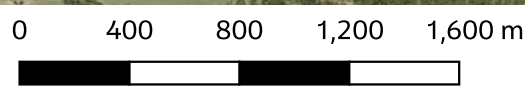









Figure A.1.6: Phase B3 Predicted Noise Impact, dB(A)



Legend

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|  Phase B3 Construction Works |  40 dB(A) |
|  Phase B3 LAmass - 52 dB(A) |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:27500
 Noise Contours Predicted at 1.5m

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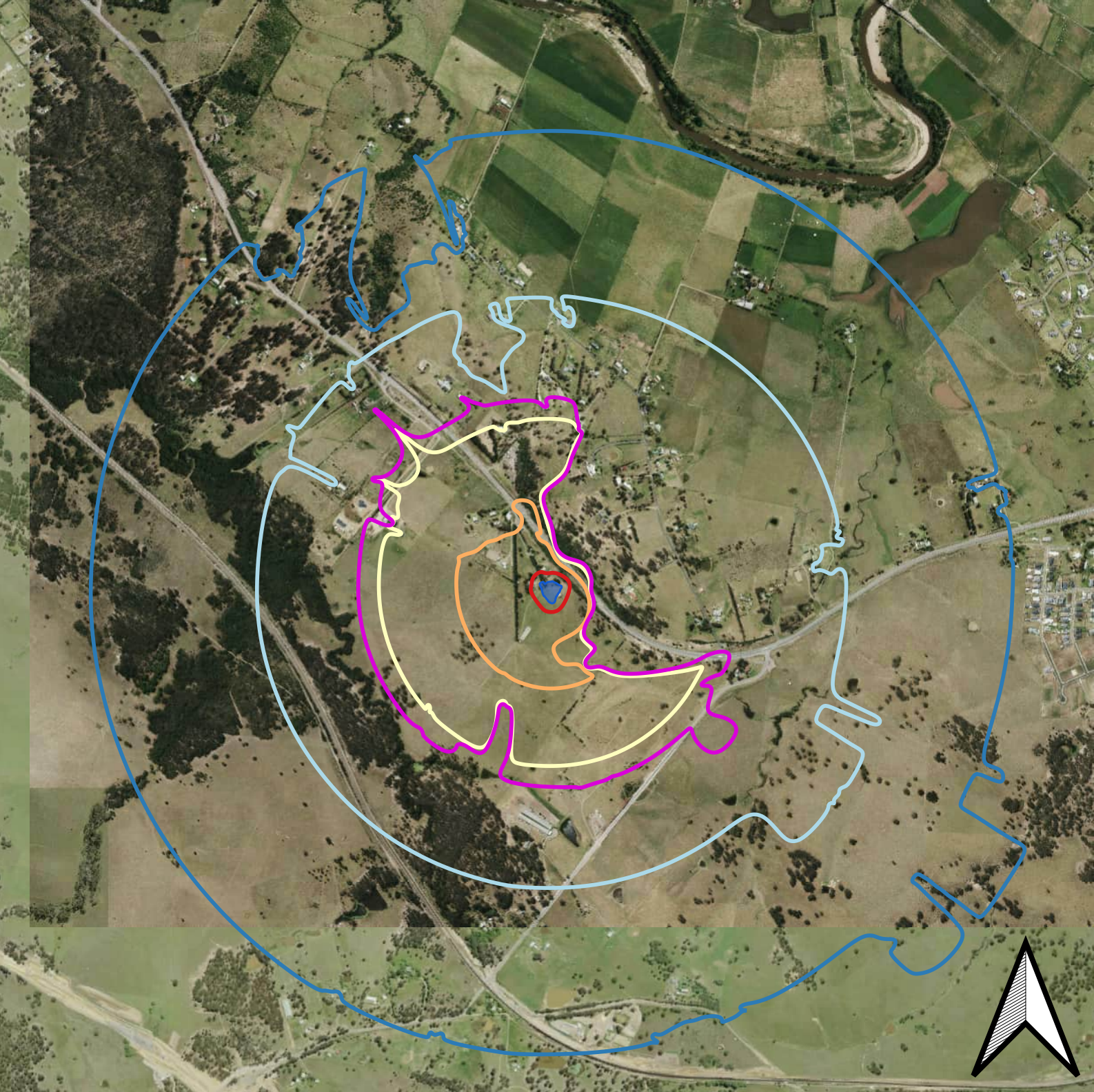
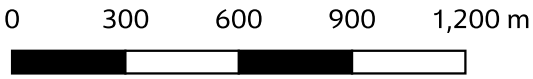


Figure A.1.7: Phase B4 Predicted Noise Impact, dB(A)



Legend

- | | |
|---------------------------------------|--|
| Phase B4 Construction Works | Phase B4 Predicted Noise Levels (LAeq) |
| Phase B4 L _{Amax} - 52 dB(A) | 40 dB(A) |
| | 45 dB(A) |
| | 50 dB(A) |
| | 55 dB(A) |
| | 75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:20000
 Noise Contours Predicted at 1.5m

