



SMEC INTERNAL REF. 30018041

**Statement of
Environmental Effects**

Muswellbrook Pumped Hydro Energy Storage Lower Reservoir Geotechnical Investigation

Client Reference No. 30018041
Prepared for: Muswellbrook Pumped Hydro Company Pty Ltd
28 April 2023

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1. Introduction

SMEC has prepared this Statement of Environmental Effects (SoEE) on behalf of the Muswellbrook Pumped Hydro Company Pty Ltd Joint Venture (JV) partners, AGL Energy Pty Ltd (AGL) and Idemitsu Australia Resources Limited (Idemitsu). The JV is seeking consent for a Development Application (DA) from Muswellbrook Shire Council (MSC) under Part 4 (DA) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This SoEE seeks consent for lower reservoir geotechnical investigations (characterised as “earthworks”) within the Muswellbrook Coal Mine site at Bells Mountain, Muswellbrook. These geotechnical investigations will inform the feasibility and design of a broader Pumped Hydro Energy Storage (PHES) project. The mine operator, Muswellbrook Coal Company Limited (MCC), has ceased mining operations at the Site and is currently undertaking rehabilitation works.

It is considered that these geotechnical investigations can be undertaken with only minimal environmental impacts. They would have a capital investment value of about \$830,000 (excluding GST). It is therefore appropriate for Muswellbrook Shire Council (MSC) to approve this DA, subject to suitable Conditions of Consent.

This SoEE seeks consent to undertake geotechnical investigations with an interim total of two borehole sites (Boreholes 11-12). A total of seven testing pits (Test Pits 1-7) generally between 1 m – 5 m (AHD) to be dug prior to construction to inform design. Depending on the outcome of initial tests, further assessments maybe required (subject to a future DA process, if required).

The geotechnical investigations comprise the following:

- Site mobilisation works and laydown area establishment
- Augmentation and improvement of existing access tracks to facilitate safe site access. Access tracks which are improved/created during the geotechnical investigation would be maintained to facilitate future site access, subject to suitable erosion controls
- Creation of new access tracks involving vegetation removal
- Borehole creation using a drilling rig, reaching depths of around 200 m – 300 m below ground surface
- Storage of excess drilling water and cuttings in a temporary waste skip bin to be removed offsite
- Rock core transportation and storage offsite
- Drill stem testing at the completion of drilling whilst the drill is still in position
- Borehole decommissioning within 28 days of completing the works either by installing a fully grouted vibrating wire piezometer and data logger, or fully grouted backfilling
- Geophysical surveys utilising seismic refraction tomography profiling
- Excavating up to seven test pits using a track mounted excavator digging pits up to 5 m deep, 1 m wide and 4 m long. Test pits are backfilled immediately after reaching target depth and geotechnical logging and sampling is completed
- Site rehabilitation works, including:
 - Reinstating areas where a cut/fill bench was created
 - Re-seeding access track areas which are not required for future site access
 - Removing all equipment and environmental controls
- Minor filling around existing culverts where the existing ground has eroded
- In situ stress measuring, undertaken progressively down the borehole whilst the drill rig is still in position
- Borehole imaging, undertaken by a specialist sub-contractor, including optical and acoustic imaging and a sonic logging profile.

Up to a total 0.4387 ha of vegetation considered to be equivalent to Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC under the *Biodiversity Conservation Act 2016* (BC Act) and Central Hunter Valley eucalypt forest and woodland CEEC under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), may be cleared as part of the borehole drilling works from within the investigation areas. However, the small-scale extent and temporary nature of the proposed works is unlikely to result in significant impacts to these communities (refer to Section 6.1).

The lower reservoir area north of Test Pit 2 contains various ephemeral waterbodies (online dams and tributaries of Sandy Creek) throughout the Site. As such, this DA also seeks consent to undertake works on waterfront land to allow geotechnical equipment and vehicle access track crossing. A Controlled Activity approval is required to be obtained as Integrated Development under the *Water Management Act 2000* (WM Act) through the Department of Planning and Environment – Water. As the geotechnical investigations do not constitute Designated Development under Schedule 3 to the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation), no Environmental Impact Statement is required to be prepared.

The geotechnical investigations would be undertaken predominantly on land owned by MCC with drilling works proposed to occur under standard working hours 7am to 6pm on weekdays, Monday to Friday, 8am to 1pm on Saturday and no works on Sundays and public holidays.

Small sections of access tracks traversing through Crown Lands will require approval from Crown Lands. This work includes access track creation civil works, and geotechnical investigation drilling works (refer to Section 6.9). Private land will also be accessed, requiring landowner consent.

Table 1-1 sets out the documentation which accompanies this SoEE.

Table 1-1: Accompanying Documents

Document	Prepared by	Attachments
Biodiversity Assessment	SMEC	Appendix A
Aboriginal Heritage Assessment	Extent Heritage	Appendix B
Noise Assessment	Resonate	Appendix C
Traffic Assessment	SMEC	Appendix D
Title Searches	Idemitsu	Appendix E
Preliminary Cost Estimate	SMEC	Appendix F

1.1 Synopsis of Proposed Geotechnical Investigation

Table 1-2 provides lower reservoir geotechnical investigation land parcel details, current licences and approvals and list of relevant statutory approvals applying to the Site.

Table 1-2: Synopsis of Proposed Geotechnical Investigation

Matter	Details
Parcel Details	<p>Lot 1 DP1004305, Coal Road Muswellbrook (access via Limestone Road)</p> <p>Lot 59 DP752484, Coal Road Muswellbrook</p> <p>Lot 60 DP752484, Coal Road Muswellbrook</p> <p>Lot 61 DP1113302, Coal Road Muswellbrook</p> <p>Lot 62 DP752484, Coal Road Muswellbrook</p> <p>Lot 44 DP1112699, 374 Sandy Creek Road Muswellbrook</p> <p>Lot 1 DP184481, Coal Road Muswellbrook</p> <p>Lot 100 DP666041, Coal Road Muswellbrook</p>
Current Licences and Approvals	<p>Muswellbrook Coal Mine and its buffer lands are currently subject to the following:</p> <ul style="list-style-type: none"> Consolidated Coal Lease 713

Matter	Details
	<ul style="list-style-type: none"> • Mining Lease 1304 • Mining Lease 1562 • Environment Protection Licence 656 • Water Access Licence WAL39806 • Water Access Licence WAL41503 • Water Access Licence WAL41521 • DA 205/2002 (MSC) and various modifications to the same
Relevant Statutory Provisions	<i>Environmental Planning and Assessment Act 1979</i> <i>Environmental Planning and Assessment Regulation 2021</i> <i>Environment Protection and Biodiversity Conservation Act 1999</i> <i>Biodiversity Conservation Act 2016</i> <i>National Parks and Wildlife Act 1974</i> <i>Protection of the Environment Operations Act 1997</i> <i>Water Management Act 2000</i> <i>Heritage Act 1977</i> <i>Local Land Services Act 2013</i> <i>Muswellbrook Local Environmental Plan 2009</i> <i>Muswellbrook Development Control Plan 2009</i> <i>State Environmental Planning Policy (Resources and Energy) 2021</i> <i>State Environmental Planning Policy (Transport and Infrastructure) 2021</i> <i>State Environmental Planning Policy (Resilience and Hazards) 2021</i>

2. Planning Context

2.1 Planning History

Muswellbrook Coal Mine and its buffer lands are largely governed by DA 205/2002, which was issued by MSC. This consent has been modified on several occasions, as set out in Table 2-1 below.

Mining activities at Muswellbrook Coal Mine were carried out wholly within Consolidated Coal Lease 713, Mining Lease 1562, Mining Lease 1304, Mining Lease 1513, and are subject to Environment Protection Licence 656.

Table 2-1: Summary of Existing Development Consents

Approval	Description	Consent Authority	Date Granted	Expiry/ Renewal Date
DA 205/2002 (MSC)	Approval for Extension of MCC Open Cut 1	Muswellbrook Shire Council	1 Sep 2003	Mining to 31 Dec 2022. No end date to approval.
DA 205/2002 (MSC) – Amendment to Condition 1.1	Power line relocation and additions to Workshop	Muswellbrook Shire Council	19 Dec 2005	Mining to 31 Dec 2022. No end date to approval.
DA 205/2002 (MSC) Amendment to 1.1 and 11.3	Relocate office buildings, workshop and bath-house	Muswellbrook Shire Council	13 July 2009	Mining to 31 Dec 2022. No end date to approval.
DA 205/2002 (MSC) Amendment to 1.1 and 11.1	Extension of mining into Area C	Muswellbrook Shire Council	23 Dec 2010	Mining to 31 Dec 2022. No end date to approval.
DA 205/2002 (MSC) Amendment to 1.1(a), 31, 33, 39, 45 and 58	Revision to Mining Infrastructure Building Requirements and Rehabilitation Plan Revision to permit the continuation of mining operations for an additional five years.	Muswellbrook Shire Council	29 Oct 2014	Mining to 31 Dec 2022. No end date to approval.
DA 205/2002 (MSC) Amendment to 1.1, 1.2 & 6.3.2 and additional conditions 59 & 60.	Modification to Permit the Continuation of Mining Operations at Muswellbrook Coal Mine for an Additional Five (5) Years - Multiple Allotments – Coal Road Muswellbrook.	Muswellbrook Shire Council	12 Dec 2003	Mining to 31 Dec 2022. No end date to approval.
DA 205/2002 (MSC) General revision of consent conditions	Modification to allow mining operations to mine additional areas and to extend the mine life of 2022.	Muswellbrook Shire Council	26 Oct 2016	Mining to 31 Dec 2022. No end date to approval.

2.2 Pre-Application Meeting

During 2020, SMEC lodged a similar geotechnical investigation DA with MSC on behalf of the JV on the Muswellbrook Coal Mine site within the lower reservoir area. The investigation was wholly within the Muswellbrook Coal Mine site. The current geotechnical investigation will require boreholes in locations not just within the lower part near the former coal mine void, but also further eastwards within the lower region of Bells Mountain, which is the site of some future PHES proposed infrastructure.

A Pre-Application meeting was held at MCC's premises on 8 August 2022 with representatives from the JV, MSC (Coordinator Development, Chief Engineer and Development Compliance Officer and Development Compliance Office) and SMEC.

An overview of the key discussion points arising from the Pre-Application meeting included:

- Discussion of Scoping Brief of geotechnical investigation for both lower and upper reservoir areas
- Geotechnical investigation completed in 2020 (DA 2020-40)
- Similarity of lower reservoir to geotechnical investigation DA 2020-40 in terms of content of SoEE
- Intention to submit two development applications ('Lower Reservoir Geotechnical Assessment' and 'Upper Reservoir Geotechnical Assessment') to reflect separate site mobilisations

- Access tracks over a portion of the Site
- Drilling works proposed to occur 24 hours a day, seven days a week
- Current land uses both lower and upper reservoir areas
- Sensitive environmental features would be avoided where practicable.

While 24/7 drilling operations were proposed during the Pre-Application Meeting with MSC, the proponent is now only considering standard hours of operation Monday to Friday 7am to 6pm and possibly work on Saturday from 8 am to 1 pm. Environmental impact assessments have been assessed based on these standard hours of operation.

Matters raised at the Pre-Application meeting and subsequently by MSC to be addressed in the site investigation works, application and SoEE document are outlined as follows:

- Provision of an SoEE to accompany the DA for the lower reservoir geotechnical investigation
- Provision of scope of works and detailed description for the lower reservoir geotechnical investigation works inclusive of access track construction and land clearing with sufficient details provided to enable Council to identify:
 - The location of exploration areas (geotechnical bore holes and test pits)
 - The location and extent of all land clearing related to the application
 - The location and typical construction detail of access tracks related to the application
 - The location and construction detail of any areas where additional stabilisation, additional clearing, culvert crossings etc. where works beyond the scope of the typical access track design are to be constructed to provide suitable access and form part of this application
- Integrated development details for the lower reservoir DA including:
 - A Controlled Activity Permit for geotechnical investigations works within C3 Environmental Management zone from the Department of Planning and Environment – Water (DPE – Water)
 - Approval from the NSW Subsidence Advisory for works within a mine subsidence district
- Details of Crown Land within the lower reservoir geotechnical investigation area and consultation with Crown Lands to confirm permitting and landowner consent
- Provision of an Aboriginal Heritage Due Diligence Assessment to consider the potential for artefacts to be disturbed by earthworks, road construction and clearing
- Provision of a biodiversity assessment undertaken by an appropriately qualified ecologist to inform vegetation clearing works to determine biodiversity off-set threshold requirements for a potential Biodiversity Development Assessment Report (BDAR) (ultimately deemed not required)
- Details of traffic associated with geotechnical investigatory works including anticipated details of traffic volumes, number of heavy vehicles movements, timeline for the carrying out of works and resulting increase in traffic volumes and vehicle access routes
- Provision of a noise assessment to determine the potential acoustic impacts by drilling rig operations by an Acoustic Engineer for proposed 24 seven operations
- Details of lighting associated with 24 seven drilling operations including full details of lighting proposed to consider the potential for lighting related impacts to nearby sensitive receivers and appropriate mitigation measures proposed
- Details of rehabilitation of drill holes or filled in post works
- Details to be provided for management of waste related to the development and drilling works including excavated soils.

2.3 Relevant Consent Authority

The DA will be determined by MSC as the capital investment value is \$830,000 (excluding GST), and the proposed geotechnical investigation therefore does not meet the requirements for designation as State Significant Development or Regionally Significant Development under *State Environmental Planning Policy (Planning Systems) 2021*.

2.4 NSW Government Agency Consultation

The DA will be lodged as Integrated Development requiring consultation and consent from the Mine Subsidence Board and Department Planning and Environment – Water for a Controlled Activity Permit under the *Water Management Act 2000* (WM Act). Consultation with these departments has commenced to inform the geotechnical investigations and seek agency statutory requirements.

Crown Lands has been consulted and informed of details of the lower reservoir geotechnical investigation works, regarding installing an access track crossing and associated vegetation clearing works. An approval to access Crown Lands will be sought along with a licence to undertake works on the Crown Road for establishment of access tracks for geotechnical drilling equipment and vehicles and drilling works (refer to Section 6.9).

Department Planning and Environment (DPE) was informed, during overall PHES project environmental scoping meeting with JV partners and SMEC, of future geotechnical investigations being assessed under Part 4 of the EP&A Act. DPE has been advised of lodgement of a separate DA for the lower reservoir geotechnical investigation work with MSC.

2.5 Strategic Planning Context

2.5.1 Hunter Regional Plan 2041

The overall proposed PHES project is considered to be consistent with the Hunter Regional Plan 2041 (Regional Plan) *Objective 7: Reach net zero and increase resilience and sustainable infrastructure and planning for the Upper Hunter*. The Regional plan's vision is where 'The region is climate resilient and energy and resource efficient. Leadership in reaching net zero emissions represents a key guiding principle for all regional decision-making.' This shift to a net zero emissions economy will create opportunities in the energy sector such as advanced energy technology. In this regard, the Regional Plan recognises the following:

Energy generation systems – 'The NSW Electricity Infrastructure Roadmap sets out the NSW Government's 20-year plan for the generation, storage, firming and transmission infrastructure needed for clean, cheap and reliable power.'

Former mining regionally significant growth areas – 'Several mines in the Upper Hunter district will likely cease mining and commence closure shortly, while others may expand. Both scenarios could enable alternative post-mining employment and economic diversification uses. Place strategy outcomes 2. Operational lands – Repurpose voids where possible to support renewable energy generation or as resource that supports employment uses elsewhere on the site.'

Liddell and Bayswater power station regionally significant growth area – 'The Upper Hunter's power transmission lines allow ready access to the grid for energy projects. The closure of Liddell power station in 2023 and Bayswater in 2030-2033 could provide the region's first renewable energy hub. Plans announced for the site include solar and thermal storage systems, grid-scale batteries, an energy from waste facility, and exploring the feasibility of a hydrogen hub. Employment investigation precincts – Plan renewable energy generation to take advantage of transmission infrastructure.'

The overall PHES project is considered to be critical if JV partners AGL and Idemitsu are to meet responsibilities as per the Objectives and Plans under the Regional Plan.

2.5.2 NSW Pumped Hydro Roadmap 2018

The *NSW Pumped Hydro Roadmap 2018* (Pumped Hydro Roadmap) was prepared to encourage private sector investment in pumped hydro projects that will deliver the long term, large-scale energy storage that is vital to NSW's future energy system.

The Pumped Hydro Roadmap acknowledges how the traditional linear model of energy delivery is transitioning towards a modern system, which is more complex and flexible. Energy storage technologies at all levels are helping to balance the system and deliver affordable energy to all the households and businesses of NSW, both where and when it is needed. NSW is planning now for a portfolio of energy and storage solutions, in which pumped hydro is expected to play a critical role in the decades to come.

The Pumped Hydro Roadmap sets out:

- The strategic need for pumped hydro projects throughout NSW
- Mapped areas for potential pumped hydro projects within NSW
- Eligibility criteria for sites to be considered suitable to deliver pumped hydro for NSW
- Details of the NSW Government's \$55M Emerging Energy Program to help fund the next generation of large-scale, on demand electricity projects in NSW, which supports technologies such as pumped hydro, concentrated solar thermal, bioenergy, hydrogen, and batteries.

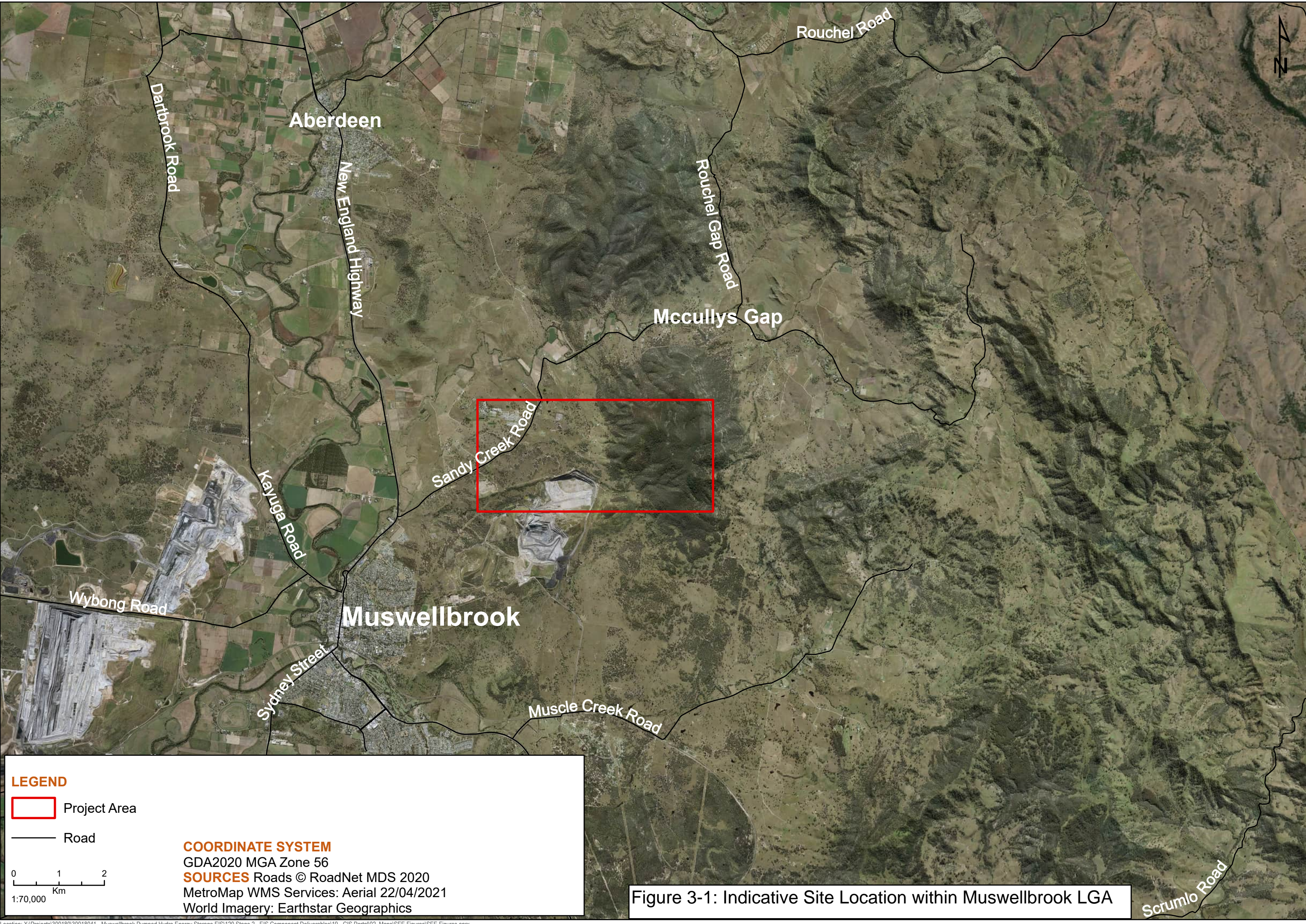
The Site is considered suitable from a technical perspective, to generate pumped hydroelectricity. The geotechnical investigations would assist Muswellbrook Pumped Hydro Company Pty Ltd in verifying this suitability by providing a range of geotechnical data which are prerequisite to finalising this feasibility.

The broader PHES project is therefore considered to be wholly aligned with the Pumped Hydro Road Map. It is also a direct response to Action 1 of the Pumped Hydro Roadmap, which is Bringing forward private investment, described as "supporting the commercialisation of new, large-scale on-demand electricity projects.

3. Site Description

3.1 Location

The Site is located within buffer lands of the existing Muswellbrook Coal Mine site, located around 4.4 km northeast of the Muswellbrook town centre, in the Hunter Valley region of NSW (Figure 3-1). The Site is entirely within the Muswellbrook Local Government Area (LGA).