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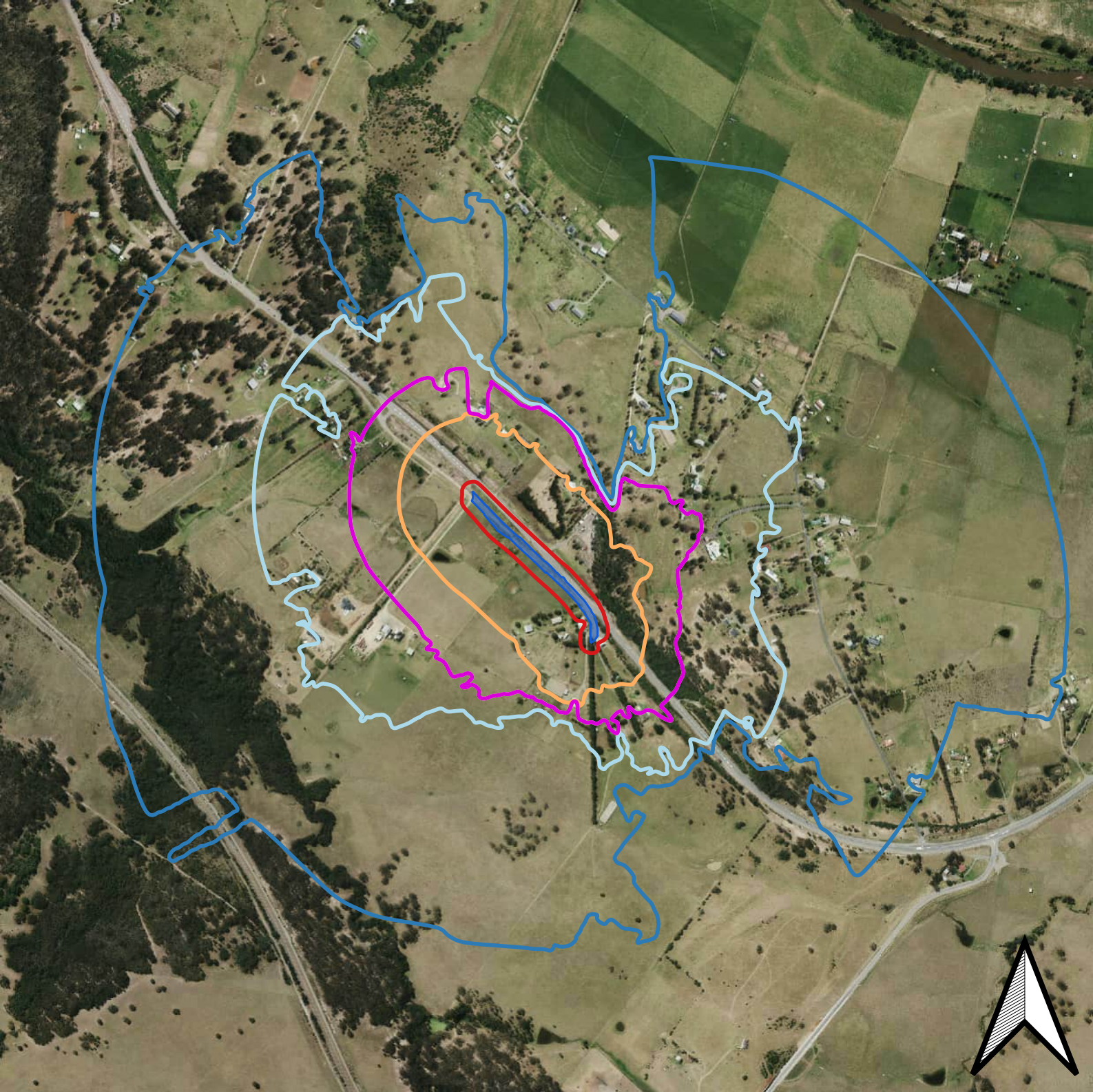
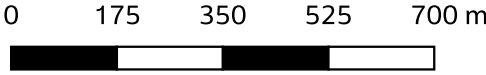


Figure A.1.8: Phase C1 Predicted Noise Impact, dB(A)



Legend

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|----------------------------|--|
| Phase C1 Construction Work | Phase C1 Predicted Noise Levels (LAeq) |
| Phase C1 LAMax - 52 dB(A) | 40 dB(A) |
| | 45 dB(A) |
| | 50 dB(A) |
| | 55 dB(A) |
| | 75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:12500
 Noise Contours Predicted at 1.5m

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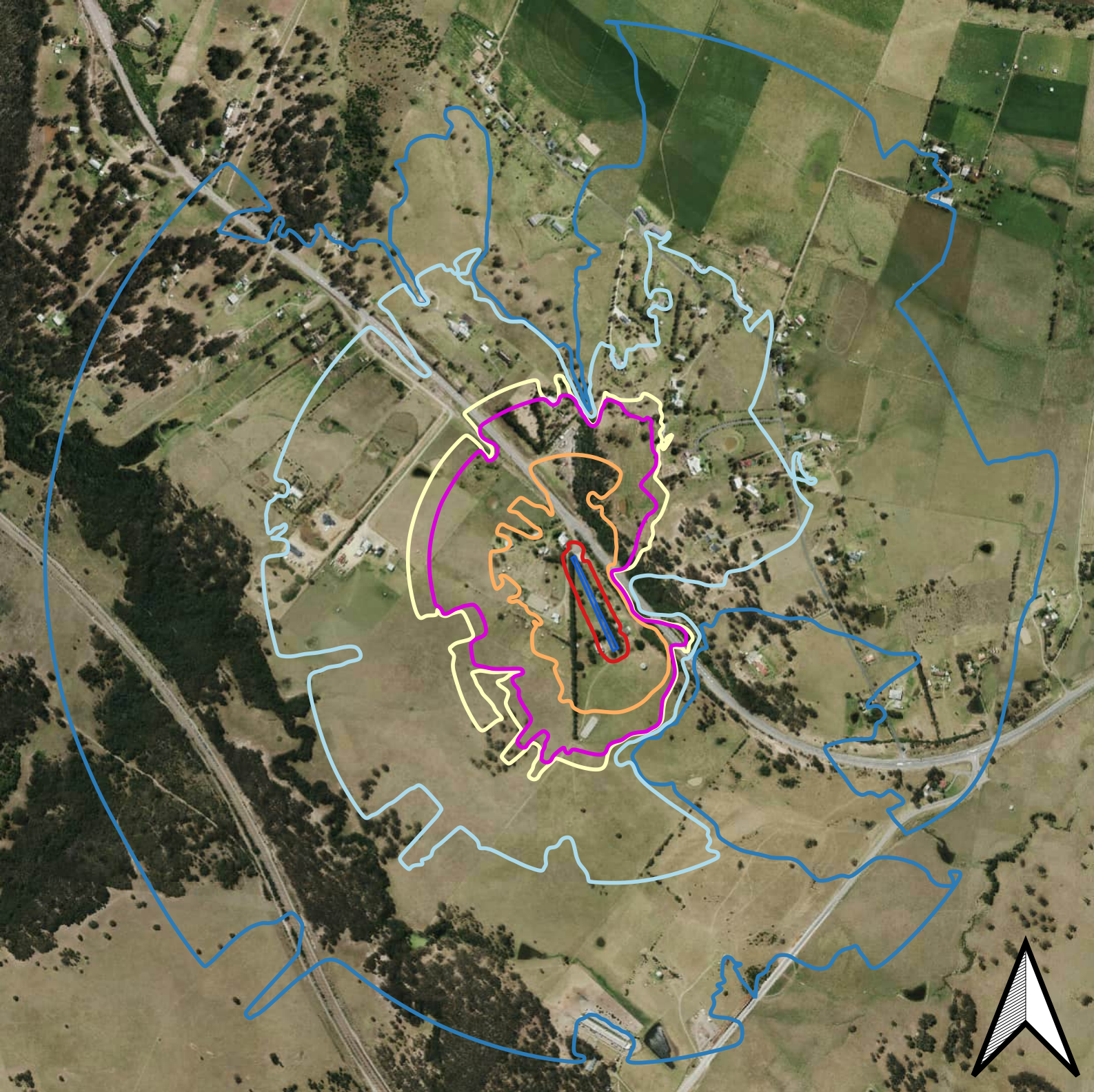
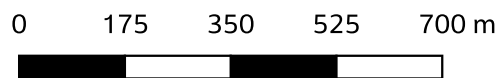









Figure A.1.9: Phase C2 Predicted Noise Impact, dB(A)



Legend

- | | |
|---|--|
|  Phase C2 Construction Work | Phase C2 Predicted Noise Levels (LAeq) |
|  Phase C1 LAMax - 52 dB(A) |  40 dB(A) |
| |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:12500
 Noise Contours Predicted at 1.5m

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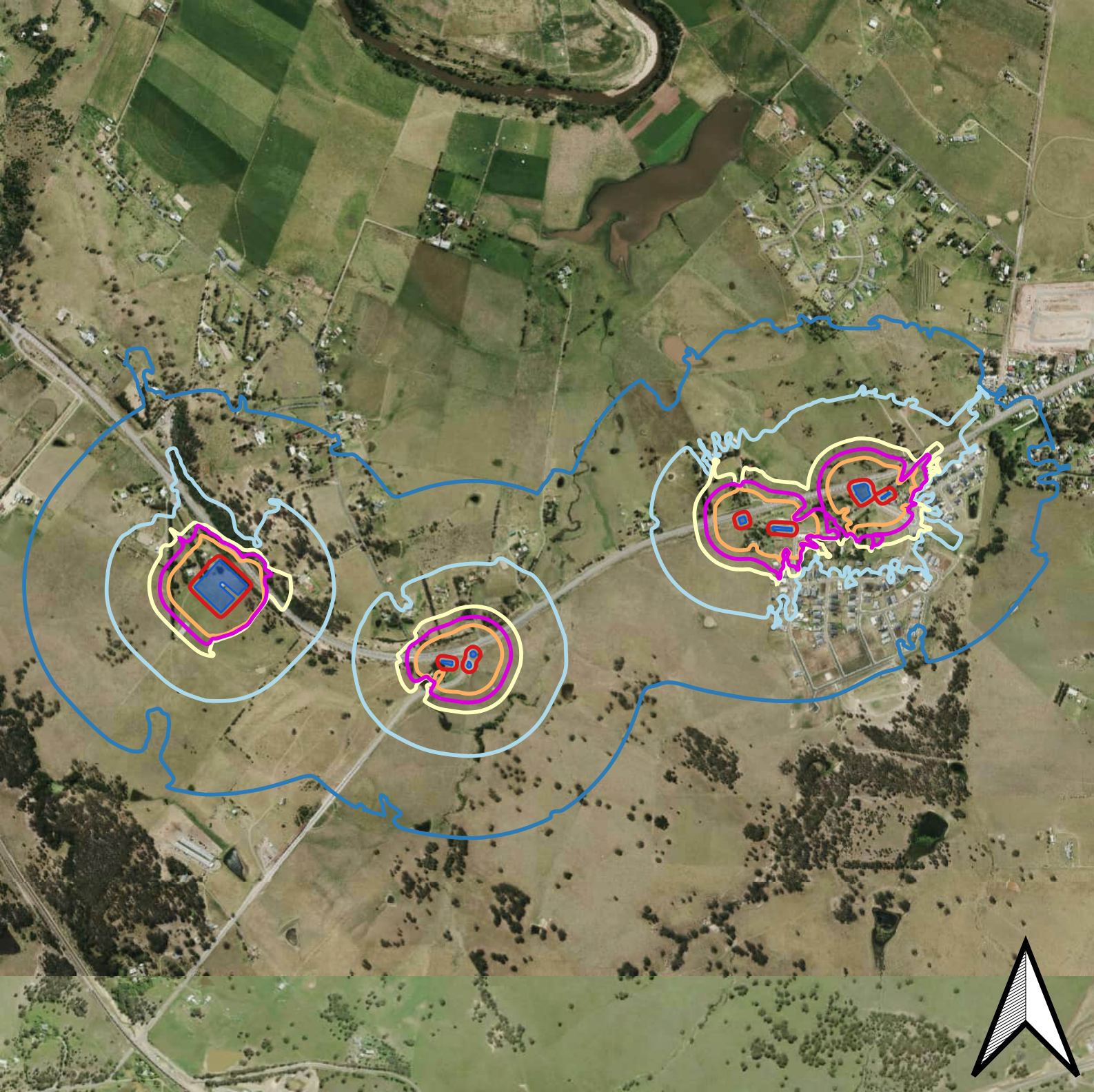