LEGEND

Project Area

Road

012

Km

1:70,000

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020
MetroMap WMS Services: Aerial 22/04/2021
World Imagery: Earthstar Geographics

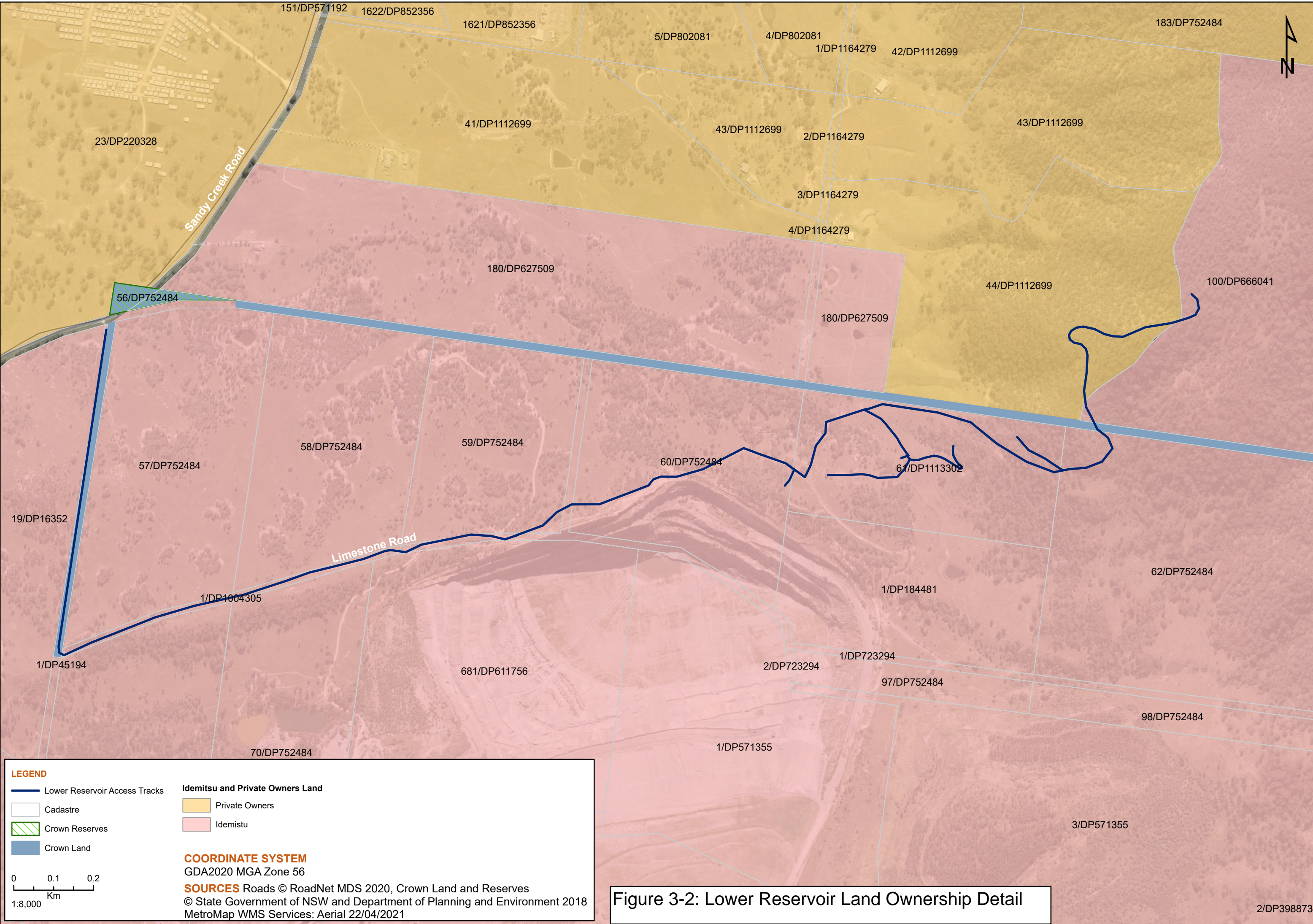
Figure 3-1: Indicative Site Location within Muswellbrook LGA

3.2 Parcel Details

The geotechnical investigations comprise works within, or access gained via the lots outlined in Table 3-1 below. Figure 3-2 provides a map of land ownership within the lower reservoir portion of the overall proposed PHES project, which is primarily located on MCC-owned land.

Table 3-1: Parcel Details

Nature of works	Parcel details
Access	Lot 1 DP1004305, Coal Road Muswellbrook (access via Limestone Road) Lot 59 DP752484, Coal Road Muswellbrook Lot 60 DP752484, Coal Road Muswellbrook Lot 61 DP1113302, Coal Road Muswellbrook Lot 62 DP752484, Coal Road Muswellbrook Lot 44 DP1112699, 374 Sandy Creek Road Muswellbrook Lot 1 DP184481, Coal Road Muswellbrook Lot 100 DP666041, Coal Road Muswellbrook
Geotechnical works	Lot 60 DP752484, Coal Road Muswellbrook Lot 61 DP1113302, Coal Road Muswellbrook Lot 44 DP1112699, 374 Sandy Creek Road Muswellbrook Lot 100 DP666041, Coal Road Muswellbrook



3.3 Existing Site Development

The site for geotechnical drilling works will be wholly within the northern part of Muswellbrook Coal Mine site and access will be via Sandy Creek Road and Limestone Road. The Site is located around 4.4 km north-east of the Muswellbrook town centre, within the Hunter Valley region of NSW, and is situated entirely within the Muswellbrook LGA. Existing unsealed mine road and access tracks north of Pit 2 will be utilised where possible for establishment of a drilling rig, otherwise areas containing native grasses and vegetation leading upwards into lower slopes of Bells Mountain will require clearing works for accessibility and establishment of test pits and borehole site. Refer to Section 6.1 and Appendix A Biodiversity Assessment.

3.4 Site Description

3.4.1 Site Conditions

Geophysical profiling will also inform the geotechnical investigation within the area located on the foot slopes and hillside of Bells Mountain, a prominent feature of the broader landscape with an elevation of around 688 m above sea level.

The investigation area consists of grassland with sporadically occurring shrubs. The soil landscape within the investigation areas is comprised of the Roxburgh and Colonel soil landscapes (DPIE, 2020). The Roxburgh landscape covers undulating low hills and undulating hills, which are dominated by yellow podzolic soil. Generally, soils are derived from sandstone, shale, mudstone, conglomerate, and coal associated with the Singleton Coal Measures geological unit (Kovac and Lawrie, 1991).

Apart from lower extend of Bells Mountain the investigation areas are highly disturbed, with a high-level of exotic weed species present and an apparent lack of canopy trees indicating historic clearing.

3.4.2 Surrounding Area and Context

Land uses surrounding the Site include agricultural activities, light industrial land uses and residential areas. Agricultural activities are located on properties surrounding the Muswellbrook Coal Mine and primarily include grazing of beef cattle. Light industrial and special land uses include Muswellbrook Quarry to the north-west (owned by MCC and leased to Daracon), St Heliers correctional centre to the north-west and the Muswellbrook Waste Management Facility to the south-west. The Muswellbrook township is to the west, with other notable rural-residential areas along Sandy Creek Road to the north, Woodland Ridge Estate to the south and along Muscle Creek Road to the south-east. Other significant features surrounding Muswellbrook Coal Mine include the Main Northern Rail Line and the New England Highway, which run to the west through Muswellbrook township and to the south towards Singleton. Numerous other mining operations and power-generating facilities exist between Muswellbrook and Singleton.

4. Geotechnical Investigations

4.1 Overview

This Section 4 explains in more detail the scope of works that is proposed to be undertaken to facilitate geotechnical investigations at the Site. These details are considered to be indicative of a typical geotechnical investigation scope and may be subject to minor changes. However, the overall footprint of the proposed geotechnical investigations would remain within the areas of impacted stipulated in this SoEE, and in particular with respect to potential Aboriginal heritage and biodiversity impacts.

Consent is being sought for geotechnical investigations (characterised as “earthworks”) at the lower slopes of Bells Mountain, Muswellbrook, to inform the feasibility study for a potential future PHES scheme using land associated with and adjacent to Muswellbrook Coal Mine. The mine operator MCC, has ceased mining activities and is currently undertaking rehabilitation works.

The geotechnical investigations specifically comprise the following:

- Site mobilisation works and laydown area establishment
- Minor augmentation and improvement of existing access tracks to facilitate safe site access. Access tracks which are improved/created during the geotechnical investigation would be maintained to facilitate future site access, subject to suitable erosion controls
- Minor filling around existing culverts where the existing ground has eroded to provide for safe access
- Borehole creation using a drilling rig, reaching depths of around 200 m – 300 m below ground surface with water supplied by truck-mounted water carts
- Storage of excess drilling water and cuttings in a temporary waste skip bin to be removed offsite by a suitable waste management contractor
- Rock core transportation and storage offsite
- Drill stem testing at the completion of drilling while the drill rig is still in position
- In situ stress measuring, undertaken progressively down the borehole whilst the drill rig is still in position
- Borehole imaging, undertaken by a specialist sub-contractor, including optical and acoustic imaging and a sonic logging profile
- Geophysical surveys utilising seismic refraction tomography (SRT) profiling
- Excavating up to seven test pits using a track mounted excavator digging pits up to 5 m deep, 1 m wide and 4 m long. Test pits are backfilled immediately after reaching target depth and geotechnical logging and sampling is completed
- Borehole decommissioning within 28 days of completing the works, either by installing a fully grouted vibrating wire piezometer and data logger, or fully grouted backfilling
- Site rehabilitation works, including:
 - Reinstating areas where a cut/fill bench was created
 - Re-seeding access track areas which are not required for future site access
 - Removal of all equipment and environmental controls
- The geotechnical investigations would be undertaken on land owned by MCC, during the following hours:
 - 7:00 am to 6:00 pm Monday to Friday
 - 8:00 am to 1:00 pm Saturdays
 - No work on Sundays or public holidays

- Prior agreement to out of hours work, if required, would be sought from the landowner or lessee with notification provided to MSC, and would be subject to proximity to nearby noise receptors and determinations from a noise assessment for out of hours work.

Figure 4-1 below provides an indication of typical vehicles which are used to undertake geotechnical investigation works.



Figure 4-1: Typical Geotechnical Investigation Mobilisation Vehicles

The following sections set out the above components of the geotechnical investigations or description of work in more detail.

4.2 Mobilisation Activities

The geotechnical investigations would include the following mobilisation and site establishment activities:

- Borehole set out within pre-approved clearance area on MCC owned land
- Establishment of suitable drilling and support equipment, this is likely to include:
 - Tracked drilling rig, Comacchio 450p or similar
 - Tracked rod carrier
 - 4x4 water truck
 - 4x4 service vehicle (SV)
 - 4x4 light vehicles (LVs)
 - Crib shed/ storage container / portaloo
 - Water storage tanks (2x5000 litre capacity)
 - Waste storage tanks (6 m³ lined skip bins)
 - Consumables
- Establishment of a secure laydown area, including:

- Delineation by with temporary fencing
 - Signage and project information
- Set up over borehole locations, including provisions for:
 - Environmental controls (erosion and sediment controls)
 - Formation of a temporary, level drilling pad
- Set up geophysical investigation survey lines on MCC owned land, or on land where MCC/JV/AGL have an existing land access agreement in place
- Set up excavator over test pit locations.

Figure 4-2 below provides an indication of typical vehicles which are used to undertake geotechnical investigation works.



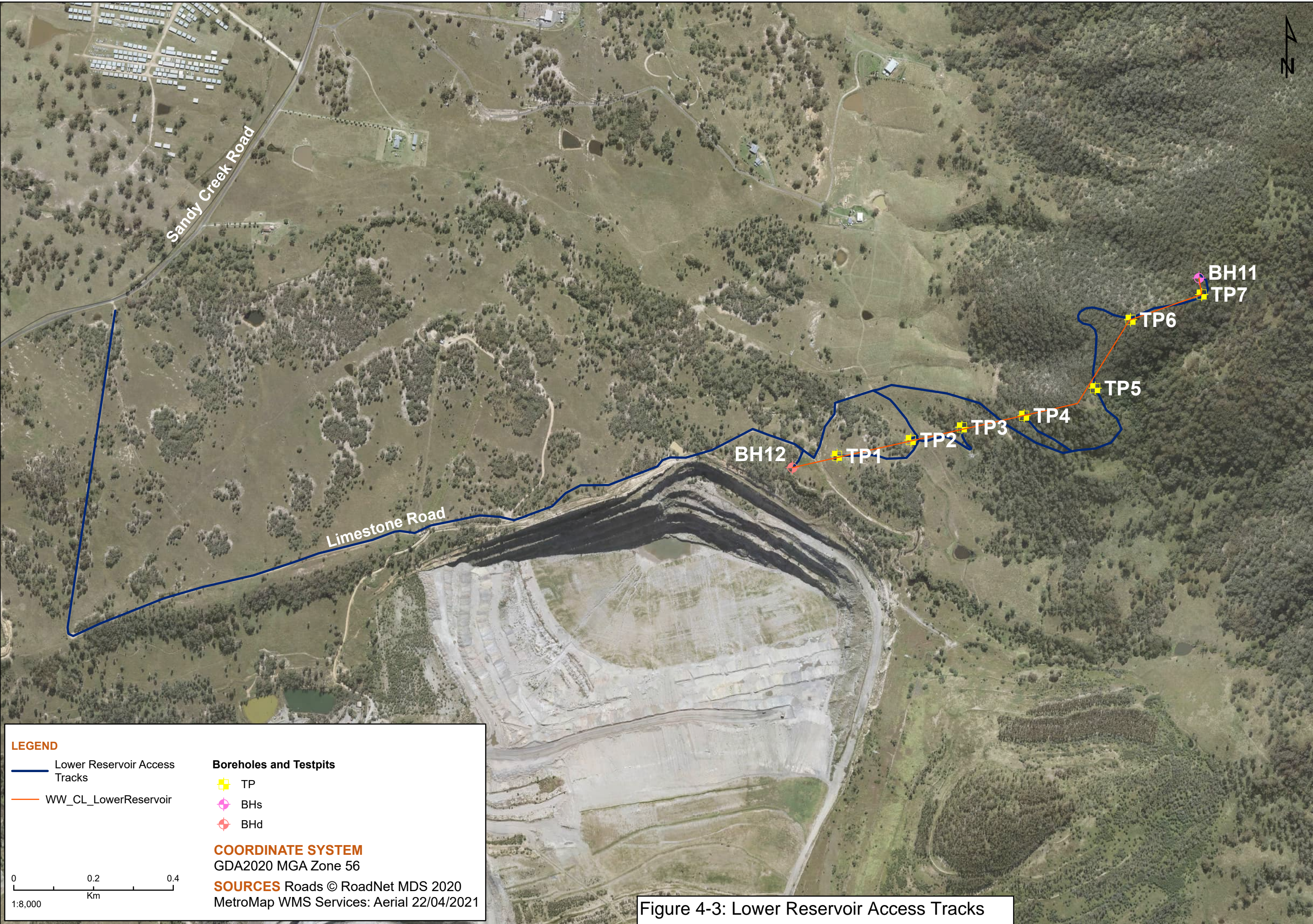
Figure 4-2: Typical drilling equipment set up

4.3 Site Access

Existing site access tracks would be used to access as close as practicable to proposed investigation locations where possible. These access tracks include existing dirt tracks off Sandy Creek Road and over grassed areas. New access tracks will be created in the lower areas of Bells Mountain within the Muswellbrook Coal Mine site area with locations chosen to minimise vegetation clearing. Access tracks which are improved/created during the geotechnical investigation would be maintained to facilitate future site access, subject to suitable erosion controls.

Site access would be appropriately delineated so that disturbance to the Site is minimised so far as is reasonably possible. Site access would be via Limestone Road, off Sandy Creek Road.

From Limestone Road, the existing dirt tracks would be used so far as is reasonably possible. The access routes are shown in Figure 4-3.



LEGEND

— Lower Reservoir Access Tracks
— WW_CL_LowerReservoir

Boreholes and Testpits

TP
BHs
BHd

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020
MetroMap WMS Services: Aerial 22/04/2021

0 0.2 0.4
Km
1:8,000

Figure 4-3: Lower Reservoir Access Tracks

Minor disturbance to existing access tracks would be required to facilitate safe site access for workers. The disturbance would be limited to:

- Placement of clean rock fill material, including geofabric separation, across a drainage depression to enable vehicles to safely cross the depression without becoming bogged and causing further impacts
- Filling in of eroded sections of the access track with clean, free draining rock fill, to facilitate safe access for vehicles.

Enabling works would also be undertaken including minor filling around existing culverts where the existing ground has eroded.

4.4 Geotechnical Drilling

Boreholes would be drilled using a large track mounted drilling rig. Borehole drilling activities would be supported by a tracked rod carrier, and 4x4 Service Vehicle (SVs) and Light Vehicles (LVs).

Boreholes would be drilled to between depths of 200 m-300 m below ground level. The boreholes would initially be advanced using auger drilling techniques. Casings would be installed to the top of rock level to facilitate water flush return.

The boreholes would be advanced through rock using HQ3 wireline drilling techniques. Water would be continually circulated in baffled mud tanks located adjacent to the boreholes. Water would be supplied by truck mounted water carts and would be stored onsite using 5,000 litre poly tanks.

Excess drilling water and cuttings would be stored in a lined 6 m³ waste skip bin, located in the delineated and fenced off laydown area. Waste would be removed by a suitable waste management contractor.

Rock core recovered during drilling would be initially stored in core trays and on pallets within the delineated laydown area. Upon completion of the drilling investigation, the core trays and pallets would be removed offsite.

A typical borehole arrangement is shown in Figure 4-4 below.

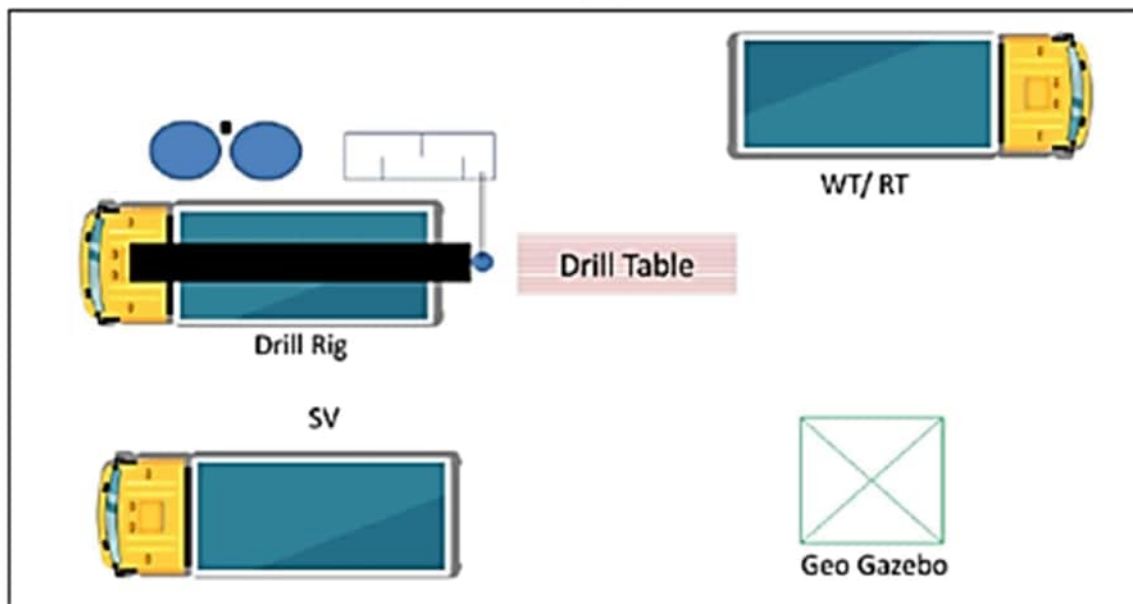


Figure 4-4: Typical borehole arrangement

4.5 Drill Stem Testing

Drill stem testing is a form of open hole well test that is used to gather permeability data. Drill seam testing is proposed in a number of boreholes. The drill seam testing is undertaken at the completion of drilling whilst the drilling rig is in position over the borehole.

An 86 mm outer diameter four stage inflatable tool is used to perform the tests. The tool is set at a specified depth and the hole pressurised. Permeability data is then obtained during the test.

The testing is undertaken using a 4x4 SV.

4.6 In situ Stress Testing

The geotechnical investigation works contractor would undertake in situ measurements of rock stresses using the over-core ANZI Cell stress measurement technique. This in situ testing is undertaken progressively down the borehole whilst the drill rig is in position.

ANZI strain cells are placed down the hole and set in place using a resin. The test is usually completed overnight, allowing for the resin to set in place overnight.

Rock core is then recovered using an over-core tool and samples obtained dispatched to a laboratory for testing.

The testing is undertaken using a 4x4 SV.

4.7 Borehole Imaging

Borehole imaging would be undertaken by a specialist subcontractor, progressively or at the completion of each borehole. The downhole imaging would comprise optical and acoustic imaging, with a sonic logging profile also obtained from the hole.

A 4x4 LV would be used to transport the imaging equipment to the Site and a winch used to lower the imaging equipment down the hole.

4.8 Borehole Decommissioning

Upon completion of borehole drilling and in situ testing, boreholes would be decommissioned. This would involve either of the following:

- Installation of fully grouted vibrating wire piezometers and data logger
- Backfilling with full grout.

Boreholes would be decommissioned following completion of all drilling, testing, and imaging. This would be within 28 days of completing the hole.

4.9 Site Rehabilitation

The drilling and geotechnical investigations may require the construction of temporary, level drilling pads. These are required to create safe level set up areas for the drilling rig. These pads would be formed by creating a small cut/fill profile on the hillside where the rig is due to be set up. Environmental controls, including silt fencing or hay bales, would be used downgradient to minimise any offsite sedimentation. Refer to Table 6-4 below.