Figure A.1.10: Phase D1 Predicted Noise Impact, dB(A)⁰

250 500 750 1,000 m

Legend

- | | |
|--|--|
|  Phase D1 Construction Work | Phase D1 Predicted Noise Levels (LAeq) |
|  Phase D1 LAMax - 52 dB(A) |  40 dB(A) |
| |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
 Scale: 1:17000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 03/11/2022

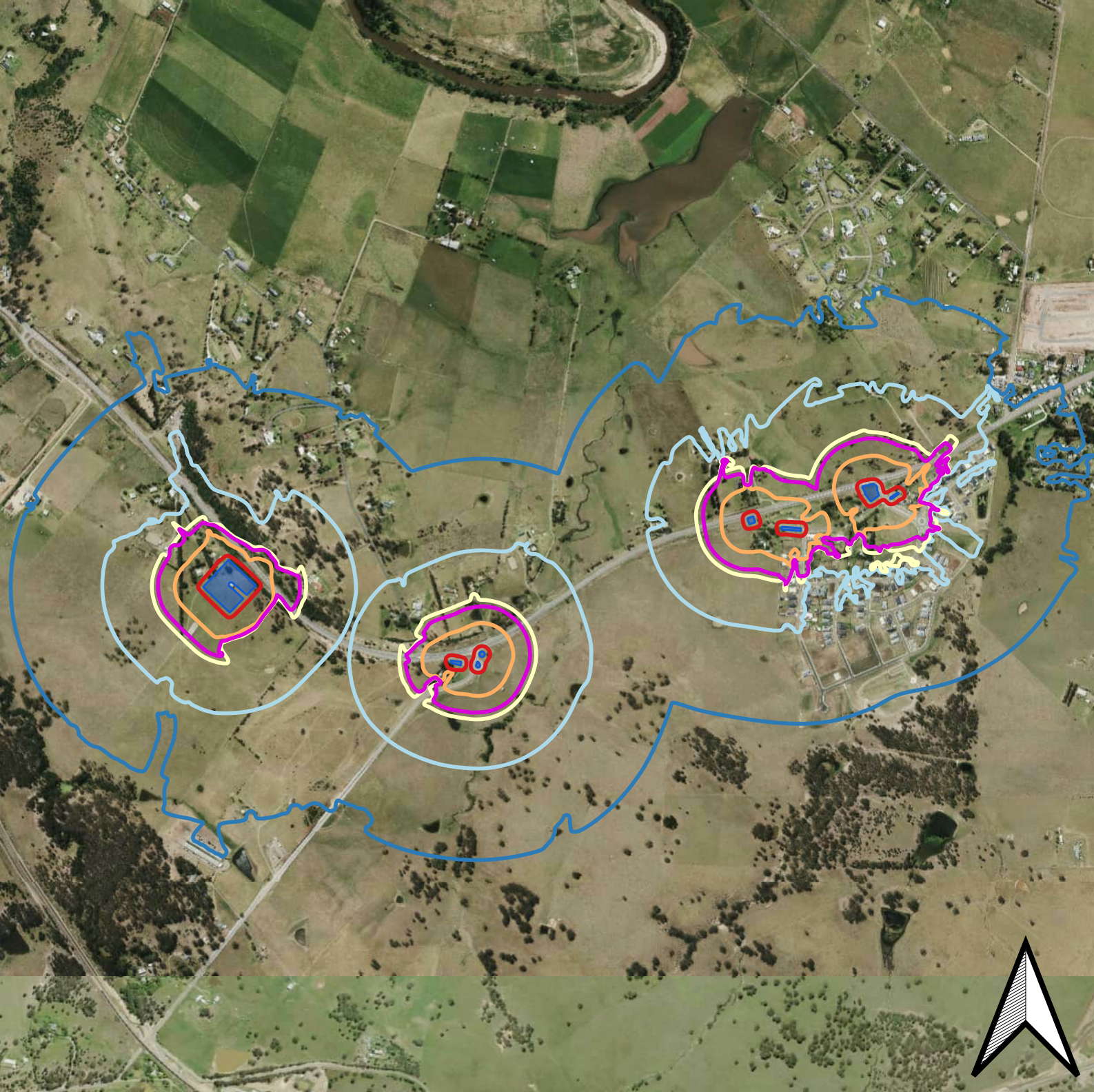









Figure A.1.11: Phase D2 Predicted Noise Impact, dB(A)⁰

250 500 750 1,000 m

Legend

- | | |
|--|--|
|  Phase D2 Construction Works |  40 dB(A) |
|  Phase D2 LAMax - 52 dB(A) |  45 dB(A) |
| |  50 dB(A) |
| |  55 dB(A) |
| |  75 dB(A) |

Basemap: NSW SixMap
Scale: 1:17000
Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
HarpersHill_GIS | Drawn: AC | Check: LS |
Date: 03/11/2022

A.2 Operational noise maps

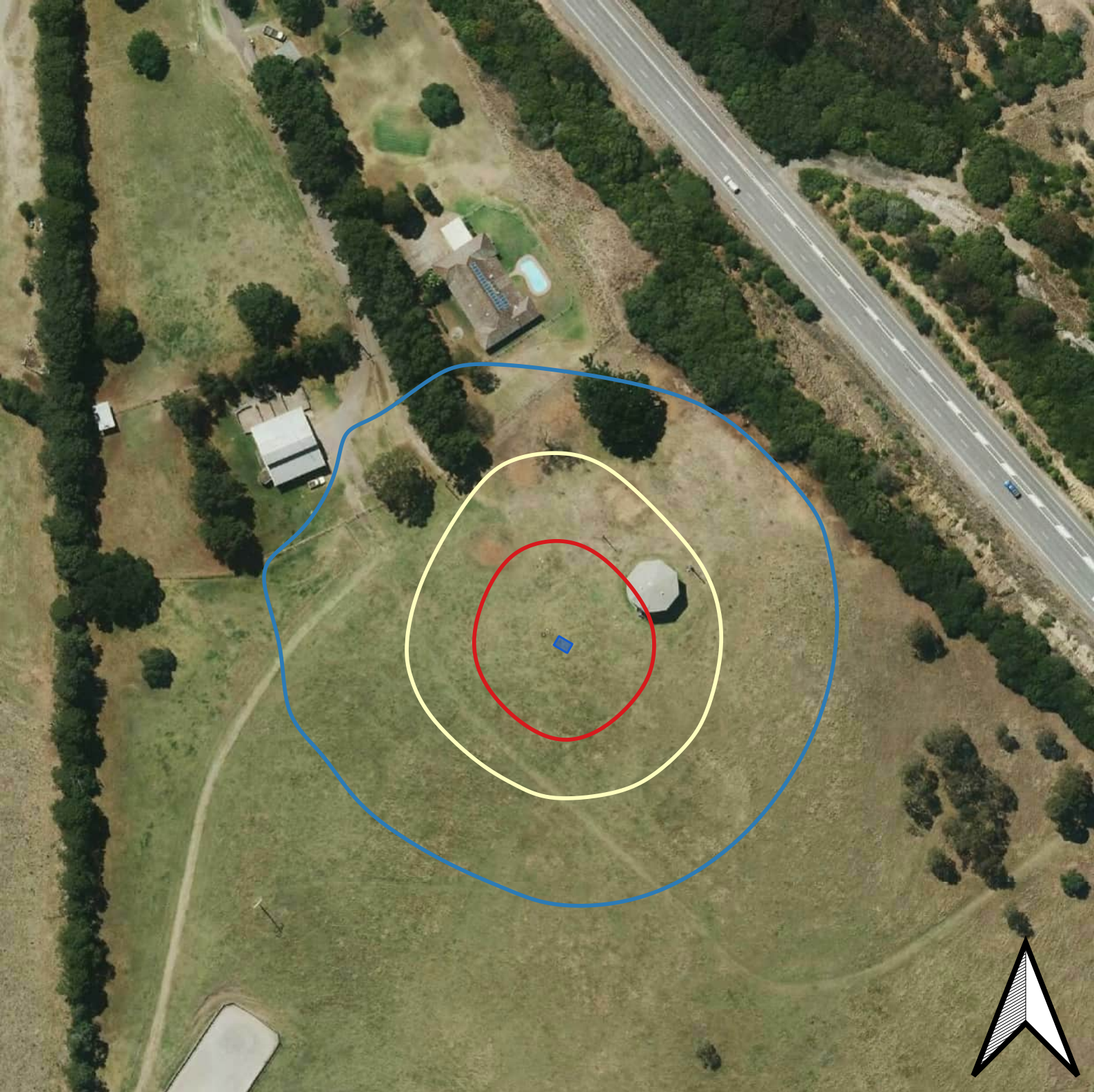
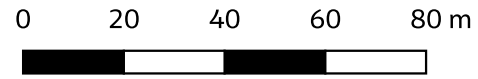


Figure A.2: Operational Predicted Noise Impact, dB(A)



Legend

- Operational Air Compressor
- Operational Noise Trigger Levels
- 38 dB(A)
- 43 dB(A)
- 48 dB(A)

Basemap: NSW SixMap
 Scale: 1:1500
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 02/11/2022