The geotechnical investigations are likely to take around two to three months to complete, depending on weather and drilling progress. Whilst every effort would be made to minimise daily vehicle movements in and out of the Site, some minor wheel tracking is likely to occur.

Upon completion of the drilling and geotechnical investigations, including removal of the temporary laydown area, the geotechnical investigation works contractor would undertake a site walkover and inspection with JV and MCC to determine the extent of any rehabilitation works required. Rehabilitation works are likely to involve:

- Reinstating areas where a cut/fill bench was created

- Re-seeding drill sites or areas not required to be used by the geotechnical investigations and which are not required for future site access
- Undertaking maintenance works including erosion control of temporary access tracks
- Removal of all equipment and environmental controls.

Access tracks which are improved/created during the geotechnical investigation would be maintained to facilitate future site access, subject to suitable erosion controls.

4.10 Test Pitting

Up to seven test pits would be excavated using a track mounted excavator. A 20 tonne excavator would be used for the test pits.

The test pits would be excavated up to 5 m deep and 4 m in length. Benching is often required to facilitate safe access and to expose materials in the pit. A geotechnical engineer would log the soils and rock encountered, take photographs, and collect soil samples for laboratory testing.

Each test pit could take up to two hours to complete. The work area will be delineated with flagging tape. The test pits would be backfilled with excavated spoil upon completion of logging and photography.

4.11 Geophysical Survey Work

Geophysical survey using seismic refraction tomography (SRT) may be undertaken. The process involves placing a series of non-destructive geophones on the ground surface, connected by cables. A signal is generated in the ground using an accelerated weight drop (hammer) on the back of a 4x4 LV. Return signals are collected using the geophones.

4.12 Exempt Survey and Mapping Works

Prior to the geotechnical investigations being undertaken, it may be necessary to undertake geophysical survey and mapping work using minor equipment and excavation works only. These geophysical survey works would generate negligible environmental impacts only and meet the various criteria for exempt development within NSW. As such, it is considered that these geophysical survey works may be undertaken as exempt development, under Clause 2.30 of *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*.

5. Statutory Assessment

5.1 Legislation

This Section 5.1 provides an assessment of the geotechnical investigations against the relevant provisions of Section 4.15 (Evaluation) of the EP&A Act, and the following statutory instruments:

- *Environmental Planning and Assessment Act 1979*
- *Environmental Planning and Assessment Regulation 2021*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Biodiversity Conservation Act 2016*
- *National Parks and Wildlife Act 1974*
- *Protection of the Environmental Operations Act 1997*
- *Water Management Act 2000*
- *Heritage Act 1977*
- *Local Land Services Act 2013*
- *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*
- *State Environmental Planning Policy (Resources and Energy) 2021*
- *State Environmental Planning Policy (Transport and Infrastructure) 2021*
- *State Environmental Planning Policy (Resilience and Hazards) 2021*
- *Muswellbrook Local Environmental Plan 2009*
- *Muswellbrook Development Control Plan 2009*
- Applicable Planning Agreements and Contributions Plans.

5.1.1 Environment and Planning Legislation

5.1.1.1 *Environmental Planning and Assessment Act 1979*

Section 1.5(1) of the EP&A Act provides the meaning of “development” in NSW includes any of the following:

- The use of land
- The subdivision of land
- The erection of a building
- The carrying out of a work
- The demolition of building or work
- Any other act, matter or thing that may be controlled by an environmental planning instrument.

Section 1.4(1) of the EP&A Act defines “work” as follows:

work includes any physical activity in relation to land that is specified by a regulation to be a work for the purposes of this Act but does not include a reference to any activity that is specified by a regulation not to be a work for the purposes of this Act.

The **carrying out** of a work includes –

- a. *the renewal of, the making of alterations to, or the enlargement or extension of, a work, or*
- b. *enclosing a public place in connection with the carrying out of a work.*

The proposed geotechnical investigations would meet this broad definition of a “work” under the EP&A Act and would therefore constitute “development” under the same. Section 5.1.2.1 below confirms the geotechnical investigations’ permissibility against the *Muswellbrook Local Environment Plan 2009* (MLEP 2009).

This DA has therefore been prepared and provided for MSC’s determination under Part 4 of the EP&A Act to facilitate approval of the proposed geotechnical investigations.

As this DA also seeks a Controlled Activity Approval to undertake works on waterfront for those portions of the Site which are within the C3 Environment Management zone (refer to Section 5.1.2.1), the geotechnical investigations also constitute Integrated Development under Section 4.47 of the EP&A Act.

5.1.1.2 Environmental Planning and Assessment Regulation 2021

Part 2 of Schedule 3 of the EP&A Regulation lists those development types which meet the criteria for assessment as Designated Development (where an Environmental Impact Statement is required to be prepared). However, the geotechnical investigations do not meet the criteria for classification as Designated Development under Schedule 3, as it does not involve any of the following related activities:

- Clause 26 Extractive Industries
- Clause 45 Waste Management Facilities or Works.

Dirty water and drill cuttings would be removed from the Site and disposed of offsite by a licensed contractor during the geotechnical investigations. However, this sort of activity, undertaken to support geotechnical investigations within an active Mining Lease area, does not meet the classification as an Extractive Industry or Waste Management.

5.1.2 Environmental Planning Instruments

5.1.2.1 Muswellbrook Local Environment Plan 2009

The Site is subject to the provisions of the MLEP 2009. Lots at the Site are zoned RU1 Primary Production and C3 Environmental Management under MLEP 2009, as set out in Table 5-1, Table 5-2 and Figure 5-1 below.

Table 5-1: Site Zoning Summary under the MLEP 2009

Lot/DP and Address*	Zone
Lot 1 DP1004305, Coal Road Muswellbrook	RU1 – Primary Production
Lot 1 DP723294, Coal Road Muswellbrook	C3 – Environmental Management RU1 – Primary Production
Lot 62 DP752484, Coal Road Muswellbrook	C3 – Environmental Management
Lot 1 DP184481, Coal Road Muswellbrook	C3 – Environmental Management RU1 – Primary Production
Lot 180 DP627509, Sandy Creek Road Muswellbrook	RU1 – Primary Production
Lot 60 DP752484, Coal Road Muswellbrook	RU1 – Primary Production
Lot 61 DP1113302, Coal Road Muswellbrook	C3 – Environmental Management RU1 – Primary Production
Lot 44 DP1112699, 374 Sandy Creek Road Muswellbrook	C3 – Environmental Management RU1 – Primary Production
Lot 100 DP666041, Coal Road Muswellbrook	C3 – Environmental Management

*Note that land parcels included in this Table include some land parcels which are required to facilitate site access only. Crown Lands reserves are also part of the land parcels requiring site access and physical works.

Table 5-2: Muswellbrook LEP 2009 zonings applicable to the Site

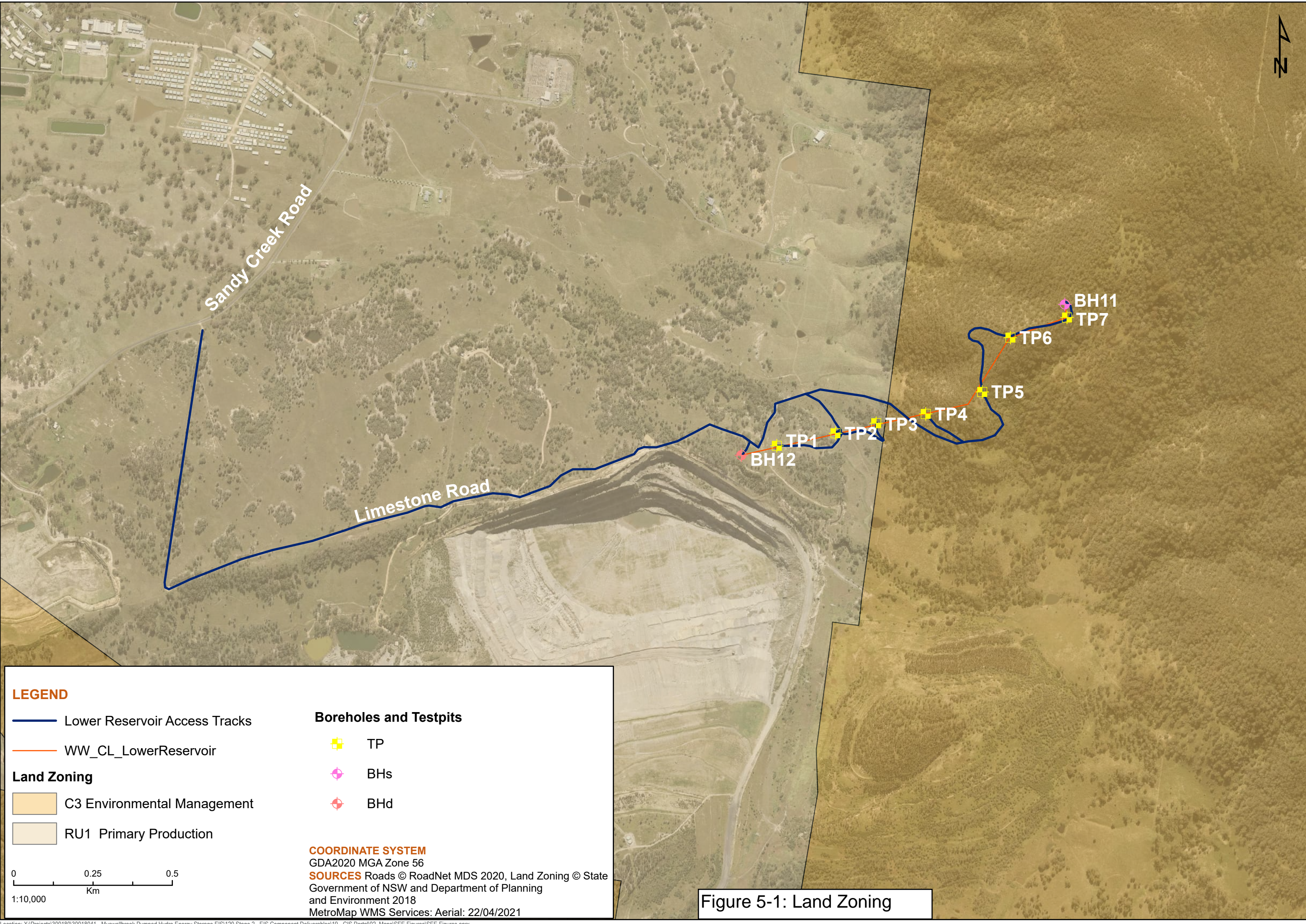
Existing zones**Zone C3 Environmental Management**

1. Objectives of the zone	<ul style="list-style-type: none"> To protect, manage and restore areas with special ecological, scientific, cultural, or aesthetic values. To provide for a limited range of development that does not have an adverse effect on those values. To maintain, or improve in the long term, the ecological values of existing remnant vegetation of significance including wooded hilltops, river valley systems, major scenic corridors, and other local features of scientific attraction. To limit development that is visually intrusive and ensure compatibility with the existing landscape character. To allow agricultural activities that will not have an adverse impact on the environmental and scenic quality of the existing landscape. To promote ecologically sustainable development. To ensure that development in this zone on land that adjoins land in the land zoned E1 National Parks and Nature Reserves is compatible with the objectives for that zone.
2. Permitted without consent	Extensive agriculture; Home occupations.
3. Permitted with consent	Air transport facilities; Animal boarding or training establishments; Bed and breakfast accommodation; Camping grounds; Caravan parks; Cellar door premises; Dwelling houses; Eco-tourist facilities; Environmental facilities; Environmental protection works; Farm buildings; Farm stay accommodation; Flood mitigation works; Home-based child care; Home businesses; Home industries; Information and education facilities; Intensive plant agriculture; Oyster aquaculture; Pond-based aquaculture; Recreation areas; Recreation facilities (outdoor); Research stations; Roads; Rural worker's dwellings; Secondary dwellings; Sewerage systems; Tank-based aquaculture; Water supply systems.
4. Prohibited	Industries; Local distribution premises; Multi dwelling housing; Residential flat buildings; Retail premises; Seniors housing; Service stations; Warehouse or distribution centres; Any other development not specified in item 2 or 3.

Zone RU1 Primary Production

5. Objectives of the zone	<ul style="list-style-type: none"> To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. To encourage diversity in primary industry enterprises and systems appropriate for the area. To minimise the fragmentation and alienation of resource lands. To minimise conflict between land uses within this zone and land uses within adjoining zones. To protect the agricultural potential of rural land not identified for alternative land use, and to minimise the cost to the community of providing, extending, and maintaining public amenities and services. To maintain the rural landscape character of the land in the long term. To ensure that development for the purpose of extractive industries, underground mines (other than surface works associated with underground mines) or open cut mines (other than open cut mines for the surface of the flood plain), will not: <ul style="list-style-type: none"> Destroy or impair the agricultural production potential of the land or, in the case of underground mining, unreasonably restrict or otherwise affect any other development on the surface, or
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Existing zones	
	<ul style="list-style-type: none"> — Detrimentially affect in any way the quantity, flow, and quality of water in either subterranean or surface water systems, or — Visually intrude into its surroundings, except by the way of suitable screening. • To protect or conserve (or both): <ul style="list-style-type: none"> — Soil stability by controlling development in accordance with land capability, and — Trees and other vegetation, and — Water resources, water quality and wetland areas, and their catchments and buffer areas, and — Valuable deposits of minerals and extractive materials by restricting development that would compromise the efficient extraction of those deposits.
6. Permitted without consent	Extensive agriculture; Home occupations; Intensive plant agriculture.
7. Permitted with consent	Air transport facilities; Airstrips; Animal boarding or training establishments; Aquaculture; Camping grounds; Caravan parks; Cellar door premises; Cemeteries; Community facilities; Crematoria; Depots; Dwelling houses; Eco-tourist facilities; Educational establishments; Environmental facilities; Environmental protection works; Extractive industries; Farm buildings; Flood mitigation works; Forestry; Function centres; Group homes; Hazardous industries; Health consulting rooms; Heavy industrial storage establishments; Helipads; Highway service centres; Home-based child care; Home businesses; Home industries; Industrial retail outlets; Information and education facilities; Intensive livestock agriculture; Kiosks; Landscaping material supplies; Open cut mining; Places of public worship; Plant nurseries; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor); Research stations; Restaurants or cafes; Roads; Roadside stalls; Rural industries; Rural supplies; Rural worker's dwellings; Secondary dwellings; Service stations; Sewerage systems; Signage; Storage premises; Take away food and drink premises; Tourist and visitor accommodation; Transport depots; Truck depots; Turf farming; Veterinary hospitals; Waste disposal facilities; Water supply systems.
8. Prohibited	Any development not specified in item 2 or 3.



LEGEND

— Lower Reservoir Access Tracks

— WW_CL_LowerReservoir

Land Zoning

C3 Environmental Management

RU1 Primary Production

Boreholes and Testpits



TP



BHs



BHd

COORDINATE SYSTEM

GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020, Land Zoning © State Government of NSW and Department of Planning and Environment 2018

MetroMap WMS Services: Aerial: 22/04/2021

Figure 5-1: Land Zoning

The proposed geotechnical investigations do not constitute a significant scope of physical works for the Site, do not include any built form works and would not require any subdivision works to be undertaken. It is therefore considered that these geotechnical investigations would not lead to land fragmentation within the Site or the broader locality. Given that the Site of the proposed geotechnical investigations is within the buffer lands of what was recently an active coal mine, it is considered that these geotechnical investigations would not conflict with the primary use of this broader site. Section 6.4 of this SoEE specifies that the geotechnical investigations can be undertaken without generating significant noise or vibration impacts for surrounding sensitive receptors.

The proposed geotechnical investigations would not create any significant visual or landscape character impacts, given that these would only take up to three months to complete.

Section 6.4 advises 'The nearest residential building has been identified to be approximately 0.5 km from the nearest borehole site. At this distance, the works are assessed to comply with the safe working distance for potential building damage Pile boring as described in Table 5-3 and are not expected to result in vibration levels above the human comfort criteria.' Resonate 2020.

Section 6.10 explains how erosion and sediment controls would be installed at the Site to manage surface runoff. This would be done in accordance with the Blue Book (*Managing Urban Stormwater, Soils and Construction, Volume 1*, (NSW Government 2004) and *Volume 2E, Mines and Quarries* (DECC 2008)). Section 6.10 sets out management measures to ensure there are no significant biodiversity impacts generated by the proposed geotechnical investigations. It is also considered that the proposed geotechnical investigations can be undertaken without significant impacts to surface or groundwater systems within the locality.

Overall, the proposed geotechnical investigations are consistent with the objectives of the RU1 Primary Production zone under the MLEP 2009 as follows:

- Sections 6.1.4 and 6.10 of this SoEE sets out management measures to ensure there are no significant biodiversity impacts generated by the proposed geotechnical works. The proposed geotechnical investigations would not create any significant visual or landscape character impacts, given that these works would only take around 12 weeks to complete
- The proposed geotechnical investigations are intended to support the potential future provision of PHES at the Site, which is considered to be a superior form of electricity generation from an ecological sustainability perspective when compared to the current open cut thermal coal mining operations. Moreover, it is considered that the proposed geotechnical investigations would not create any unacceptable environmental impacts contrary to the principles of ecologically sustainable development
- The Site does not adjoin land which is zoned C1 National Parks and Nature Reserves. As such, there is no need to consider the objectives of that zone.

Moreover, the proposed geotechnical investigations are consistent with the objectives of the C3 Environmental Management zone under the MLEP 2009 as follows:

- The Site is not mapped under the MLEP 2009 as containing any special ecological scientific, cultural, or aesthetic values. In any event, this SoEE has demonstrated that the potential for impacts to such matters at the Site is minimal
- It is considered that the potential impacts of the geotechnical investigations can be mitigated to an appropriate level of impact
- Currently there are various land uses which are permitted within the C3 Environmental Management zone of the site. However, the proposed geotechnical investigations would be temporary only, and so would not encroach upon any permissible land uses
- The site is not mapped under the MLEP 2009 as containing a significant visual corridor. Nevertheless, the proposed geotechnical investigations would not significantly impact on the rural and vegetation character values of this Site. In terms of visual character and aesthetics, the geotechnical investigations would not have any lasting impact, and would have only a negligible to minimal impact given the broader land use context of mine rehabilitation activities taking place on land adjacent land
- The geotechnical investigations do not constitute an agricultural activity
- The geotechnical investigations will support an overall PHES project which is considered to exemplify ecologically sustainable development, as it involves the reuse of a brownfield coal mine final void in order to

generate renewable energy that can be used to augment existing gaps in the NSW renewable energy market (by providing supplementing electricity during times of peak needs, and as needed).

The proposed geotechnical investigations are most appropriately characterised as being for ‘earthworks’ under the *Standard Instrument – Principal Local Environmental Plan* (Standard Instrument) and the MLEP 2009. Under both of these Environmental Planning Instruments, ‘earthworks’ “means excavation or filling.”

Earthworks are deemed development types under the Standard Instrument and are therefore not subject to the Land Use Table of the MLEP 2009. The proposed geotechnical investigations are therefore permissible with consent at the Site, as these are development types which may not be prohibited. This is the case as Direction 5 of the Standard Instrument lists those development types which are both defined in NSW and which may be included in any LEP Land Use Table – ‘earthworks’ is not included in that list.

Subclause 7.6(2)(b) of the MLEP 2009 provides that a separate development consent must be provided for earthworks unless they are ancillary to another development for which consent has already been given (or if the proposed earthworks are otherwise exempt). Subclause 7.6(2) is extracted below:

7.6 Earthworks

.....

(2) Development consent is required for earthworks unless –

(a) the work is exempt development under this Plan or another applicable environmental planning instruments, or

(b) the work is ancillary to other development for which development consent has been given.

As consent for the future PHES scheme has not been provided at the Site, and is not being sought at the current time, it is therefore necessary to apply for an earthwork’s DA only at this stage.

The proposed geotechnical investigations are therefore permissible with consent in the first instance within both the RU1 Primary Production and C3 Environmental Management zones, as these are development types which may not be prohibited in a Land Use Table, and for which consent is required under clause 7.6 of the MLEP 2009.

In response to the specific matters for consideration under clause 7.6(3):

- The geotechnical investigations can be undertaken without causing any detrimental impacts to the existing drainage patterns or soil stability of the locality (refer to Sections 6.7, 6.8 and 6.10)
- The geotechnical investigations would involve the Site being effectively rehabilitated once the geotechnical investigations are completed, meaning that future development of the Site would not be affected by the geotechnical investigations
- As set out in Section 6.6, around 60 tonnes of dirty water and drill cuttings is expected to be removed from the Site and disposed of offsite by a suitable waste management contractor
- It is considered that the geotechnical investigations can be undertaken without causing any significant impacts for surrounding receivers (refer to Sections 6.4 and 6.10)
- As set out in Sections 5.1.6 and 6.2, the geotechnical investigations would not disturb any recorded Aboriginal Heritage items, and there is no need to apply for an Aboriginal Heritage Impact Permit under Section 90 of the NP&W Act to facilitate the geotechnical investigations. As set out in Section 6.3, the geotechnical investigations would not impact on any non-Aboriginal heritage items
- It is considered that the geotechnical investigations can be undertaken in compliance with Section 120 of the POEO Act (refer to Section 5.1.10). The Site is not located within a mapped drinking water catchment. The Site also does not meet the definition of an Environmentally Sensitive Area under clause 3.3. of the MLEP 2009
- As such, it is considered appropriate for MSC to grant consent for the geotechnical investigations.

5.1.2.2 Muswellbrook Development Control Plan 2009

An assessment of the geotechnical investigations against the relevant provisions of the Muswellbrook Development Control Plan 2009 (DCP 2009) is provided in Table 5-3.