Appendix B. Vibration setback maps

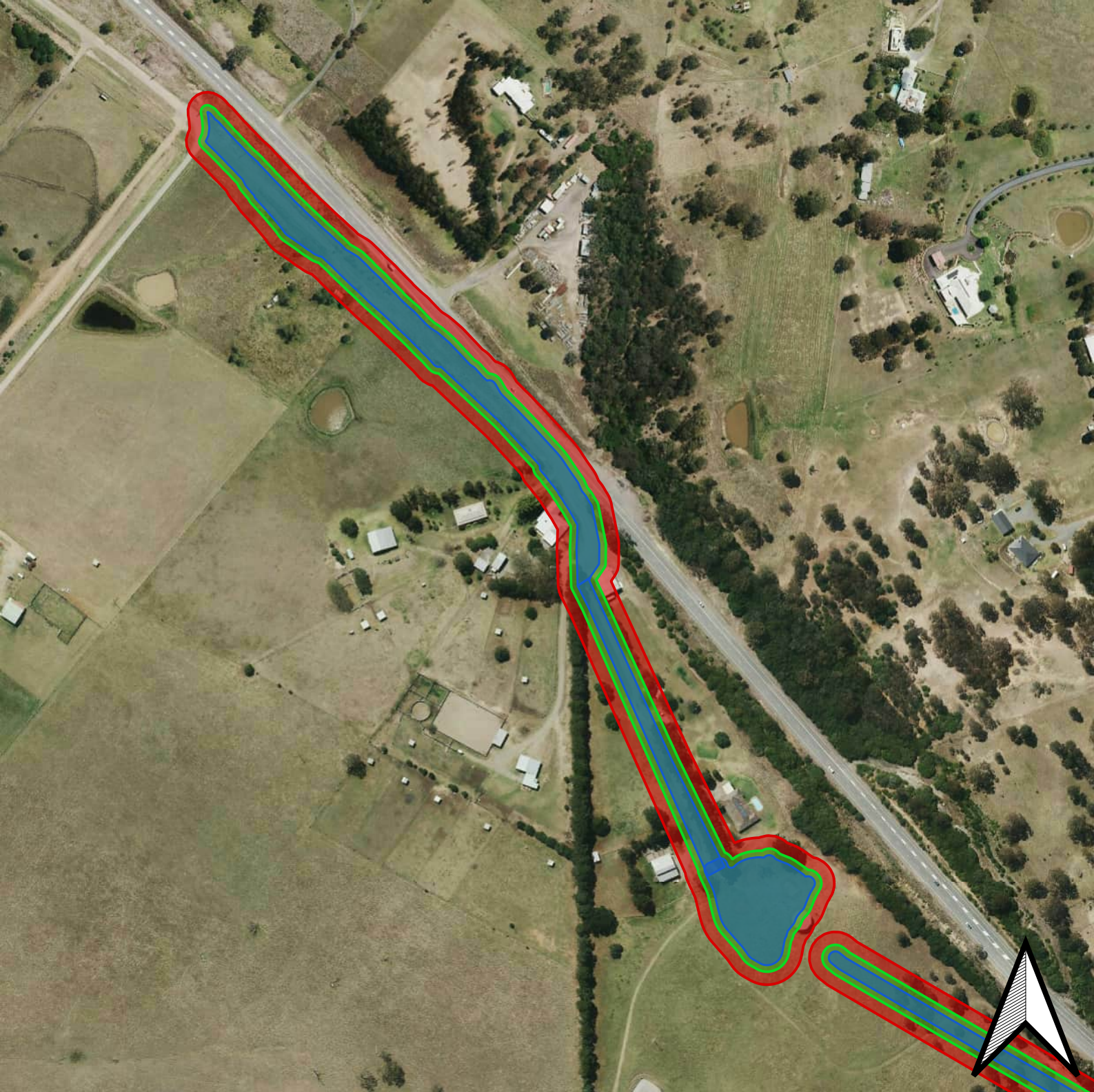
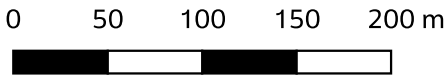


Figure B.1: Small Compactor Vibration Setback Distances - Access Road and Reservoir

- Legend**
- Construction Boundary - Access Road Upgrade and Reservoir
 - Compactor Vibration Setback Distances**
 - 5m - Cosmetic Damage Setback Distance
 - 15m - Human Comfort Setback Distance



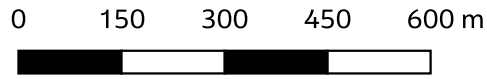
Basemap: NSW SixMap
 Scale: 1:4000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 02/11/2022






Figure B.2: Small Compactor Vibration Setback Distances - Pipeline Upgrade



Legend

 Construction Boundary - Pipeline Upgrade

Compactor Vibration Setback Distances

 5m - Cosmetic Damage Setback Distance

 15m - Human Comfort Setback Distance

Basemap: NSW SixMap

Scale: 1:11000

Noise Contours Predicted at 1.5m

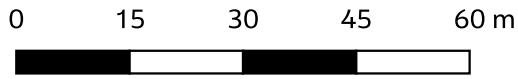
NSW ACOUSTICS - GIS PROJECT FILE:

HarpersHill_GIS | Drawn: AC | Check: LS |

Date: 02/11/2022



Figure B.3: Underboring Vibration Setback Distances - Allandale Rd



- Legend**
- Construction Boundary - Underboring Allandale Rd
 - Underboring Vibration Setback Distances**
 - 2m - Cosmetic Damage Setback Distance
 - 4m - Human Comfort Setback Distance

Basemap: NSW SixMap
 Scale: 1:1000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 02/11/2022