Table 5-3: Assessment against Muswellbrook DCP 2009

	Detail	Proposed	Complies?
Section 8 – Rural & Environmental Zone Development			
8.3.2 Vegetation	(i) Identification and control of developments which are expected to impact on the areas of remnant vegetation as determined and mapped by The Vegetation of Central Hunter Valley NSW project represented in Council's native vegetation mapping layer.	Section 6.1 of this SoEE and Appendix A Biodiversity Assessment set out how existing, native vegetation at the Site has been surveyed and identified as belonging to three separate Plant Community Types corresponding to identified ecological communities listed under the EPBC Act and/or the BC Act.	Yes
	(ii) The clearing of native remnant vegetation or protected regrowth on properties (excluding permitted activities) which are zoned as rural or rural residential must receive appropriate approval from the Catchment Management Authority (CMA) in regard to the Native Vegetation Act 2003.	The <i>Native Vegetation Act 2003</i> was repealed on 25 August 2017 with provisions covering the clearing of native vegetation transferred to the <i>Local Land Services Act 2013</i> and the BC Act. This DA seeks consent for clearing up to a total of 0.4387 ha of vegetation considered to be equivalent to Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC under the BC Act and Central Hunter Valley eucalypt forest and woodland CEEC under the EPBC Act, which may be cleared as part of the borehole drilling works from within the investigation areas.	Yes
	(iii) The approval of any clearing in regard to native remnant vegetation or protected regrowth within the definitions of the Native Vegetation Act 2003 will only be granted by the CMA if the clearing will improve or maintain environmental outcomes.	The small-scale extent and temporary nature of the proposed works is unlikely to result in significant impacts to these communities (refer to Section 6.1 Biodiversity for more details).	Yes
	(iv) Any clearing of native remnant vegetation or protected regrowth which is deemed to be 'permitted clearing' under the definitions of the Native Vegetation Act and which does not require CMA approval, is to be undertaken as per the requirements of the Act and to ensure that clearing is limited only to those areas deemed necessary for the development.	The geotechnical investigations do not propose such a clearing.	Not Applicable

	Detail	Proposed	Complies?
	(v) The provisions of Clause 5A of the Environmental Planning and Assessment Act 1979 may require the submission of a flora and fauna assessment report with the development application. See the guidelines for submitting applications in section 3 of this DCP.	This has been provided as Appendix A Biodiversity Assessment.	Yes
8.3.3 Riparian buffers	(i) A riparian buffer area is generally defined as the area located within 40 m of each bank of a river, stream, creek, tributary or other natural water course.	As set out in Section 5.1.12, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the Site.	Yes
	(ii) Avoid undertaking works within riparian buffer areas where other options are available. Any project within the riparian buffer area is accompanied by a detailed consideration of the environmental impacts associated with the project and alternative options considered and reasons why those alternatives are not viable.	As set out in Section 5.1.12, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the Site.	Yes
	(iii) Consideration of habitat connectivity during the assessment of developments which may impact on watercourses and riparian vegetation	In some cases of stream crossings along access tracks, gravel fill is required to stabilise vehicle movement. The proposal would not involve any permanent in-stream works and would not impact on the connectivity of watercourse and riparian vegetation habitats.	Yes
	(iv) If works associated with development are required to occur within riparian buffer areas, Council will not grant consent to the development unless it is satisfied that appropriate measures are incorporated to: - <ul style="list-style-type: none"> • Maintain stream bank and riparian stability • Manage and prevent erosion and sedimentation through appropriate controls in accordance section 20 of this DCP • Maintain or restore native vegetative cover • Minimise the disturbance to in stream habitats such as 	As set out in Section 5.1.12, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the Site. However, as the geotechnical investigations comprise temporary works only (around three months in length) which would be rehabilitated once finalised, and as the streams at the Site are ephemeral only, it is considered that the geotechnical investigations would not impact on surround surface water systems in terms of water quality or their hydrodynamic functionality. Section 6.10 of this SoEE explains how erosion and sediment controls would be installed at the Site to manage surface runoff. This would	Yes

	Detail	Proposed	Complies?
	gravel beds, snags, aquatic macrophytes etc. <ul style="list-style-type: none"> • Protect water quality • Implement rehabilitation and restoration measures following disturbance 	be done in accordance with the <i>Blue Book (Managing Urban Stormwater, Soils and Construction, Volume 1</i> , (NSW Government 2004) and <i>Volume 2E, Mines and Quarries</i> (DECC 2008)).	
	(v) Works proposed within the W1 zone demonstrate compliance with the provisions of “Policy and Guidelines – Aquatic Habitat Management and Fish Conservation 1999”, produced by the Department of Primary Industries where works are proposed in riparian buffer areas.	The geotechnical investigations would not comprise any works within the W1 zone.	Not Applicable
	(vi) The decline of riparian vegetation is listed by the Fisheries Management Act as a key threatening process. The assessment of activities which involve an impact on riparian vegetation must take this into consideration and may be required to receive concurrence or approval from the Department of Primary Industries.	The ephemeral streams at the Site fall outside of the mapped Key Fish Habitat under <i>the Fisheries Management Act 1994</i> .	Not Applicable
Important Notes	Any works which occur within proximity to a watercourse may require permits, approvals, or licences from other bodies such as the NSW Department of Water & Energy or the Department of Primary Industries. It is the responsibility of the proponent to establish the requirement for additional permits or approvals.	Such a permit is being sought under the WM Act (refer to Section 5.1.12).	Yes
8.3.4 Management of Rivers, Creeks, Streams	(i) Consideration of existing flow regimes of natural water courses which may be impacted by activities or developments	As the geotechnical investigations comprise temporary works only (around 12 weeks in length) which would be rehabilitated once finalised, and as the streams at the Site are ephemeral only, it is considered that the geotechnical investigations would not impact on surround surface water systems in terms of water quality or their hydrodynamic functionality.	Yes
	(ii) Large scale or high-density developments to be located in areas located alluvials zones.	The geotechnical investigations do not constitute a large scale or high-density development.	Not Applicable

	Detail	Proposed	Complies?
	(iii) Mitigation and/ or treatment of water quality impacts from land use activities or development (iv) Assessment of increased flows to natural water courses and drainage channels during the preparation of development applications and supporting documentation.	As the geotechnical investigations comprise temporary works only (around three months in length) which would be rehabilitated once finalised, and as the streams at the Site are ephemeral only, it is considered that the geotechnical investigations would not impact on surround surface water systems in terms of water quality or their hydrodynamic functionality.	Yes
	(v) Consideration of habitat connectivity during the assessment of developments which may impact on watercourses and riparian vegetation.	The geotechnical investigations would not involve any in-stream works and would therefore not impact directly on watercourse habitats.	Yes
	(vi) any activities which require additional permits or approvals to be obtained by the applicant or landholder.	As set out in Section 5.1.12, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the Site.	Yes
Section 20 – Erosion and Sediment Control			
20.2 Erosion and Sediment Control Planning	An Erosion and Sediment Control Plans (ESCP) is essential for any development with potential to cause significant soil erosion and sedimentation. The greater the potential for these impacts the more detailed the plan.	Section 6.10 of this SoEE explains how erosion and sediment controls would be installed at the Site to manage surface runoff. This would be done in accordance with <i>Blue Book (Managing Urban Stormwater, Soils and Construction, Volume 1 (NSW Government 20004) and Volume 2E, Mines and Quarries (DECC 2008))</i> . Section 6.10 sets out management measures to ensure there are no significant biodiversity impacts generated by the proposed geotechnical works. It is also considered that the proposed geotechnical investigations can be undertaken without significant impacts to surface or groundwater systems within the locality.	Yes
Section 24 – Waste Minimisation and Management			
Submission/ Application Requirements	A Site Waste Management Plan is required to be prepared.	Waste management matters are responded in Section 6.6.	Yes
Section 25 – Water Management			
25.6 Plans	Soil and Water Management Plans Soil and water management are required for all development where site disturbance is greater than 1,000 m ² .	These matters are dealt with in a comprehensive Environmental Management Plan which is being prepared to support the geotechnical investigations.	Yes

5.1.2.3 State Environmental Planning Policy (Resources and Energy) 2021

As MCC's mining leases are still active, it is relevant to consider the applicability of *State Environmental Planning Policy Resources and Energy 2021* (Resources and Energy) SEPP.

Part 2.2 of the Resources and Energy SEPP sets out a range of ancillary land uses which are permissible with or without consent with respect to mining. However, for the proposed geotechnical investigations to be considered permissible under the (Resources and Energy) SEPP, they would have to serve the dominant purpose of mining. Rather, the proposed geotechnical investigations are intended to support the potential future provision of PHES at the Site.

Overall, the proposed geotechnical investigations do not require any approvals under the (Resources and Energy) SEPP.

Some of the geophysical survey and mapping works which would be undertaken prior to the geotechnical investigations can be considered exempt development under Clause 2.13(2) of the (Resources and Energy) SEPP which allows the following without development consent:

- Geological mapping and airborne surveying
- Sampling and coring using hand-held equipment
- Geophysical (but not seismic) surveying and downhole logging
- Accessing of areas by vehicle that does not involve the construction of an access way such as a track or road
- However, not all of the proposed works will be undertaken within existing Mining Lease areas. Therefore, this clause is not entirely relied upon for these geotechnical investigations.

5.1.2.4 State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) sets out a range of provisions relating to electricity generation and supply, none of which apply to the proposed geotechnical investigations at this preliminary investigation stage. As the future PHES project progresses, these matters would be considered as part of a future DA package of works at the Site.

It is acknowledged that the geotechnical investigations would not:

- Meet any threshold for traffic generating development under Schedule 3 of T&I SEPP
- Require any additional infrastructure to be provided at the Sites
- Require any additional consultation to be undertaken with the owner of nearby electricity transmission infrastructure, as the Applicant.

5.1.2.5 State Environmental Planning Policy (Resilience and Hazards) 2021

Chapter 4: Remediation of land, Section 4.6 of *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience SEPP) provides that a consent authority must not consent to the carrying out of any development on land unless:

- a) It has considered whether the land is contaminated, and
- b) If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and
- c) If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

Given that the Site of the geotechnical investigations are located within the buffer lands of an operating coal mine, and that the locality has an agricultural history, it is possible that there may be existing contamination present at the Site. However, as the current DA only relates to geotechnical investigations, which would be backfilled, decommissioned, and remediated at completion, there is no need to consider whether the Site, in its current state, is suitable from a contamination perspective to support a geotechnical investigation.

As the geotechnical investigations do not relate to a change of use specified in Section 4.6 of the Resilience SEPP (residential, educational, recreational, or childcare purposes, or for the purposes of a hospital), there is moreover no requirement to undertake a preliminary investigation report to support the broader PHES project.

5.1.2.6 Any Proposed Draft Instrument

There are no proposed or draft instruments that have been the subject of public consultation, and that are relevant to the geotechnical investigations.

5.1.3 Contributions

5.1.3.1 Voluntary Planning Agreement

MCC and Muswellbrook Shire Council entered into a Voluntary Planning Agreement (VPA) on 13 February 2018.

Clause 4 of this VPA specifies that it:

Will apply to all future coal mining and rehabilitation activities as currently approved in the Development Consent and any further modifications to the Development Consent, up until the scheduled end of mining on 31 December 2022 and the end of the Life of Project (for the purposes of rehabilitation activities) but excluding any modification of condition 7 of the Development Consent that increases the limits on production to greater than two million tonnes per annum of product coal.

As such, the existing VPA does not relate to the geotechnical investigations.

5.1.3.2 Muswellbrook Section 94 Contribution Plan 2001

The Muswellbrook Section 94 Contributions Plan 2001 relates to development within the entire Muswellbrook Shire area. However, the geotechnical investigations do not appear to be a development-type which is triggered for Section 7.11 (formerly Section 94) contributions to be made payable, as the geotechnical investigations would not increase the demand for public amenities or services within the area (as is specified under the EP&A Act).

5.1.3.3 Muswellbrook Shire Council Section 94A Development Contributions Plan 2010

The Muswellbrook Shire Council Section 94A Development Contributions Plan 2010 does not relate to land on which Section 94 contributions have been previously paid as part of a DA, including for subdivision works. It is considered that Section 94 Contributions would have already been paid for the Site when the Muswellbrook Coal Mine originally approved for operations. As such, the geotechnical investigations are exempt from the Muswellbrook Shire Council Section 94A Development Contributions Plan 2010.

5.1.4 Environment Protection and Biodiversity Conservation Act 1999

MNES listed under the EPBC Act and relevant to the proposed works comprise one CEEC, which was identified within the proposed geotechnical investigation and access track upgrade areas. The Biodiversity Assessment concluded that significant impact to these communities was unlikely given the temporary nature and small spatial extent of the proposed works (refer to Section 6.1 and Appendix A).

A self-assessment has concluded that the geotechnical investigations do not require referral to DCCEEW under the EPBC Act, as the geotechnical investigations are not anticipated to have a significant impact on MNES.

5.1.5 Biodiversity Conservation Act 2016

The geotechnical investigations work would occur in areas of known threatened communities, listed as EECs under the BC Act. The assessment undertaken to inform this SoEE concluded that significant impact to these communities was unlikely given the temporary nature and small spatial extent of the proposed works (refer to Section 6.1 and Appendix A Biodiversity Assessment).

The investigation area does not contain any Areas of Outstanding Biodiversity Values declared under the BC Act nor do they contain mapped biodiversity values as per the Biodiversity Values Map and Threshold Tool.

5.1.6 National Parks and Wildlife Act 1974

Aboriginal objects, whether recorded or as yet undiscovered, are afforded statutory protection under the NP&W Act. The Aboriginal Heritage Assessment did not discover any recorded artefacts within the areas proposed for geotechnical investigations, and none are recorded at the Site. The assessment undertaken to inform this SoEE concluded that there is a very low risk that activities to be undertaken for the geotechnical investigations would impact sub-surface Aboriginal artefacts (refer to Section 6.2 and Appendix B Aboriginal Heritage Assessment).

As such, there is no need to apply for an Aboriginal Heritage Impact Permit under Section 90 of the NP&W Act. No approval is required under the NP&W Act.

5.1.7 Local Land Services Act 2013

This DA seeks consent for clearing up to a total of 0.4387 ha of vegetation considered to conform to Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions EEC under the BC Act and Central Hunter Valley eucalypt forest and woodland CEEC under the EPBC Act, which may be cleared as part of the borehole drilling works within the investigation areas. In order to facilitate vehicle and plant access to the Site, it would also be necessary to prune a *Eucalyptus crebra* tree along the main access track. This is not a tree pruning activity to which an exemption is provided for under Schedule 5A to the *Local Land Services Act 2013*. The DA for the proposed geotechnical investigations would therefore seek approval to clear vegetation.

5.1.8 Heritage Act 1977

No non-Aboriginal heritage items were identified within the geotechnical investigation areas (refer to Section 6.3). As such, the geotechnical investigations are not anticipated to impact any non-Aboriginal heritage items and no permit is required to be obtained under the *Heritage Act 1977*.

5.1.9 Rural Fires Act 1997

Section 100B of the *Rural Fires Act 1997* requires that a Bushfire Safety Authority must be obtained for subdivision on bushfire prone land facilitating rural residential or residential development, or for any development on bushfire prone land for a 'special fire protection purpose.'

The Site is subject to various categories of bushfire prone land mapping under the MLEP 2009.

The geotechnical investigations do not seek to subdivide the Site and does not comprise a special fire protection purpose as defined in Section 100B (6) of the *Rural Fires Act 1997*. As such, no further consideration of the *Rural Fires Act 1997* is required.

5.1.10 Protection of Environment Operations Act 1997

The geotechnical investigations do not constitute a scheduled activity as listed in Schedule 1 to the *Protection of the Environment Operations Act 1997* (POEO Act) and which would therefore trigger an Environment Protection Licence (EPL) application through the NSW Environment Protection Authority. Although item 19 of Schedule 1 relates to Extractive Activities, this would only become an EPL regulated activity where the resulting extractive materials are processed for the primary purpose of resale. The soil and rock materials which would be removed during the geotechnical works would not meet this criterion.

Groundwater aquifers at the Site are expected to be encountered/intercepted during the geotechnical investigations. However, given the proximity of the proposed boreholes to the existing open pit mine, along with proposed safeguards and management measures, drilling works are considered unlikely to contaminate or interconnect groundwater resources, or lead to a reduction in groundwater levels.

It is therefore considered that the works can be undertaken in compliance with Section 120 of the POEO Act with regard to preventing water pollution. No approvals are required under the POEO Act.

5.1.11 Waste Avoidance and Resource Recovery Act 2001

Waste management procedures during the construction of the geotechnical investigations should aim to decrease the amount of waste generated and recycle or reuse materials where possible and minimise any pollution or hazard

caused by waste through appropriate disposal. Waste solutions should be prioritised according to the Waste Management Hierarchy, as outlined in the *Waste Avoidance and Resource Recovery Act 2001*. In order of importance these priorities are:

- Avoid unnecessary resource consumption
- Reduce waste generation and disposal
- Re-use waste resources without further manufacturing
- Recycle waste resources to make the same or different products
- Recover waste resources, including the recovery of energy
- Treat waste before disposal, including reducing the hazardous nature of waste
- Dispose of waste only if there is no viable alternative.

The following waste related mitigation measures should be implemented during construction where possible to minimise risk of impact and disposal in landfill by maximising waste avoidance, resource recovery, reuse, and recycling:

- Minimise waste generation through:
 - Recovery of mature vegetation including large timbers for use in fauna habitat enhancement and/or mulched for use as erosion and sediment control, landscaping, and revegetation
 - Recovery of topsoil for use in landscaping and revegetation
 - Recovery of spoil for use as fill where the spoil is geotechnically appropriate
 - Recovery of spoil for use as fill where the spoil is geotechnically appropriate
 - Calculate bill of quantities appropriately to prevent over ordering of materials (i.e., concrete, steel)
 - During construction, provide for recycling as well as general waste collection
- Minimise risk of environmental impact:
 - Where viable, import recovered or recycled materials for use during construction
 - Disposal of waste (including contaminated wastes) is to be offsite and undertaken by an adequately licensed sub-contractor to an appropriately licensed facility
 - Staff should be trained in appropriate chemical handling, storage, and use
 - Ensure sufficient waste storage facilities are available onsite, with appropriate bunding/protection and access to spill kits
 - Waste storage and stockpile locations are to be determined during the detailed design phase and located appropriately (i.e., away from watercourses)
 - Regular removal of waste to appropriate facility
 - Ensure vehicles and equipment are regularly maintained to reduce emissions.

The Waste Levy will be applicable to all waste generated from the geotechnical investigations that is disposed of in landfill. Opportunities to minimise waste disposed at landfill should be identified in the planning and detailed design stage and carried out during construction and operation (as outlined below). In addition, some wastes disposed to landfill may be eligible for an exemption from the levy (e.g., clean earth). Further wastes may be eligible for exemption by application including contaminated land and others as outlined in the Protection of the Environment Operations (Waste) Regulation 2014.

The NSW EPA 'Levy regulated area and levy rates' is applicable to most waste disposed of in landfill. The 2022–23 waste levy rates apply from 1 July 2022. In line with the Waste Regulation, the rates have increased from the previous year. The Consumer Price Index, and the calculated Regional Levy Area fees are \$87.30 per tonne.

There will be opportunities to minimise waste generation and disposal to landfill during the planning, design, construction, and operational phases. Some opportunities that should be explored include:

- The design should seek to minimise resource use by utilising materials generated by construction (e.g., mulch from cleared vegetation and clean spoil from earthworks)
- Giving preference to construction materials that will reduce the direct and indirect waste generated
- Minimising waste from construction through identification of required sizes, volumes of materials at the planning and design phase
- Identifying the closest licensed facilities for the types of waste to be generated and ensuring that the facility has capacity to accept the materials (note that regulated wastes, recyclable, reusable, or residual materials may require separate management facilities)
- Planning of construction works should consider opportunities and potential efficiencies for minimising transport of waste and resources (e.g., Re-use, use of larger vehicle to minimise journeys to receiving facility)
- Specifying waste reduction measures in contract documentation including using recycled materials where appropriate
- Investigating beneficial use options for water treatment residuals (i.e., sludge).

5.1.12 Water Management Act 2000

The geotechnical investigation drilling site falls within the *Water Sharing Plan for the Hunter Regulated River Water 2016* and is therefore subject to the provisions of the WM Act. Section 91 of the WM Act provides that there are two types of activity approvals which may apply to works within NSW, being Controlled Activity Approvals and aquifer interference approvals.

Controlled Activity Approvals are required where works are proposed to be undertaken on waterfront land. Waterfront land is defined under the Dictionary to the WM Act as being:

- The bed of any river and a line drawn parallel to 40 m inland from the highest riverbank, or
- The bed of any lake and a line drawn parallel to 40 m inland from the highest lake shore, or
- The bed of any estuary and a line drawn parallel to 40 m inland from the estuary mean high water mark, or
- The bed of coastal waters and a line drawn parallel to 40 m inland of the mean coastal high-water mark.

River is defined under the WM Act to include:

- Any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and
- Any tributary, branch, or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and
- Anything declared by the regulations to be a river, whether or not it also forms part of a lake or estuary but does not include anything declared by the regulations not to be a river.

Clause 3(2) of the *Water Management (General) Regulation 2018* (WM Regulation) clarifies that the following are declared to be a river under the WM Act:

- Any watercourse, whether perennial or intermittent and whether comprising an artificial channel that has changed the course of the watercourse
- Any tributary, branch, or other watercourse into or from which a watercourse referred to in a paragraph (a) flow.

The proposed geotechnical investigation works would be undertaken within the vicinity of ephemeral storage dams. This includes online dams which are connected to ephemeral tributaries of Sandy Creek, with the nearest permanent water sources being located around 4.5 km west and 5 km south respectively. The ephemeral streams onsite have been characterised as 1st, 2nd, and 3rd order streams. Minor filling works may be required to be undertaken around existing culverts at the Site where the existing ground has eroded.

There may be a need to undertake the proposed geotechnical investigations within 40 m from these existing, ephemeral storage dams. As such, a controlled activity permit to carry out works on waterfront land may be required.