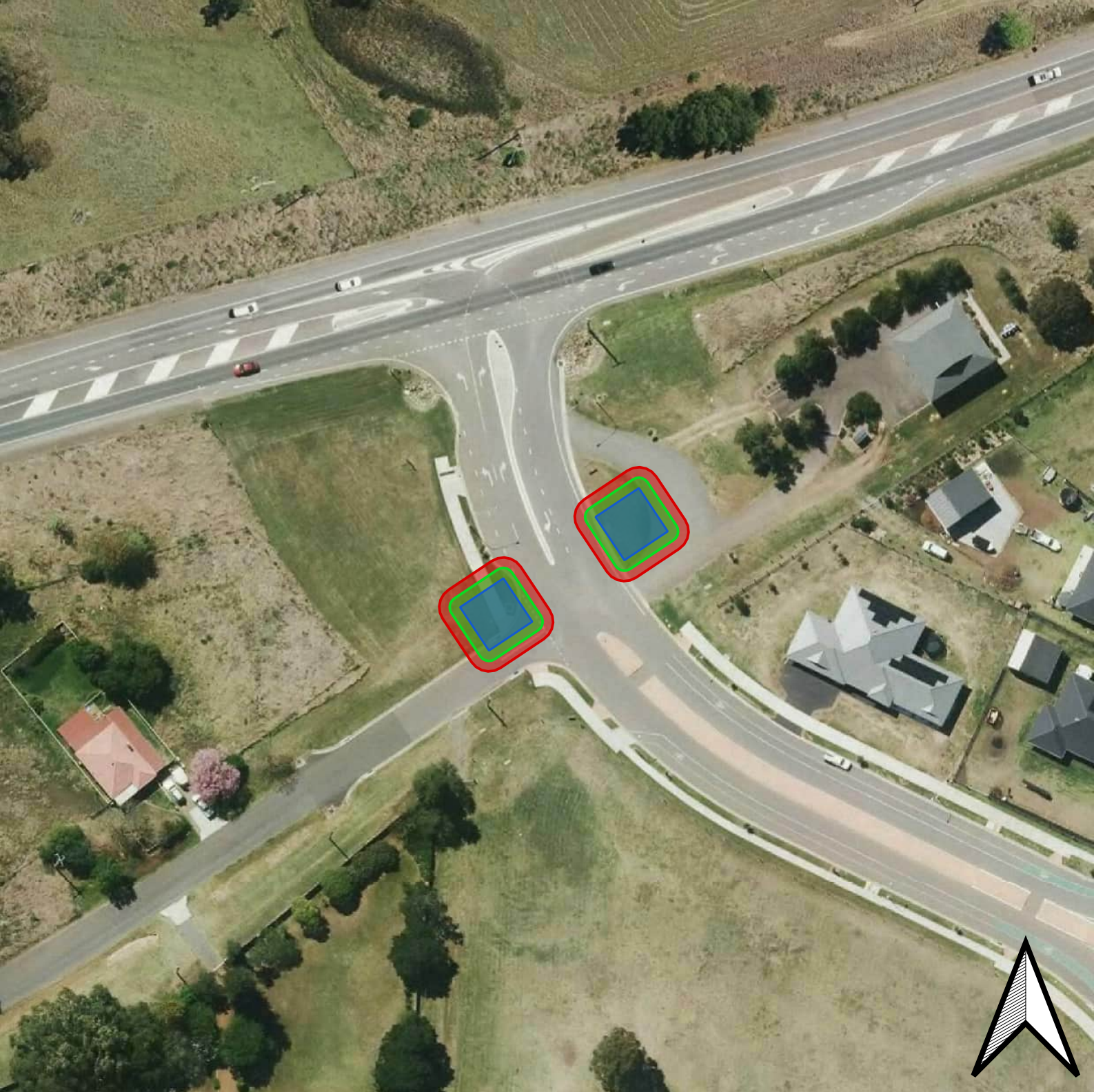
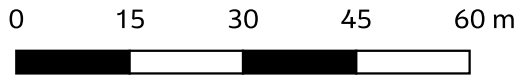


Figure B.4: Underboring Vibration Setback Distances - Terriere Dr



- Legend**
- Construction Boundary - Underboring Terriere Dr
 - Underboring Vibration Setback Distances**
 - 2m - Cosmetic Damage Setback Distance
 - 4m - Human Comfort Setback Distance

Basemap: NSW SixMap
 Scale: 1:1000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 02/11/2022

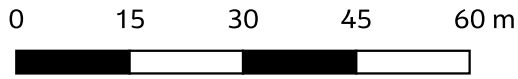
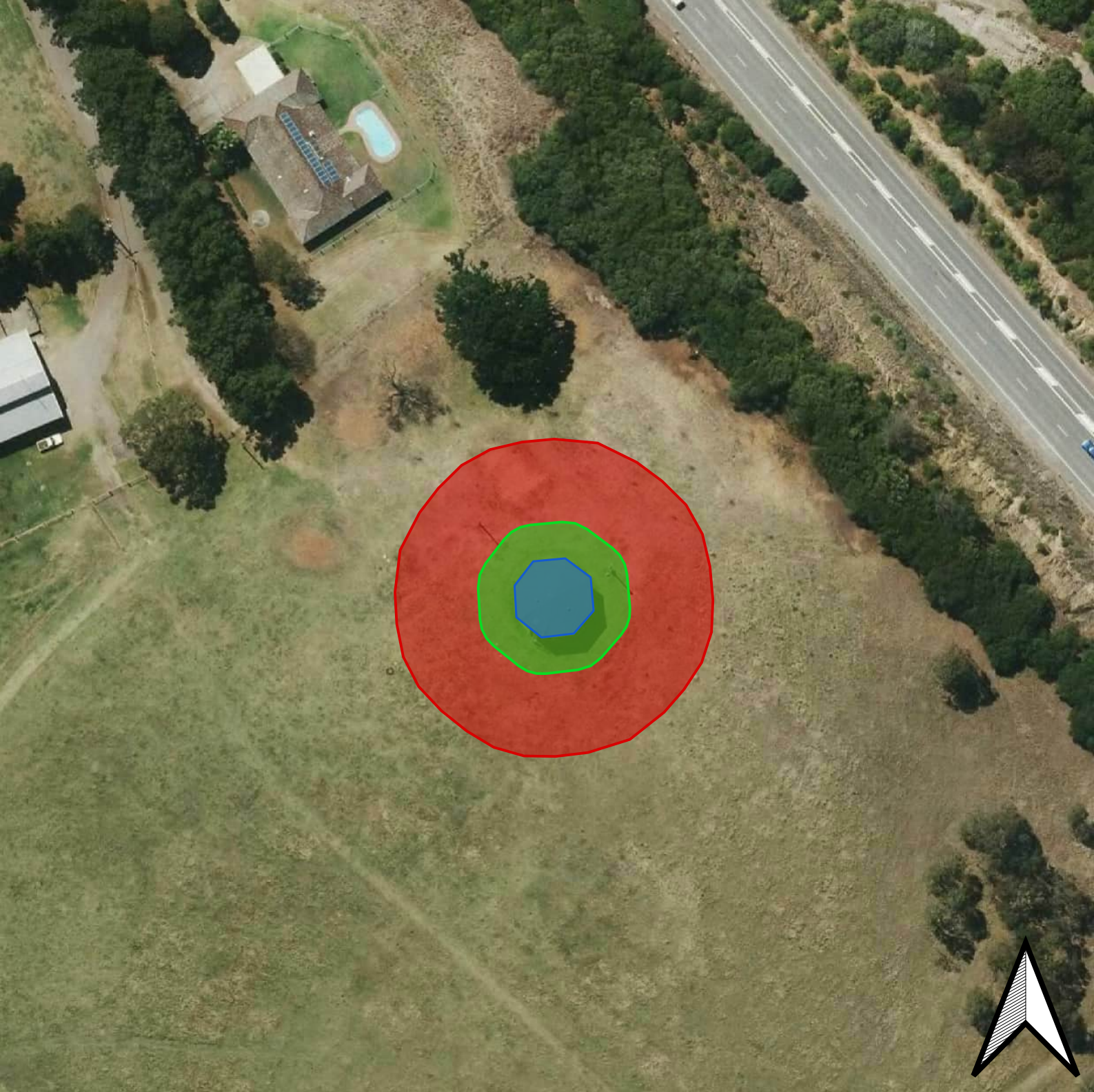