In terms of aquifer interference, both the initial geophysical survey works, and the later geotechnical investigations meet the criteria for a defined minimal impact aquifer interference activity under Section 3.3 of the *Aquifer Interference Policy* (Department of Primary Industries: Office of Water 2012), as they would fall within the following description:

Core holes, stratigraphic (chip) holes, geo-environmental and geotechnical bores, works or activities (the latter as listed in AS 1726) intersecting the water table if they are decommissioned in such a way as to restore aquifer isolation to that which existed prior to the construction of the bore, work, or activity and that the decommissioning is conducted within a period of 28 days following completion of the bore, work, or activity.

Groundwater is likely to be intercepted at the Site. However, it is considered that the initial geophysical survey and mapping works would not reach sufficient depths to intercept groundwater at the Site (between 100 mm-200 mm) and can be undertaken without an aquifer interference approval in place.

Clause 7(2)(f), Part 1 of Schedule 4 to the *Water Management General Regulation 2018* clarifies that a person is not required to obtain an access licence to take water under the WM Act where the relevant activity comprises an aquifer interference activity for the purposes of a geotechnical investigation, and no more than 3 megalitres of water is taken in a calendar year. Therefore, even though groundwater would be taken from the drilled boreholes, no water additional access licence is required to be obtained. For this exemption to be applied, the following conditions must be followed:

- Record water taken for which the exemption is claimed, and
- Make the record not later than 24 hours after water is taken, and
- Make the record in an approved form and manner, and
- Keep the record for a period of five years, and
- Give the record to the Minister in an approved form and manner:
 - Not later than 28 days after the end of the water year in which the water was taken, or
 - If the Minister directs the person in writing to give the record to the Minister on an earlier date, by that date.

In any event, MCC already holds three Water Access Licences over Muswellbrook Coal Mine as follows:

- Water Access Licence WAL39806
- Water Access Licence WAL41503
- Water Access Licence WAL41521.

As this DA would be referred to DPE – Water as Integrated Development, the suitability to these existing Water Access Licences to facilitate the proposed geotechnical investigation works would be established during that consultation.

As the minor stream crossing works would also traverse the C3 Environmental Management zone at the Site, it has been identified that these works cannot be considered exempt under Clause 23, Part 1 of Schedule 4 to the WM Regulation. Rather, approval is sought for these minor stream crossing works as part of this DA.

A controlled activity approval to undertake works on waterfront land would be required under Section 91(2) of the WM Act. This would be sought as part of the Integrated Development referrals process during the DA assessment. This DA also seeks consent for the minor stream crossing works.

5.1.13 Matters Prescribed by the Regulations

None of the matters prescribed under Clause 61 of the EP&A Regulation relate to the scope of the geotechnical investigations.

5.1.14 Any Submissions Received

Following public notification of the DA it is anticipated that Council Officers would consider the content of any submissions received in accordance with Section 4.15 of the EP&A Act.

6. Evaluation of Likely Impacts of Development

6.1 Biodiversity

An assessment of potential impacts from geotechnical investigation activities on biodiversity values of the investigation area was undertaken. This comprised a desktop review of relevant information, site investigations, risk, and impact assessments (refer to Appendix A Biodiversity Assessment).

6.1.1 Assessment Methodology

6.1.1.1 Desktop review

Database searches and literature reviews were undertaken to identify threatened species, populations, and Threatened Ecological Communities (TECs) that have been recorded or are predicted to occur within the locality. A likelihood of occurrence table was compiled to assess the likelihood of each of the threatened species identified during desktop research being present within the study area. The assessment was based on habitat requirements in the Threatened Biodiversity Profiles Database, PlantNet, species profiles and scientific literature where available. It includes consideration of location of nearby records and observation dates, presence of key habitat features and information about species populations in the area.

6.1.1.2 Site Inspection

Field surveys were carried out by two ecologists from 22-23 August 2022 and from 26-28 October 2022. Surveys comprised:

- Rapid data points were conducted to check for presence of native vegetation communities. Information collected included the dominant species for major structural layers – the canopy, shrub layer and ground layer. Additional species were also collected if they were relevant to providing diagnostic evidence to a potentially present TEC in the location
- Habitat assessments were conducted at each of survey sites. The presence of microhabitat features such as large trees hollow-bearing trees, fallen logs, grass tussocks and logs were noted for each survey site. Occurrences of hollow-bearing trees clearly within the path of access tracks or geotechnical test sites were mapped
- Targeted threatened flora surveys were conducted for species listed as threatened under the EPBC and/or BC Acts and assessed with regard to a moderate or higher likelihood of occurring in the study area. Surveys incorporated the use of transects to search for target species in areas of potential habitat
- Species with a moderate or higher likelihood of occurrence in the study area based on recent records and the availability of suitable habitat within the study area were targeted during the fauna survey period. Survey techniques used included diurnal bird census, active reptile searches, spotlighting and call playback.

Detailed survey methods, locations, target species and survey limitations are described in Section 2.2 of the Biodiversity Assessment report (Appendix A Biodiversity Assessment).

The 'study area' for this biodiversity assessment comprises:

- The length of the proposed access tracks with a buffer of 10 metres from each side of the centre of the alignment
- The survey sites (geotechnical investigation pads and an additional three sites along the access tracks), with a 20 metre buffer from the centre of the pads (Figure 6-1).

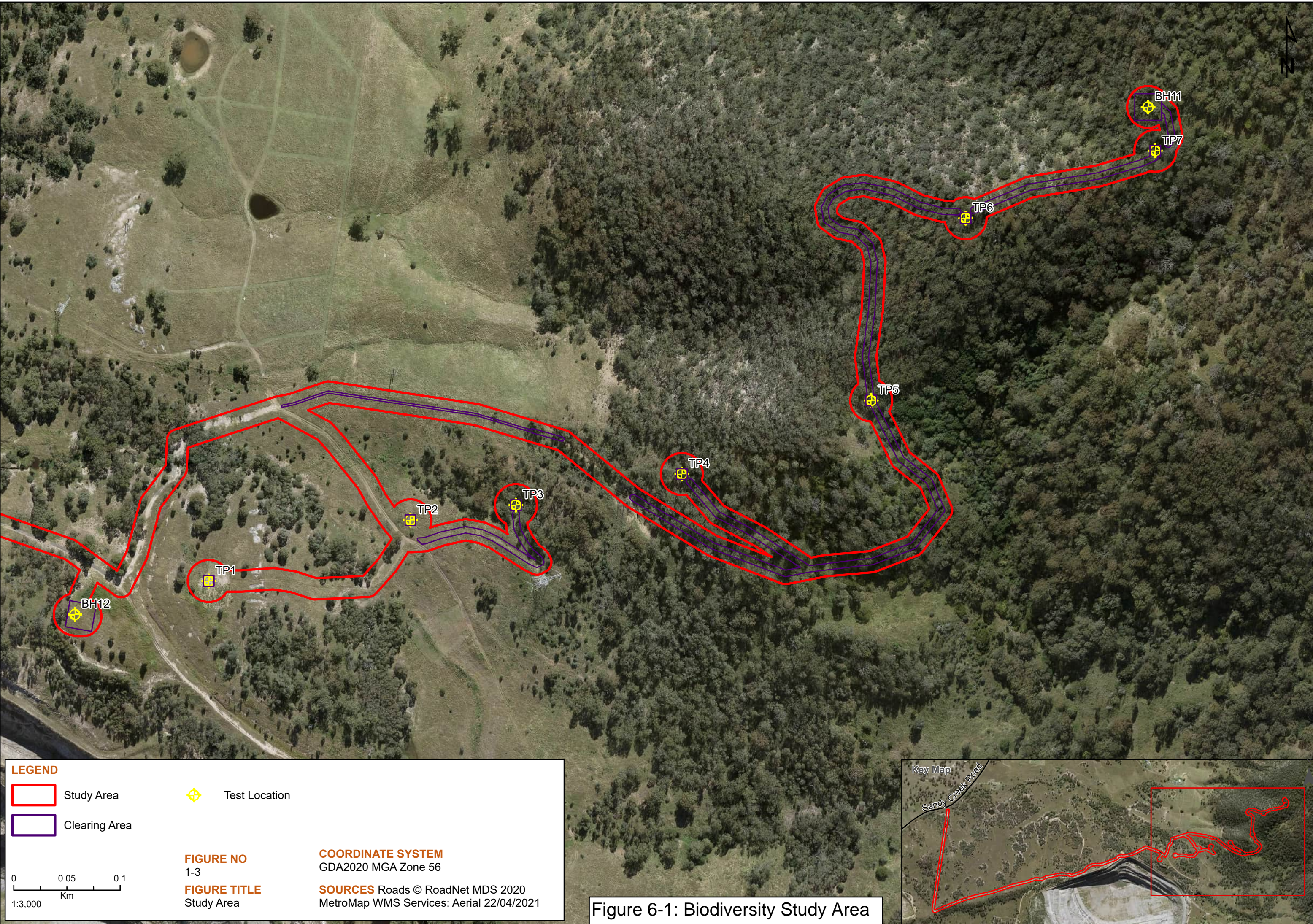


Figure 6-1: Biodiversity Study Area

6.1.2 Existing Environment

6.1.2.1 Vegetation communities

Five native vegetation communities and one non-native community were identified in the study area:

- PCT 1605: Narrow-leaved – Native Olive Shrubby Open Forest of the Central and Upper Hunter
- PCT 1608: Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter
- PCT 1691: Narrow-leaved Ironbark – Grey Box Grassy Woodland of the Central and Upper Hunter
- PCT 1543 Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley
- PCT 796: Derived Grassland of the NSW South Western Slopes
- Non-native areas, highly disturbed without native dominant vegetation cover.

6.1.2.2 Threatened Ecological Communities

TECs that have been identified as within the study area. However, works have been sited to avoid direct impacts to these TECs. These TECs are as follows:

- Central Hunter Grey Box-Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions (Endangered under the BC Act)
- Central Hunter Valley eucalypt forest and woodland (Critically Endangered under the EPBC Act).

6.1.2.3 Threatened flora

The desktop assessment identified five threatened flora species with a moderate likelihood of occurring in the study area. None of the threatened flora species were recorded in the study area during the field surveys. Assessments of significance determined that the geotechnical investigations are unlikely to have a significant impact on any of these species.

6.1.2.4 Threatened fauna

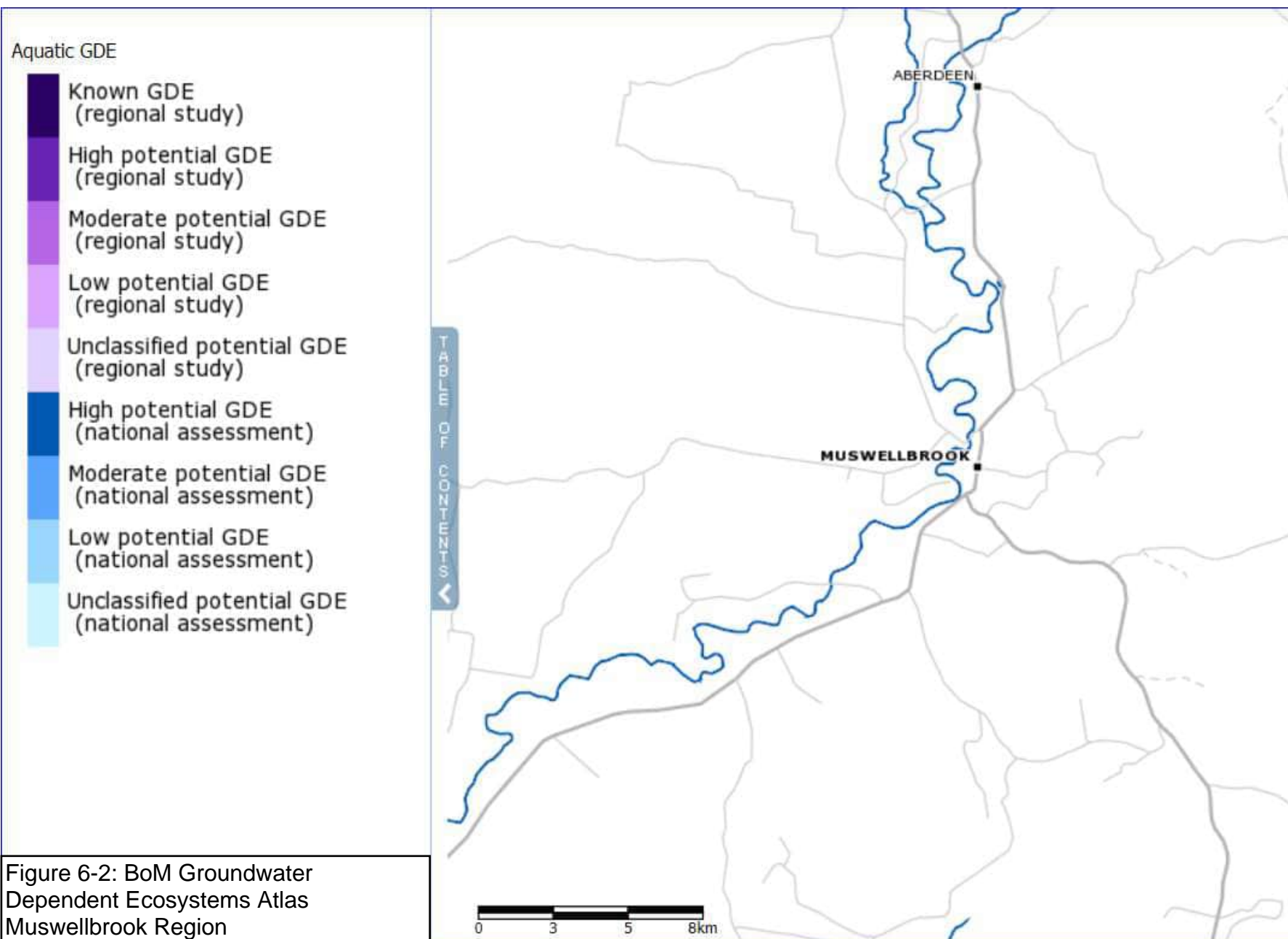
Eight fauna species were identified as having a high likelihood of occurrence in the study area based on the availability of suitable habitat and recent nearby sightings. One EPBC listed vulnerable species, the Speckled Warbler (*Chthonicola sagittata*), was recorded during the October 22 surveys. Assessments of significance determined that the geotechnical investigations are unlikely to have a significant impact on any threatened fauna species.

The study area and surrounding landscape contains habitat features suitable for supporting a range of native species. Hollow-bearing trees containing large hollows were observed in the study area. Fallen logs also occur in areas with more mature vegetation.

6.1.2.5 Groundwater Dependent Ecosystems

A desktop review was undertaken to determine the presence of groundwater dependent ecosystems (GDEs). GDEs are defined as “ecosystems that require access to groundwater to meet all or some of their water requirements, so as to maintain their communities or plants animals, ecological processes and ecosystem services” (DPE 2020).

A search of the national atlas of GDEs (BoM 6 January 2023) identified the potential for GDEs in proximity to the proposed geotechnical investigation area. The closest GDE was associated with the Hunter River and no potential GDEs were shown to occur within the geotechnical investigation area. Refer to Figure 6-2.



6.1.3 Assessment of Impacts

6.1.3.1 Direct impacts

The geotechnical investigations will result in the following direct impacts:

- Clearing of approximately 0.908 ha of native vegetation, which does not contain any TECs as currently listed under the BC Act or the EPBC Act
- Removal of threatened species habitat, including 0.855ha of threatened fauna habitat
- Possible fauna injury or mortality as a result of habitat disturbance
- Key threatening processes including bushrock removal, clearing of native vegetation, loss of hollow-bearing trees and removal of dead wood and dead trees.

6.1.3.2 Indirect impacts

The geotechnical investigations may result in the following indirect impacts: Increase in edge effects as a result of vegetation clearing

- Introduction and spread of weeds and exotic flora
- Invasion and spread of pests
- Invasion and spread of pathogens and disease
- Increase in noise, light, and vibration
- Temporary change to surface runoff and sedimentation.

6.1.4 Mitigation and Management Measures

The location of test pits and boreholes has been established to avoid and minimise where possible impacts on vegetation and to fauna and their habitats.

To prevent and mitigate any direct and indirect impacts on adjacent vegetation and threatened species habitat refer to Section 6.10, including Table 6-4.

6.2 Aboriginal Cultural Heritage

6.2.1 Assessment Methodology

An assessment of the impacts from geotechnical investigation works and creation of access tracks on Aboriginal heritage included desktop and register searches, including areas for where there is elevated potential for Aboriginal objects to be present below ground surface and also Aboriginal places. The study area included borehole locations identified as BH11 and BH12 and test pits TP1 to TP7 along with associated access tracks. This assessment was required to take into consideration the potential Aboriginal heritage impacts of these geotechnical activities in the lower reservoir area in accordance with the *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (NSW Minerals Council 2010). The assessment has also been undertaken in accordance with the principles in the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010a), *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010b) and statutory requirements under the NPW Act to the assessment comprised the following tasks:

- Review of existing archaeological data, including assessments previously completed within the vicinity of the study area and relevant heritage databases (Aboriginal Heritage Information Management System (AHIMS))
- Investigation of the environmental context of the study area

- Synthesis of the background information into a predictive model to inform an assessment of archaeological potential across the study area
- Completion of an archaeological field survey of the study area to test the results of the predictive model and further inform an assessment of archaeological potential.

The Aboriginal heritage assessment is intended to meet statutory due diligence in relation to the borehole and test pit investigation works and access tracks required to mobilise geotechnical drilling equipment for the lower reservoir site having regard to above mention legislation, in particular the NPW Act. The investigation based on desktop research and supported by observations made during field work at and around the lower reservoir access track and geotechnical investigation sites is not a full Aboriginal Cultural Heritage Assessment Report (ACHAR) for development of the broader PHES project but is designed to inform this DA for geotechnical investigations.

This report assumes that the standard provisions of the NP&W Act will apply to these geotechnical investigation works in the lower reservoir site. An Aboriginal Heritage Impact Permit (AHIP) is not considered to be required for activities identified as 'low impact' activities by the *National Parks and Wildlife Regulation 2019* (clause.58). The legislation allows for permissible 'low impact' activities to occur, which includes drilling and/or geophysical subsurface investigations. These activities are considered low risk to cause damage to Aboriginal objects. Refer to Appendix B Aboriginal Heritage Assessment report by Extent Heritage 2022.

6.2.2 Existing Environment

The lower reservoir is located on the western slopes of Bells Mountain 4.4 km northwest of Muswellbrook and 2 km southwest of McGullys Gap. The Site is located northeast of Pit 2 Muswellbrook coal mine. The study area is characterised by shallow soils over occasional sandstone outcrops, increasing in number with elevation. The mountain's flanks include gullies between steep rock faces that appear to include rocky overhangs with potential for past Aboriginal heritage. The Hunter River is about 7 km to the west which is fed by a number of creeks less than 2 km distance.

Two field survey works were undertaken in the area which had experienced significant rainfall over the preceding three years, after prolonged dry seasons. This caused thicker grass and vegetation cover than that characterised by Extent Heritage in previous investigation of the lower reservoir area during the due diligence field survey work in December 2020.

Bells Mountain is located close to stone resources suitable for artefact manufacture. Prior to the area's settlement it contained abundant flora and fauna suitable for exploitation by Aboriginal people, and water sources were located in the vicinity. The area includes rocky overhangs that have potential for past human habitation and as such the area has high potential for archaeological evidence of Aboriginal habitation. While Aboriginal occupation can produce a wide variety of archaeological material, the following site types are most common in the Muswellbrook region:

- Subsurface scatters and isolated artefacts
- Open camp sites
- Quarry sites
- Scarred trees
- Grinding groves
- Rock shelters
- Ceremony places.

Previous disturbance was assessed by reviewing historical aerial photographs of the study area to assess processes that can reduce the potential for Aboriginal cultural heritage sites. These can include physical processes that have disturbed the ground surface such as erosion, faunal and floral intrusions into deposits, human habitation, and land clearing and development activities. Historical aerial photographs were reviewed for the years 1958, 1964, 1972 and 1993. The most significant change in the immediate surrounds of the study area is the location of the open cut mine visible in the 1993 aerial. The study area had been mostly cleared of tree cover by 1958, with all but the eastern end of the study area, at Bells Mountain, almost devoid of trees at that time. Refer Appendix B Aboriginal Heritage Assessment Extent Heritage report Table 1 A series of historical aerals of the study area.

The AHIMS database search undertaken on 3rd December 2019 (AHIMS ID:469320) informing four registered sites within close proximity (<100 m) of the proposed geotechnical works was confirmed by updated search on 7th November 2022. In consideration of these findings provided in following Figure 6-3, it should be noted many archaeological sites included in the database have not been ground-truthed by archaeologists. The findings have alerted the Extent Heritage archaeologist to the potential for sites being present within the study area. Refer to Appendix B Aboriginal Heritage Assessment Extent Heritage 2022 report Table 2 AHIMS registered sites in the general vicinity of the study area. Source: AHIMS (2022).




EXTENT

HERITAGE ADVISORS

Bells Mountain Heritage Clearance Works

 Study area

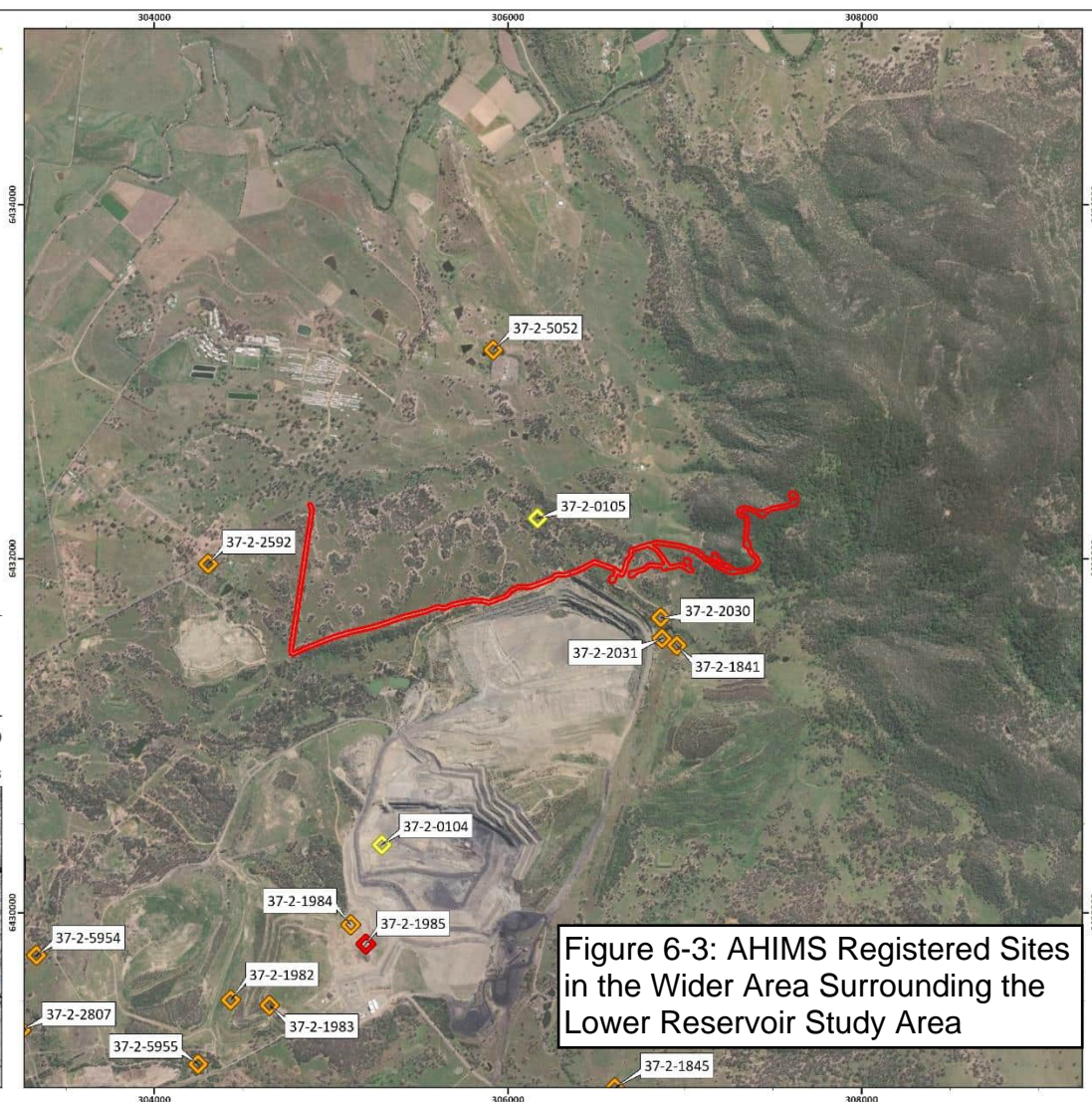
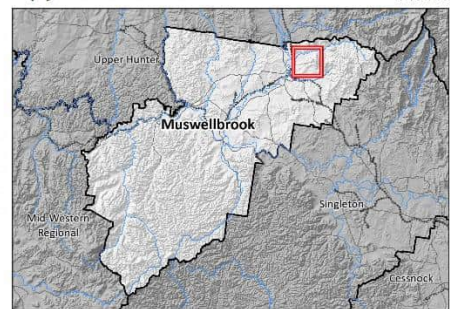
AHIMS search features

-  Art (Pigment or Engraved)
-  Artefact
-  Modified Tree (Carved or Scarred)

Drawn by: Alexander Murphy
 Checked by: Reiner Mantel
 Date: 27 February 2023
 Projection: GDA 1994 MGA Zone 56
 Data sources: Extent, Nearmap, DPIE



0 500 1,000 1,500
 Metres



The study area is not listed on either the National Heritage List or the Commonwealth Heritage List.

6.2.3 Assessment of Impacts

Field surveys by Extent Heritage archaeologist occurred on the 18th and 19th October 22 for lower reservoir Test Pits TP1 to 3 and borehole BH12. A later field survey was undertaken on the 22nd December 22 for borehole BH11 and test pits TP6 and TP7. Figure 6-4 provides location of the lower reservoir test pit and borehole locations.

Section 7.1 of Extent Heritage 2022 report advised 'No Aboriginal artefacts or places were identified during the inspection of BH12, TP1 and TP2'. Ground surface visibility (GSV) for this survey was approximately 10-20%. A drainage line had been cut within the locality and it is evident that this location had already experienced a very high level of disturbance prior to the inspection.'

The area around TP3 was covered in dense scrub with poor GSV. Small (about 10 cm), rough, natural conglomerate cobbles were visible in places, but no Aboriginal objects were identified in this area. TP4 is situated in a highly disturbed, hilly, grassland environment on the lower slopes of Bells Mountain, where the original vegetation has been cleared. The area around TP4 had poor GSV. Patches of conglomerate outcropping along shallow ledges were surveyed for any signs of Aboriginal objects and signs of activity (such as art, charcoal, or visible smoke staining). However, no Aboriginal objects or evidence of Aboriginal activities were found on the outcrop. The track between TP4 and TP5 had poor GSV. No sections of ground were visible.

TP5 was completely obscured by an overgrown fallen tree and area around this location was dense vegetation with no ground surface exposures. Stands of immature ironbark and other gum trees were present in the area. The track between TP5 and TP6 had poor GSV due to thick vegetation cover. A small patch of grass about 90 m south-west of TP6 had some ground exposure where GSV was better. No artefacts or identifiable materials were identified at TP6 (Extent Heritage 2022).

Extent Heritage (2022) states that the location of TP6 was inaccessible due to dense vegetation and there were stands of sticky hop bush approximately 2 m in height. In areas of ground surface exposure, medium sub-angular cobbles were visible at times through the ground cover. No artefacts were identified.

The track between TP6 and TP7 had large conglomerate outcrops along it and displayed no visible signs of working, or art, and the shallow ledges had no visible signs of charcoal or smoke staining (Extent Heritage, 2022). The rest of the track was inaccessible and had poor GSV, with dense scrub making the rest of the track and BH11 and TP7 inaccessible (refer to Appendix B Aboriginal Heritage Assessment report).

EXTENT

HERITAGE ADVISORS

Bells Mountain Heritage Clearance Works

 Study area

 Watercourse

Areas approved for geotechnical works

 Testing locations surveyed

Drawn by: Alexander Murphy

Checked by: Reiner Mantel

Date: 27 February 2023

Projection: GDA 1994 MGA Zone 56

Data sources: Extent, Nearmap, DPIE



0 100 200 300

Metres

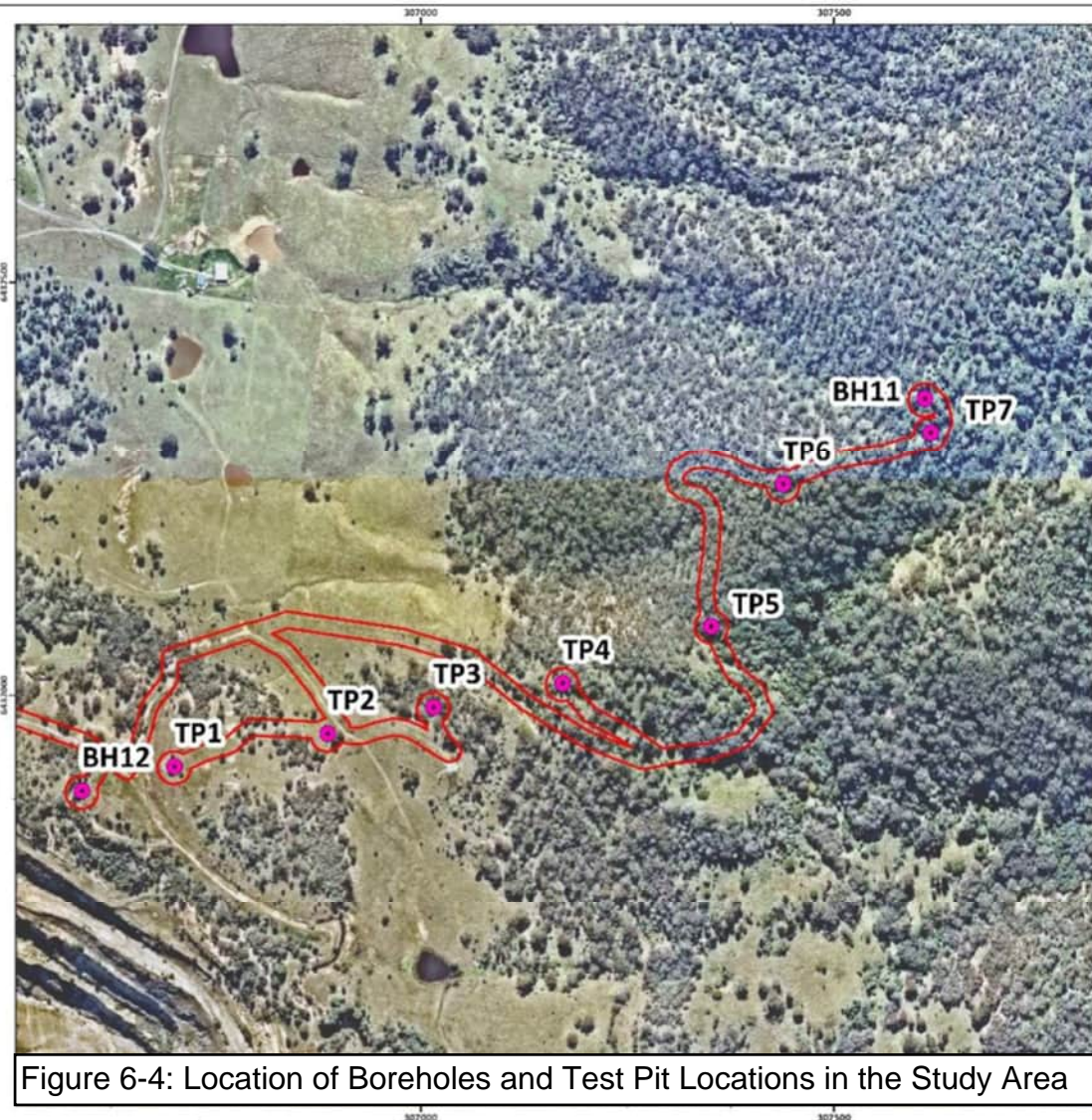


Figure 6-4: Location of Boreholes and Test Pit Locations in the Study Area

6.2.4 Mitigation and Management Measures

The report recommends a cautious approach based on Figure 6-5 below where those parts of the study area that were effectively surveyed are appropriate for works to proceed and those parts where survey was hampered by poor conditions as outlined in the Aboriginal heritage assessment report a cautious approach is required with additional heritage management.

Extent Heritage (2022) states that it is appropriate for the works to proceed in the study area from the access track Sandy Creek road to TP4 and roughly 145m south of TP5 (refer to Figure 6-5). There is low potential for those work to impact Aboriginal objects. Nevertheless, it is recommended that an archaeologist be present to monitor the works in that part of the study area. Should Aboriginal objects be identified in the surface or subsurface deposits, works are to be halted at that specific location until such time a heritage professional can perform an onsite inspection. If the site cannot be avoided the heritage professional will organise consultation with the local Aboriginal representatives and the relevant State government agencies such as DPIE.

To the east of the more effectively surveyed part of the study area including TP5, TP6, TP7 and BH 11, shown in Figure 6-5, a different approach is recommended owing to this area being assessed as having elevated potential for Aboriginal objects. These areas have historically undergone minimal ground disturbance with much of the area never being cleared. Extent Heritage (2022) identifies that it is due to this factor that there is a higher potential for Aboriginal cultural heritage to still exist in situ. It is recommended that before works commence in this area, the Registered Aboriginal Party (RAP) be consulted, observing statutorily defined processes.

It is appropriate for activities to proceed along all existing access tracks (e.g., regarding, movement of heavy vehicles). There is low potential for such activities to impact Aboriginal objects. However, if artefacts are identified during the geotechnical investigations on any access tracks, an AHIP may be required to proceed with the works.

If human skeletal material less than 100 years old is discovered, the *Coroners Act 2009* requires that all works should cease, and the NSW Police and the NSW Coroner's Office should be contacted. Traditional Aboriginal burials (older than 100 years) are protected under the NPW Act and should not be disturbed. In the event skeletal material is found an appropriate skilled anthropologist should be contacted to recommend course of action and if Aboriginal remains, notification of OEH and the Local Aboriginal Land Council will be required.

EXTENT

HERITAGE ADVISORS

Bells Mountain Heritage Clearance Works

- Study area
- Watercourse
- Area requiring RAP consultation
- Area where works can commence
- Areas approved for geotechnical works**
- Testing locations surveyed

Drawn by: Alexander Murphy
 Checked by: Reiner Mantel
 Date: 27 February 2023
 Projection: GDA 1994 MGA Zone 56
 Data sources: Extent, Nearmap, DPIE



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Metres

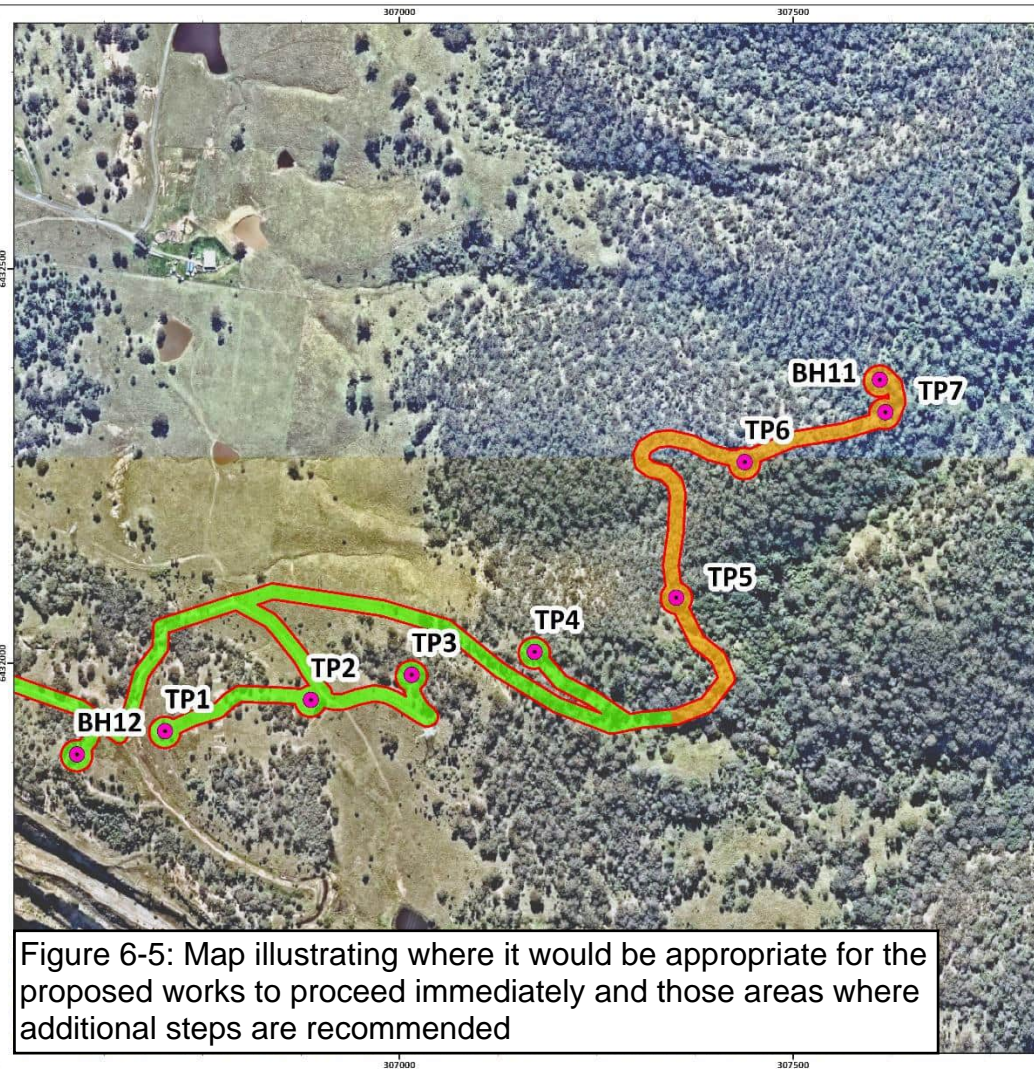


Figure 6-5: Map illustrating where it would be appropriate for the proposed works to proceed immediately and those areas where additional steps are recommended

6.3 Non-Aboriginal Heritage

6.3.1 Methodology

The assessment of non-Aboriginal or European heritage relies upon desktop research of:

- National Heritage List
- Commonwealth Heritage List
- NSW State Heritage Register (SHR)
- MLEP 2009
- National Trust of Australia (NSW)

The desktop review also included a review of studies undertaken in the study area including Indigenous and Non-Indigenous Heritage Study, Muswellbrook Coal Company No.1 Open Cut Extension. Pymble NSW: HLA-Envirosciences Project No U888-4.HLA (2002).

6.3.2 Existing Environment

6.3.2.1 Regional History

The Non-Aboriginal or European heritage of the Upper Hunter Region is reasonably well-established. This includes historical accounts of early European settlement of the Hunter Valley, and the pastoral, urban and industrial development of the region, particularly coal mining.

The Muswellbrook area was first explored by Europeans in 1819. In 1833 surveyor Robert Dixon defined the town plan based on a reserve already set aside for a government village. The first lots were sold in 1834. The towns grew steadily throughout the 1800's to a population of about 1895 in 1911. Agricultural cultivation was among the first activities of European settlers. This included crops, orchards, vineyards, and vegetable production and led to the establishment of associated development. Pastoral activities, primarily cattle grazing and dairying, were also a major part of early European settlement in the region and again led to the development of associated industries (HLA 2002).

The Great Northern Railway was the first railway completed in Muswellbrook in 1869 and the first coal mine opened in the area in the 1890s. In 1907 the Muswellbrook Coal Mine was established, which resulted in an increasing importance of coal mining and power generation in the area.

6.3.2.2 Coal Mining

Coal was discovered in the Hunter region in 1797; however, it wasn't until the 1890s that coal mining began in the Muswellbrook area, although this was limited until the discovery of the Greta Coal Measures and subsequent founding of the MCC in 1907. The continued development of coal mining and subsequently power generation defined the area. Construction of the Liddell Power Station commenced in 1964, and power generation commenced in 1972. This had a dramatic impact on employment, housing, and commerce in the area (HLA 2002).

Prior to mining operations commencing, the land that is now encompassed within the Muswellbrook Coal Mine lease was likely used for agricultural and pastoral purposes.

6.3.2.3 Heritage Register Searches

A summary of heritage register searches for items within 2 km of the proposed geotechnical works is provided in Table 6-1.

Table 6-1: Heritage Registers Search Results

Listing	Search results
Statutory Listings	
National Heritage List	No National Heritage Items within the search area

Listing	Search results
Commonwealth Heritage List	No Commonwealth Heritage Items within the search area
NSW State Heritage Register (SHR)	No SHR listed items within the search area
MLEP 2009	No MLEP 2009 listed items within the search area
Non-Statutory Listings	
National Trust of Australia (NSW)	No National Trust of Australia listed items within the search area

6.3.3 Assessment of Impacts

Noting that no non-Aboriginal heritage items were identified in the study area, it is unlikely that the geotechnical investigations would impact on non-Aboriginal heritage.

6.3.4 Mitigation and Management Measures

While searches for Non-Aboriginal or European heritage did not discover item/s in the area of geotechnical investigation works, if during establishment of access tracks and borehole drilling pads uncover heritage items areas the onsite supervisor will observe the MCC site rules when discovering items with potential heritage values. Should items be uncovered, that may have heritage significance, work is to cease, and advice sought from MCC. Refer to Section 6.10.

6.4 Noise and Vibration

Resonate Consultants (Resonate) were engaged to conduct a noise and vibration assessment for the geotechnical drilling works for lower reservoir site. A summary of the noise and vibration assessment methodology, impacts and management and mitigation measures are provided in following sections. The Resonate 'Geotechnical Investigation Noise and Vibration Assessment' is provided in Appendix C Noise and Vibration Assessment.

6.4.1 Methodology

The Interim Construction Noise Guideline (ICNG) assessment methodology has been adopted by Resonate to develop project-specific construction noise management levels to assess potential impacts and recommend any necessary mitigation and management measures.

The drill boring works will be undertaken during recommended standard hours as defined by the *Interim Construction Noise Guideline* (ICNG, DECC, 2009):

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

Any works outside these hours would be classified as out of hours work requiring separate assessment and approval. The duration of drilling works will be up to a period of three months.

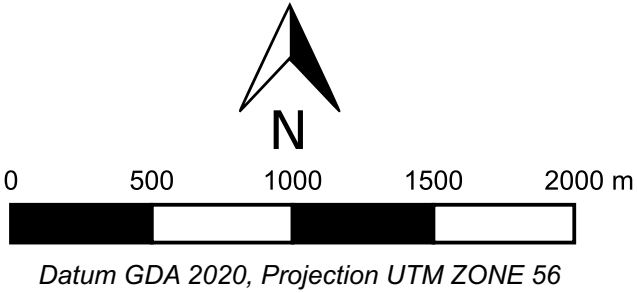
Three calibrated unattended field Rion NL-42 environmental noise loggers were placed in locations UM1, UM2 and UM3 as shown in Figure 6-6 between 11th to 23rd November 22 to determine the background noise level of the nearest sensitive receiver locations. To ensure noise data were captured during periods of favourable weather conditions, half-hourly weather data were obtained from the Bureau of Meteorology (BOM).