Figure B.5: Medium Hydraulic Hammer Vibration Setback Distances - Existing Reservoir

- Legend**
- Existing Reservoir Demolition Area
 - Medium Hydraulic Hammer Vibration Setback Distances
 - 7 m - Cosmetic Damage Setback Distance
 - 23 m - Human Comfort Setback Distance

Basemap: NSW SixMap
 Scale: 1:1000
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 02/11/2022

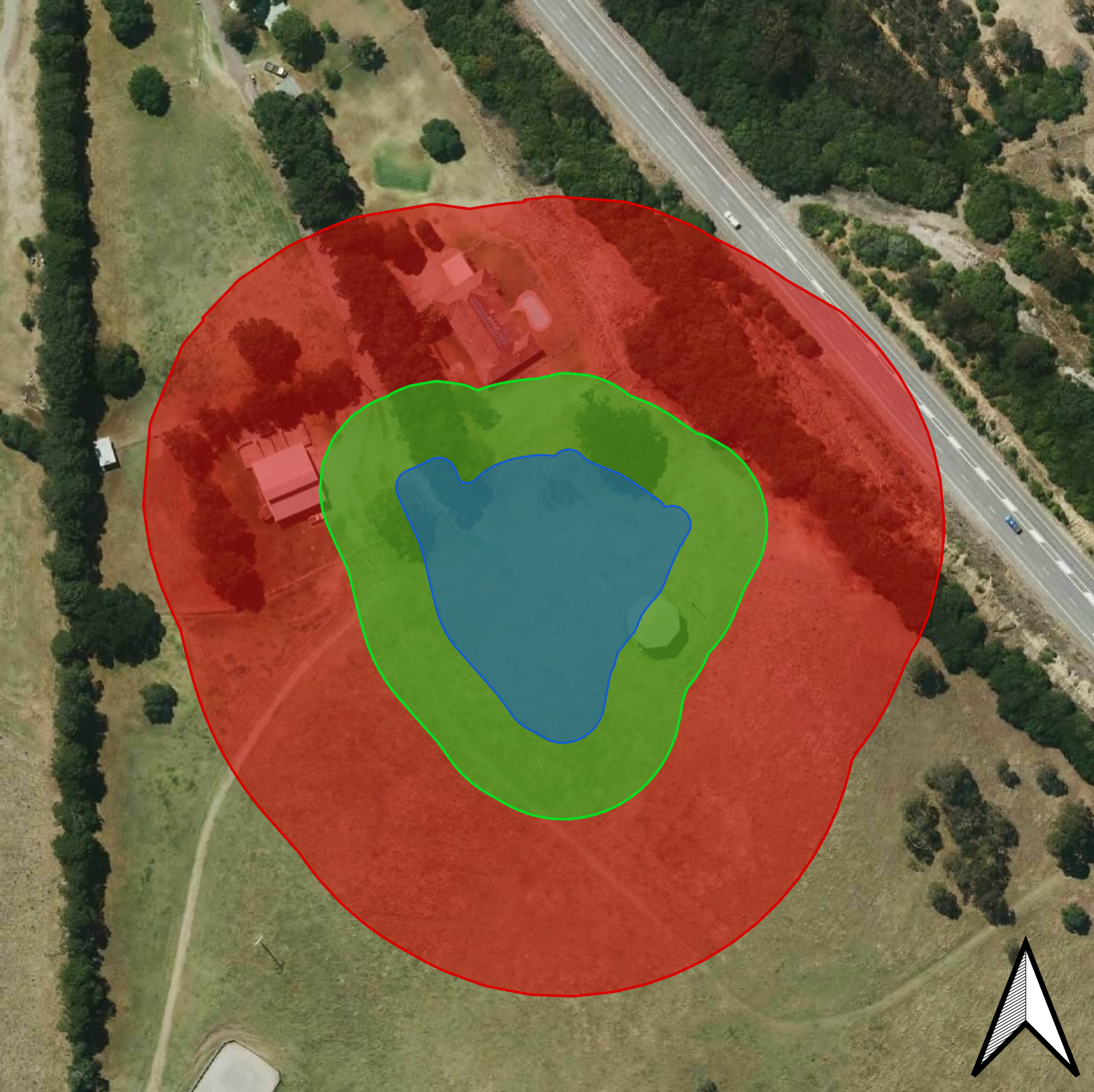
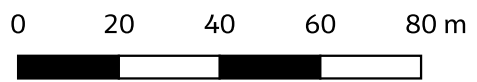


Figure B.6: Impact Piling Rig Vibration Setback Distances

- Legend**
- Construction Boundary - Proposed Reservoir
 - 22 m - Cosmetic Damage Setback Distance
 - 73 m - Human Comfort Setback Distance



Basemap: NSW SixMap
 Scale: 1:1500
 Noise Contours Predicted at 1.5m

NSW ACOUSTICS - GIS PROJECT FILE:
 HarpersHill_GIS | Drawn: AC | Check: LS |
 Date: 02/11/2022