Bells Mt, Muswellbrook Geotech Investigations

Noise sensitive receivers

PROJECT NUMBER S210514
DRAWN BY AS
DATE ISSUED February 2023

Legend
● Noise sensitive receivers



Resonate

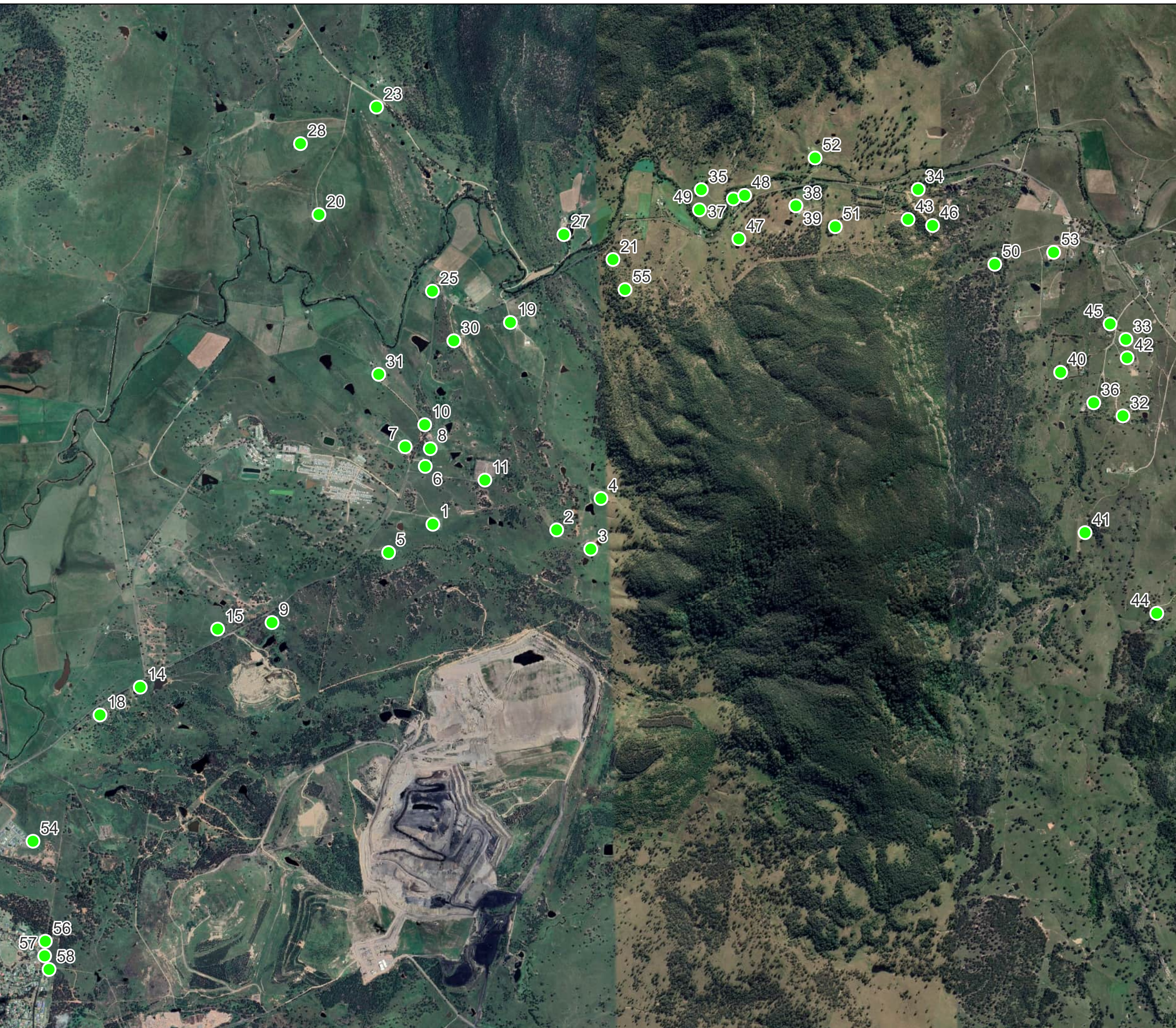


Figure 6-6: Noise Catchment Area (NCA) and noise study area overview

Background noise levels were determined using noise logger data processed in accordance with the procedures contained in the NSW Noise Policy for Industry (NPI, EPA, 2017). The NPI requires that background noise levels are calculated by taking the arithmetic mean noise level that was exceeded for 90% of the time during the assessment period to provide a single rating background noise level (RBL).

Noise emissions for geotechnical drilling works were quantified using noise modelling software (SoundPLAN v8.2 using the CONCAVE calculation algorithm Category 6) to predict the $L_{Aeq(15\text{-minute})}$ noise levels at nearby receivers. Refer to Section 4 Construction noise assessment provided in Resonate report Appendix Geotechnical drilling vibration was assessed in accordance with *Assessing Vibration – a technical guideline* (the Vibration Guideline, DECC 2006).

6.4.2 Existing Environment

Geotechnical investigations will be undertaken within the Muswellbrook Coal Mine site northeast of Pit 2. The surrounding land-uses of the proposed drilling site are detailed below:

- North – Noise sensitive receivers scattered to the north of the Site, including a substation to the north. Nearest sensitive receiver is at a distance of approximately 0.5 km
- West – Distance noise sensitive receivers scattered to the west of the Site. Nearest sensitive receiver is at a distance of approximately 1.4 km
- East – Vegetation and hills (Bells Mountain) are located to the east of the Site with no noise sensitive receivers
- South – Distant noise sensitive receivers scattered to the south of the Site. Nearest sensitive receiver is at a distance of approximately 5.4 km
- Southwest – Muswellbrook town is located to the southwest of the coal mine approximately 4.4 km away from the proposed bore hole and test pit sites.

6.4.3 Assessment of Impacts

The following Resonate Table 6-2 Plant and equipment sound power levels were used in the assessment of geotechnical borehole drilling works to determine predicted noise levels (PNLs):

Table 6-2: Plant and equipment sound power levels (Resonate 2020)

Stage	Plant and Equipment	Plant Items	Lw, dB(A)
Boreholes	Piling Rig (bored)	1	104
	Water cart	1	107
	Light vehicles	3	88
	Total Lw		109

The modelled PNL $L_{eq}dB(A)$ and standard hours criterion, dB(A) provided in Appendix B Resonate report found that predicted noise levels are not predicted to exceed the standard hours noise management levels at sensitive receivers for any of the bore hole locations.

Non-conformance of noise and vibration during geotechnical drilling works and mobilisation may result in:

- Exceedance of adopted receiver specific construction noise management levels; triggering requirement for noise management measures
- Exceedance of annoyance and structural objectives
- Justified community complaints relating to noise and vibration.

The geotechnical investigation drilling and access track development works will require vibration-intensive equipment including compaction equipment such as a vibratory roller for development of access tracks. Table 6-3 provides the recommended safe setback distances.

Table 6-3: Recommended Safe Setback Distances for Relevant Vibration-Generating Plant (Resonate, 2020)

Plant Item	Rating/Description	Minimum Working Distance-Cometic Damate1 (BS7385)	Minimum Working Distance – Human Response (OH&E Guideline)
Pile Boring	≤ 800 mm	2 m (nominal)	4 m

The nearest residential building has been identified to be approximately 0.5 km from the nearest borehole site. At this distance, the works are assessed to comply with the safe working distance for potential building damage Pile boring as described in Table 6-3 and are not expected to result in vibration levels above the human comfort criteria (Resonate, 2020).

6.4.4 Mitigation and Management Measures

The following principles and proactive noise management measures, detailed in Resonate report, that would be considered for implementation are provided in Section 6.10.

The drilling contractor would undertake all reasonable and feasible measures to reduce noise impacts and minimise these impacts through the programming of works to minimise their duration, as well as by liaising with the affected landholders and receivers (refer to Appendix C Noise and Vibration Assessment). During the planning and scheduling of construction works, the predicted noise levels should be considered in establishing work site locations, construction techniques and on-site practices.

Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions. The following principles and proactive noise management measures are to be considered for implementation:

- Fixed and mobile construction plant and equipment shall be located to maximise separation distance from nearest noise and vibration sensitive and residential receivers
- Construction plant shall be orientated away from nearest receivers where possible
- Where practical, simultaneous operation of dominant noise generating plant shall be managed to reduce noise impacts, such as operating at different times or increasing the distance between the plant
- Where possible and in compliance with occupational safety and health standards, reversing beepers on trucks would be replaced with low pitch non-tonal beepers (quackers). Alternatives to reversing beepers include the use of spotters and designing the site to reduce the need for reversing may assist in minimising the use of reversing beepers
- Ensure that all works comply with the ICNG standard daytime period's start and finish times
- Where feasible and practicable, surrounding residences shall be notified of potential construction works at least two weeks prior to the commencement of works
- Construction noise and vibration management practices are to be provided to all staff and contractors and be included during site inductions and daily tool-box talks. The tool-box talks should include as a minimum, the permitted hours of construction work, work site locations, site ingress/egress and the required noise management measures for each construction phase.

In the event of justified adverse community response or complaint to construction noise, monitoring of construction noise is recommended to confirm construction noise levels at the complainant's property. All noise monitoring would be undertaken by suitably qualified practitioners with consideration to guidance provided in the ICNG and relevant regulatory and statutory guidelines. Non-conformances for noise and vibration during construction works may include:

- Exceedance of adopted receiver specific construction noise management levels; triggering the requirement for noise management measures
- Exceedance of annoyance and structural vibration objectives.
- Justified community complaints relating to noise and vibration.

The construction works shall be immediately assessed to review operation of noise generating plant, required construction activity and current on and off-site noise mitigation measures in place.

Any non-conformances and subsequent corrective actions shall be resolved with consideration to the project's Community Consultation Strategy. The Environment Manager and Site Supervisor shall determine where corrective action is required and implement necessary mitigation measures.

All adopted noise mitigation measures should be updated in work method statements and identified as part of routine tool-box talks to inform staff of current construction noise and vibration issues and required mitigation measures.

Consistent with the noise mitigation measures presented in this report; examples of corrective actions to be implemented by the Environment Manager include:

- Implementing alternative construction methodologies utilising low noise or low vibration generating plant
- Replacing excessively noisy equipment
- Fitting additional acoustic controls to minimise emissions from machinery
- Increasing separation distance between noise generating plant and nearest sensitive receivers.
- Consider respite periods where construction noise impacts include potential tonal, low frequency or impulsive annoying characteristics at nearest receivers.

6.5 Traffic and Access

6.5.1 Methodology

Data searches and literature review were used in determining existing traffic and transport movements. Assessment of geotechnical drilling equipment and other associated vehicles conveying water, containers and equipment for geotechnical investigation of lower reservoir has been assessed by:

- Reviewing proposed works, traffic that will be generated (type and number of vehicles) and nominated site access routes
- Reviewing of existing traffic conditions and TfNSW Permanent Count Site and public transportation from Muswellbrook to Scone via Aberdeen
- Determining traffic impact assessment by considering:
 - Road network capacity
 - Pavement conditions
 - Average travel speed
 - Property access
 - Pedestrian and cyclists
- Assumed average 10 working hours per day with standard working hours 7am to 6pm on weekday Monday to Friday and 8am to 1pm on Saturday.

6.5.2 Existing Environment

Access to the lower reservoir geotechnical investigation site will be from the northern entry to Muswellbrook Coal Mine site from the New England Highway north of Muswellbrook and then Sandy Creek Road and Limestone Road (refer to Figure 6-7 below).

The New England Highway is a State Road that forms part of the inland Sydney to Brisbane road link. To access the northern entry of the coal mine, geotechnical drilling equipment will travel through the township of Muswellbrook. In the vicinity of the Site, the road is a two-lane, two-way road with a posted speed limit of 60 km/h. An overtaking lane (approximately 125 m) is provided on the northbound carriageway at the intersection of Sandy Creek Road.

Sandy Creek Road is a two-way, two-lane road with a speed limit of 100 km/h reduced to 60 km/h on the approach to the New England Highway. The road has an at-grade rail crossing facility located approximately 40 m to the east of New England Highway.

Limestone Road is a narrow gravel access track located approximately 2.85 km to the east of New England Highway. The road intersects with Sandy Creek Road at its northern end and provides direct access to the Site.

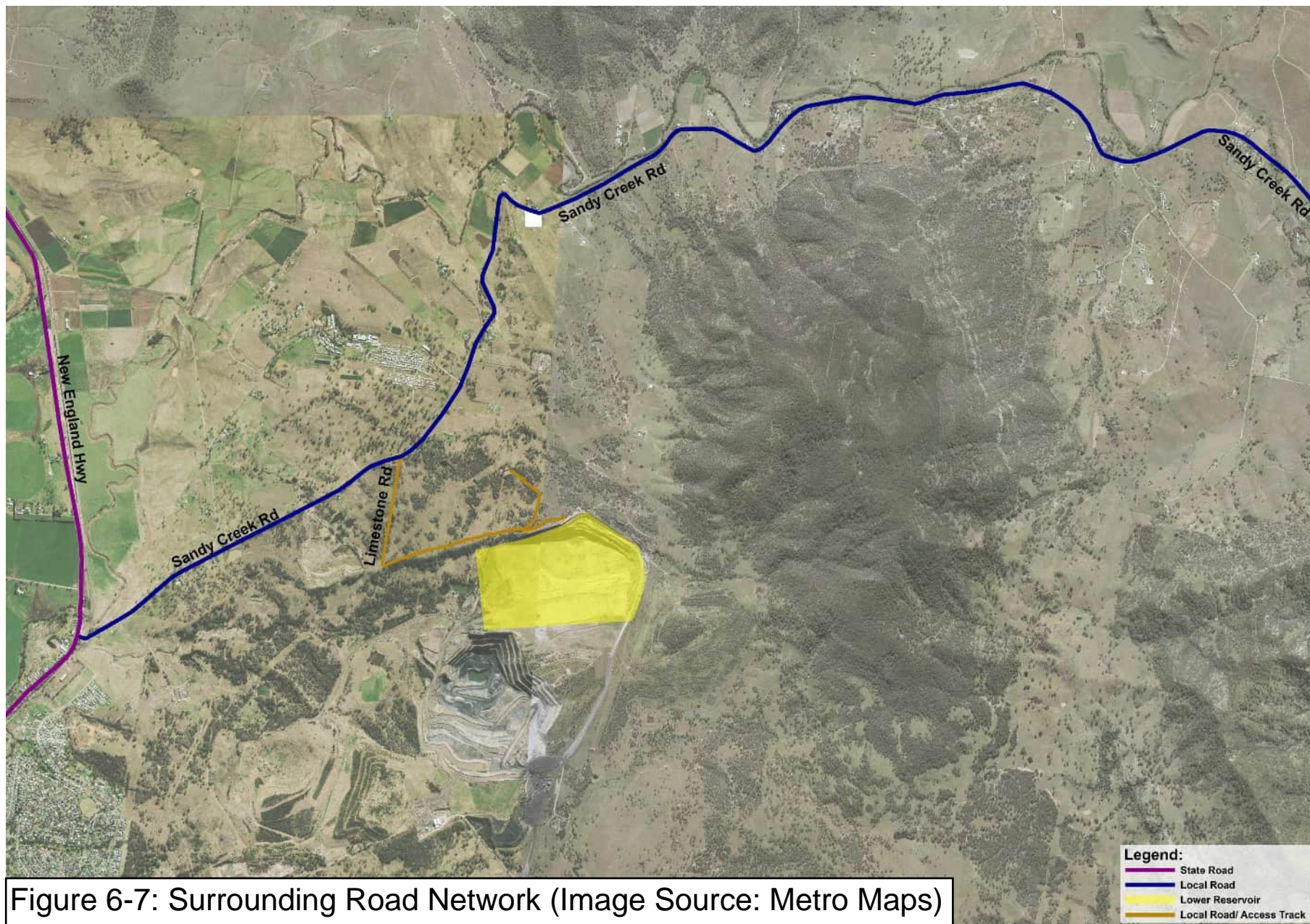


Figure 6-7: Surrounding Road Network (Image Source: Metro Maps)

6.5.3 Assessment of Impacts

Road network capacity data for the New England Highway was determined to be (08:00-09:00) AM peak and for traffic leaving the Site after (15:00-16:00 PM peak). The highway is anticipated to have sufficient capacity to accommodate the additional 16 two-way light vehicle movements for the duration of the works as well as the maximum of 24 two-way heavy vehicle movements associated with mobilisation and demobilisation.

The introduction of 24 heavy vehicle movements per day during mobilisation and demobilisation and 8 light vehicle movements during the AM and PM peaks for the duration of the proposed works is anticipated to have minimal impacts on the operation of surrounding road network.

6.5.4 Mitigation and Management Measures

Sandy Creek Road provides local access to a number of properties. Limestone Road off Sandy Creek Road is a narrow access track providing access to the coal mine, these roads currently have low traffic volumes and whilst the capacity of these road is able to accommodate the additional traffic it will require management of traffic flows. Refer to Appendix D Traffic Impact Assessment Report.

6.6 Waste

6.6.1 Assessment Methodology

Information on waste streams has been drawn from existing literature for the geotechnical investigations and includes a review of geotechnical investigation activities, including generation of waste materials and ancillary activities that generate waste materials. Mitigation measures, opportunities and impacts have been proposed for identified waste streams to be consistent with expectations identified in relevant standards, legislation, and guidelines. The following information was reviewed as part of this assessment:

- *Protection of the Environment Operations Act 1997*
- *Protection of the Environment Operations (Waste) Regulation 2014*
- *Waste Avoidance and Resource Recovery Act 2001*
- Council websites for disposal options.

6.6.2 Assessment of Impacts

Details of identified waste streams expected to be generated during development of access tracks and geotechnical drilling works are outlined below. The waste streams, risks and management procedures outlined below are anticipated to be relevant to the geotechnical investigations.

The geotechnical investigations have the potential to generate various types of waste that can be reused or recycled in accordance with the principles of the *Waste Avoidance and Resource Recovery Act 2001* with various requirements for storage, transport, and disposal. Potential impacts associated with the waste streams identified in Table 6-4 may include:

- Unnecessary consumption of materials, generation of wastes and disposal of waste to landfill
- Water quality impacts due to improper storage, handling, and transport of waste materials
- Ground contamination as a result of improper storage, handling, and transport of waste materials
- Improper storage, handling, transport, or disposal of regulated wastes; potentially contaminated soils should be identified and confirmed prior to construction works to inform suitable management measures and disposal options
- Increased energy/fuel usage as a result of double handling of materials or inefficient transportation of materials.

It is anticipated that moderate levels of waste soil and wastewater will be generated as result of the geotechnical drilling works.

6.6.2.1 Identified Waste Streams

Waste streams have been identified based on typical geotechnical drilling work waste materials. Table 6-4 details the expected waste streams likely to be generated during geotechnical investigation works.

Table 6-5: Expected waste streams associated with the geotechnical investigations

Waste Stream	Description
Green waste	From the clearing of vegetated areas including both native and exotic vegetation species for access tracks and test pit and borehole sites.
Excavation waste / spoil	Spoil material generated from geotechnical investigation works.
Wastewater	Approximately 60 tonnes of liquid wastewater from the geotechnical investigation drilling works will be generated and potential for stormwater runoff.
General wastes	This includes site work area waste, scrap materials, recyclables (aluminium cans, glass etc.) and putrescible waste.

6.6.2.2 Waste Disposal Options

Council owned and operated facilities are available to accept commercial wastes including some contaminated wastes. For a full range of accepted materials refer to the Council websites, the relevant facilities include:

Solid waste:

- Muswellbrook Waste and Recycling Facility - Muswellbrook Shire Council
- Muswellbrook Wastewater Treatment Plant
- Singleton Waste Management Facility – Singleton Shire Council.

The management of waste generated streams generated from the lower reservoir geotechnical investigations will be defined in the EMP inclusive of waste disposal options.

Liquid waste would be removed from site by a contractor licensed to do so, and removed to a facility that is licensed to deal with said waste stream.

6.6.3 Mitigation and Management Measures

The management of waste generated streams generated from the lower reservoir geotechnical investigation will be defined in the geotechnical investigations works EMP inclusive of waste disposal options.

Waste and its management are not expected to significantly impact the assessment of the geotechnical investigation, An EMP will be developed for the geotechnical works and will address the management of waste materials generated by this investigation works and where feasible waste streams identified in Table 6-4 will be recycled or reused.

6.7 Surface Water

6.7.1 Methodology

Surface water in the vicinity of proposed geotechnical test pits, boreholes and access tracks north-east Pit 2 and lower slopes of Bells Mountain were assessed by review of mapped water features (Spatial Public Stream Order Map Service (DCS, 2022) and observations from field surveys.

6.7.2 Existing Environment

No permanent surface water features occur in the vicinity of proposed geotechnical drilling works. Permanent surface waterbodies near the proposed works area include Sandy Creek (approximately 4.5 km west), the Hunter River (about 5.5 km west) and Muscle Creek (about 5.0 km south).

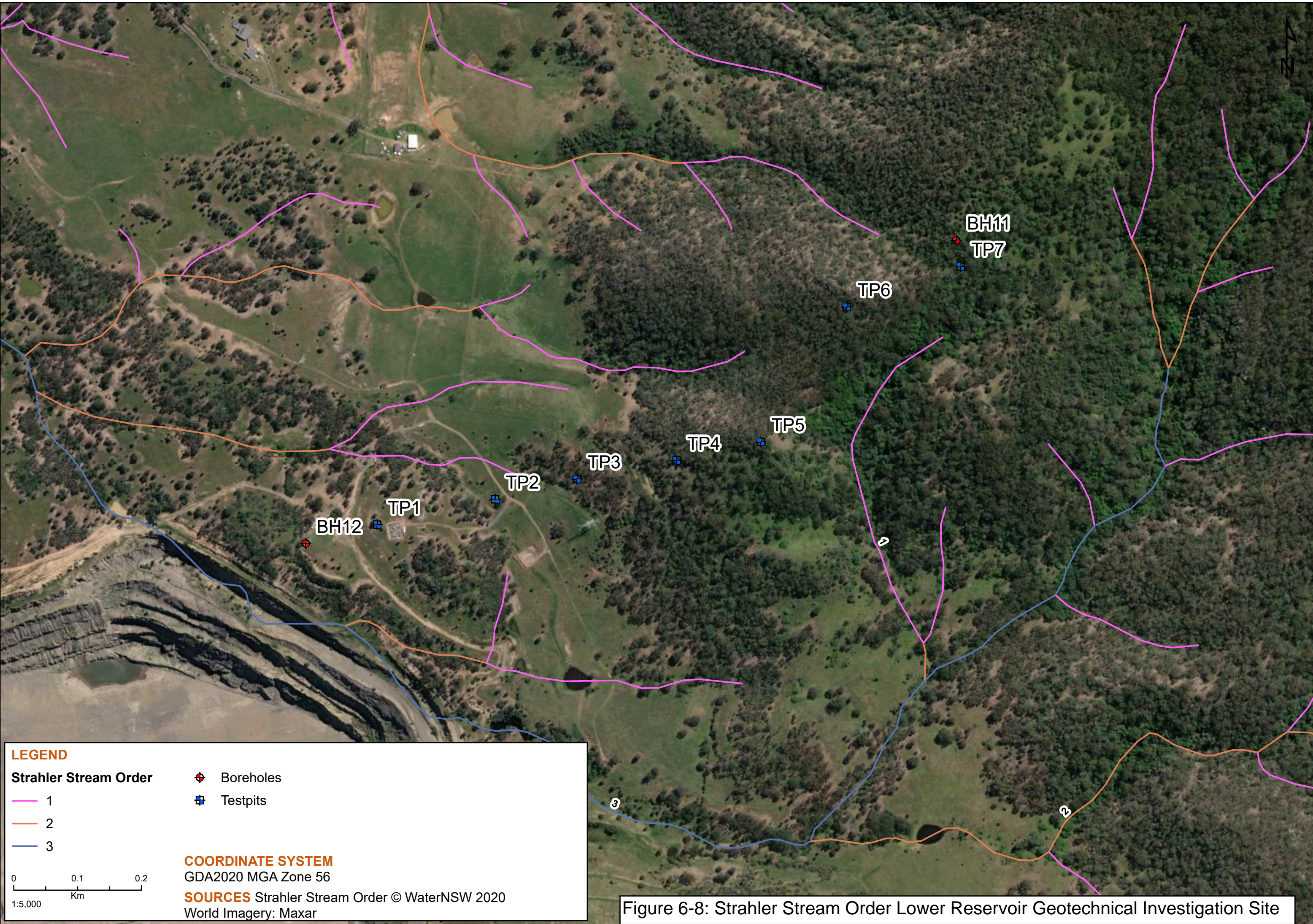
Mapped surface water features (Spatial Services (DCS, 2022) within the Site include numerous ephemeral drainage channels, comprising 1st, 2nd, and 3rd order streams. No standing water was present in these at the time of site surveys in August 2022.

The proposed investigation area sits on a ridge at Bells Mountain which drains in a west-north-west direction eventually meeting Sandy Creek.

6.7.3 Assessment of Impacts

Geotechnical drilling equipment require use of water during drilling operations. Potential for surface water runoff exists during geotechnical drilling operations and if not captured has the potential to cause water and sediment runoff into existing ephemeral drainage channels. Any release of water will have localised impacts as the nearest surface waterbody is Sandy Creek approximately 4.5 km west of proposed drilling works. Surface water drainage stream lines are represented in Figure 6-8 below.

Some minor stream crossings will be required to be stabilised in order to safely facilitate site access during the geotechnical investigations. Often this is undertaken by placing inert materials, such as clean gravel, in the area of the stream which is proposed to be crossed.



LEGEND

Strahler Stream Order

- 1
- 2
- 3

Boreholes

Testpits

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Strahler Stream Order © WaterNSW 2020
World Imagery: Maxar

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Figure 6-8: Strahler Stream Order Lower Reservoir Geotechnical Investigation Site

6.7.4 Mitigation and Management Measures

An erosion and sediment control plan would be prepared in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004) and included in the Environmental Management Plan and geotechnical investigation works EMP.

A Controlled Activity approval would also be sought for these works under the WM Act for works within the C3 Environmental Management Zone.

6.8 Groundwater

6.8.1 Methodology

The assessment of groundwater impacts in the vicinity of the lower reservoir geotechnical investigation area relies upon:

- Previous Muswellbrook Coal Mine SLR Continuation Project Groundwater Assessment 2016 and its review of groundwater levels and flows.
- Review of SEED data portal mapping of groundwater vulnerability in Muswellbrook region.

6.8.2 Existing Environment

Previous assessments (SLR, 2016) identified two main groundwater systems in the vicinity of the proposed geotechnical investigations:

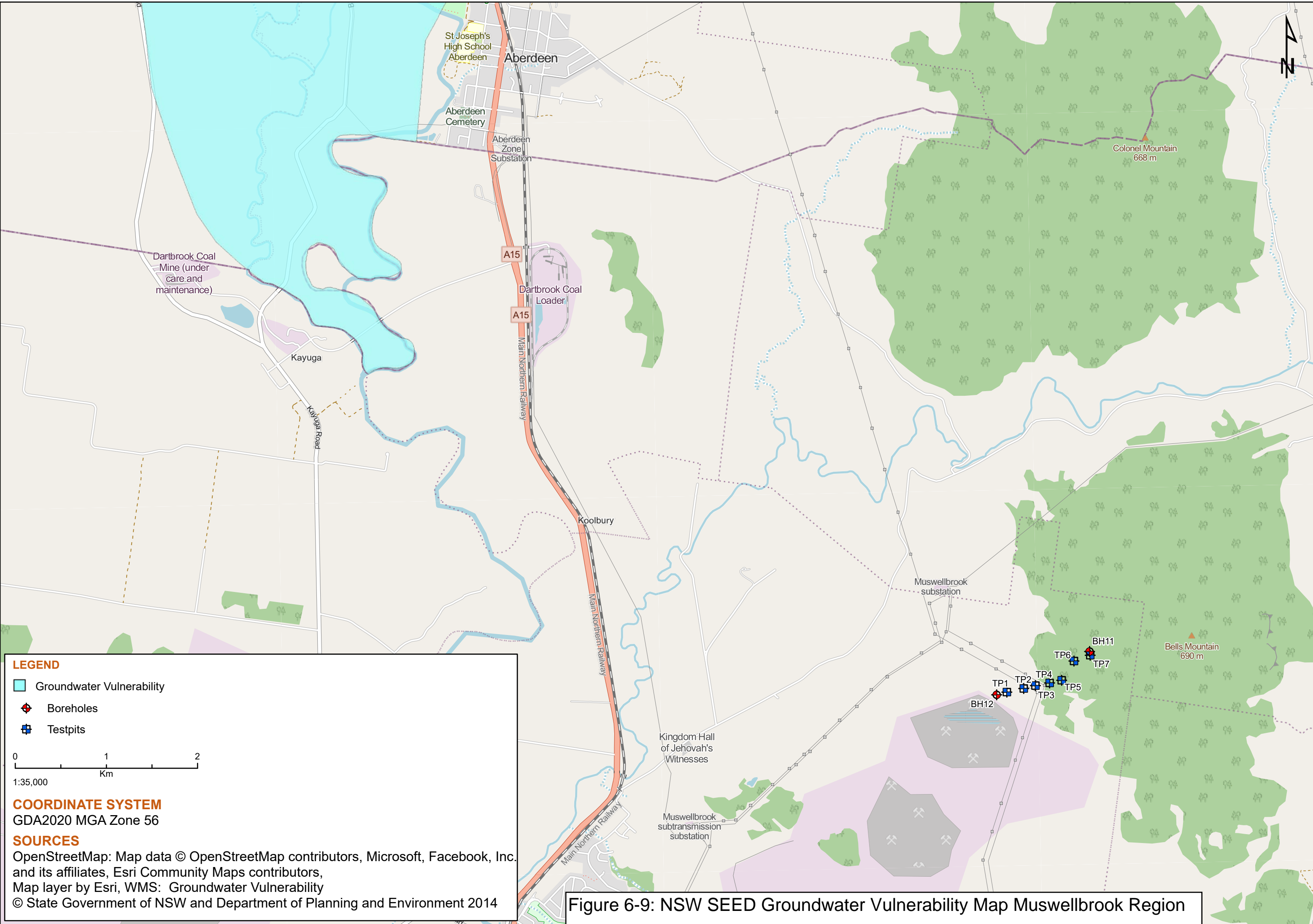
- Shallow bedrock (regolith):
 - Comprising surficial sandy and silty-clayey soils and weathered bedrock, with variable permeability and porosity, at variable depth and thickness
 - During sustained wet periods, the aquifer becomes a temporarily perched
 - Provides a source of recharge to the underlying coal measures, although limited due to the very hydraulic conductivities of deeper strata
- Permian bedrock (Greta Coal Measures):
 - Comprising negligible intergranular porosity and permeability, with low to moderately permeable coal seams as the primary water bearing strata with typical permeability of c. 2 m/day at shallow depths to less than 0.01 m/day at a depth of 130 m
 - Groundwater is associated with fracture (secondary) permeability and porosity from discontinuities (fractures, faults, joints, and bedding planes)
 - Intervening unproductive coal measures are “tight” with permeability c.2 orders of magnitude lower than that of the coal seams (i.e., 0.01 m/day at shallow depths to 0.0001 m/day at 100 m depth)
 - Specific storage coefficient (storativity) is estimated to be in the order of c.3 x 10⁻⁶.

MCC has groundwater monitoring well in proximity to the proposed geotechnical works. There is no information on the depth of this well. However, groundwater levels at this well between 2013-2016 ranged fluctuated between 50 and 60 m below the surface (SLR, 2016). Analysis of this data by SLR (2016) suggested that:

- Groundwater elevations within the Permian strata outside the old mine workings are significantly higher, as indicated by monitoring data for RDH616 and RDH617. Despite these two monitoring locations being located immediately adjacent to the No. 2 Open Cut void, the groundwater elevations at these two locations are estimated at c.186 to c.193 m AHD, which is:
 - c.1, 10 m higher than the water elevation within this void (c.80 m AHD).
 - c.75 m higher than the groundwater elevations within the Heliers Colliery and No.2 Underground mine workings (c.116 m AHD).

The significant difference in groundwater elevations is considered to reflect the low permeability of the undisturbed in situ bedrock around the mine site as well as the monitoring points being located on the opposite side of a fault (SLR, 2016).

The NSW SEED mapping of groundwater vulnerability in the Muswellbrook region identifies a vulnerable groundwater area within the Aberdeen area, approximately 4.4 km from nearest geotechnical borehole site and Pit 2. Refer to Figure 6-9. NSW SEED Groundwater vulnerability map Muswellbrook region.



LEGEND

- Groundwater Vulnerability
- Boreholes
- Testpits

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COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES
OpenStreetMap: Map data © OpenStreetMap contributors, Microsoft, Facebook, Inc. and its affiliates, Esri Community Maps contributors,
Map layer by Esri, WMS: Groundwater Vulnerability
© State Government of NSW and Department of Planning and Environment 2014

Figure 6-9: NSW SEED Groundwater Vulnerability Map Muswellbrook Region

6.8.3 Assessment of Impacts

Review of NSW SEED Environment Protection Indicator (EPI) groundwater vulnerability map identifies no areas in the immediate vicinity of geotechnical drilling work test pit and borehole locations. The nearest groundwater vulnerability area located near mine site is north, northwest of Aberdeen and owing to the separation distance is highly unlikely to be impacted by geotechnical drilling works and relatively small volumes of water being extracted.

6.8.4 Mitigation and Management Measures

Geotechnical investigation drilling works are to be undertaken in accordance with proposed methods provided in Section 4 and relevant site mobilisation, geotechnical drilling, decommissioning, and rehabilitation subsections. Locations of boreholes and test pits are to adhere to site location mapping data.

6.9 Crown Lands Reserves

6.9.1 Methodology

Crown Lands road reserves within the lower reservoir geotechnical investigation site adjacent to Limestone Road and located east of Muswellbrook Coal Mine Pit 2 has been assessed initially by review of cadastre relative to land ownership within the location of access tracks and in consultation with Crown Lands Department to confirm location and ownership of Crown road reserves.

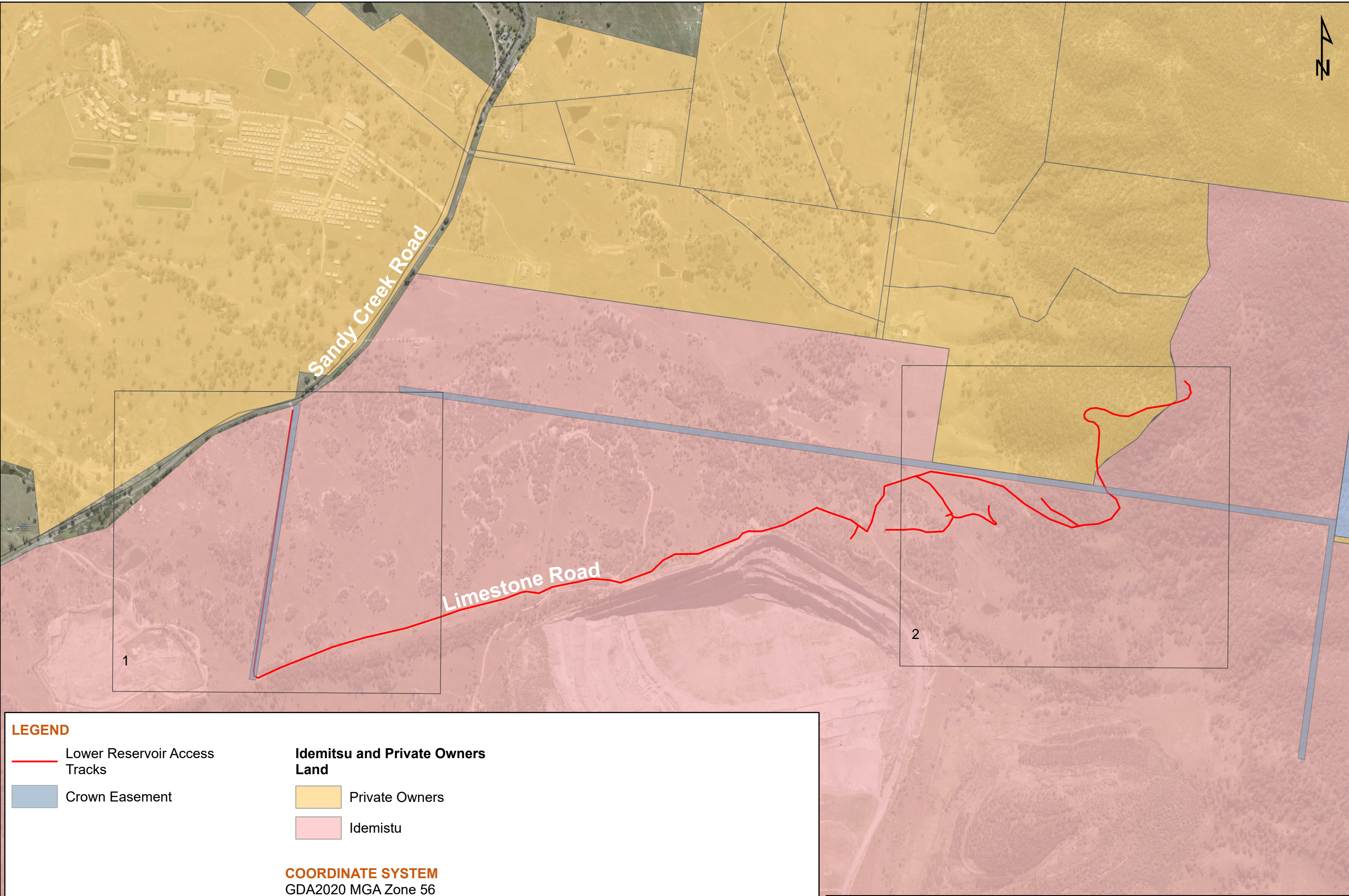
Mapping of boreholes, test pits and access track locations crossing Crown roads have been developed to assess environmental impacts on:

- Biodiversity
- Aboriginal heritage
- Noise and vibration.

6.9.2 Existing Environment

Entry location onto the Muswellbrook Coal Mine site for the lower reservoir geotechnical investigation drilling equipment and other servicing vehicles including water container/s is off Sandy Creek Road via Limestone Road northeast of Muswellbrook. The access track within the mine site is displayed as the red line in Figure 6-10 below along with two Crown road reserves shown as two mauve lines. The Crown roads reserves have no designated Lot or Deposited Plan numbers but have been confirmed as being owned by NSW Crown Lands. Therefore, a separate approval is required for both accessing these roads and to undertake track improvement and construction works including vegetation removal.

The Crown road reserve to the east of mine Pit 2 is located on the slopes of Bells Mountain and will require civil works to form an access track to allow geotechnical drilling equipment to traverse through this Site.



LEGEND

Lower Reservoir Access Tracks

Crown Easement

Idemitsu and Private Owners Land

Private Owners

Idemitsu

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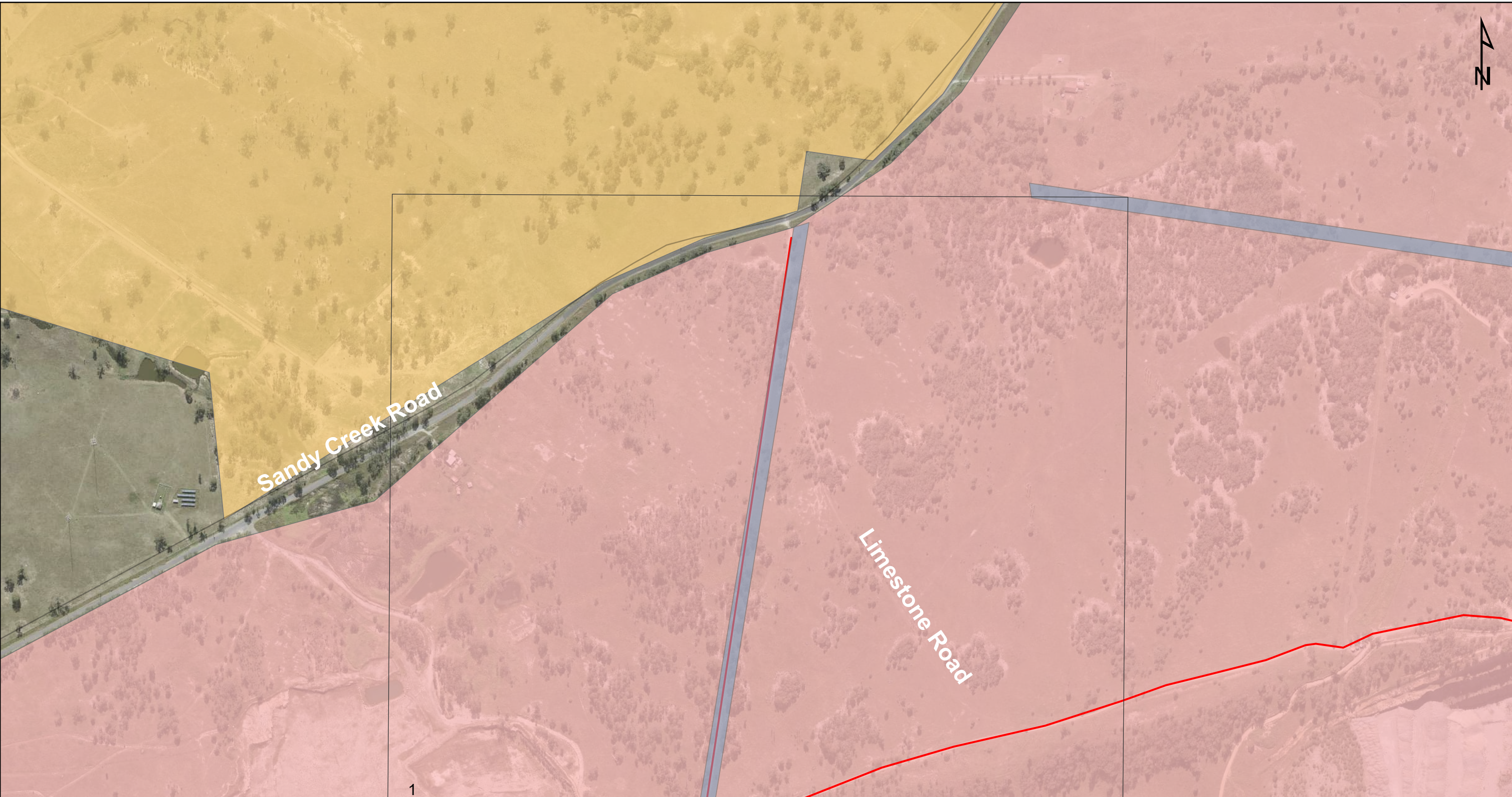
SOURCES Roads © RoadNet MDS 20200, Crown Land and Reserves
© State Government of NSW and Department of Planning and Environment 2018
MetroMap WMS Services: Aerial 22/04/2021

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Figure 6-10: Muswellbrook Coal Mine Crown Road Reserves and Lower Reservoir Access Tracks



LEGEND

Lower Reservoir Access Tracks

Crown Easement

Idemitsu and Private Owners Land

Private Owners

Idemitsu

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SOURCES Roads © RoadNet MDS 20200, Crown Land and Reserves
© State Government of NSW and Department of Planning and Environment 2018
MetroMap WMS Services: Aerial 22/04/2021

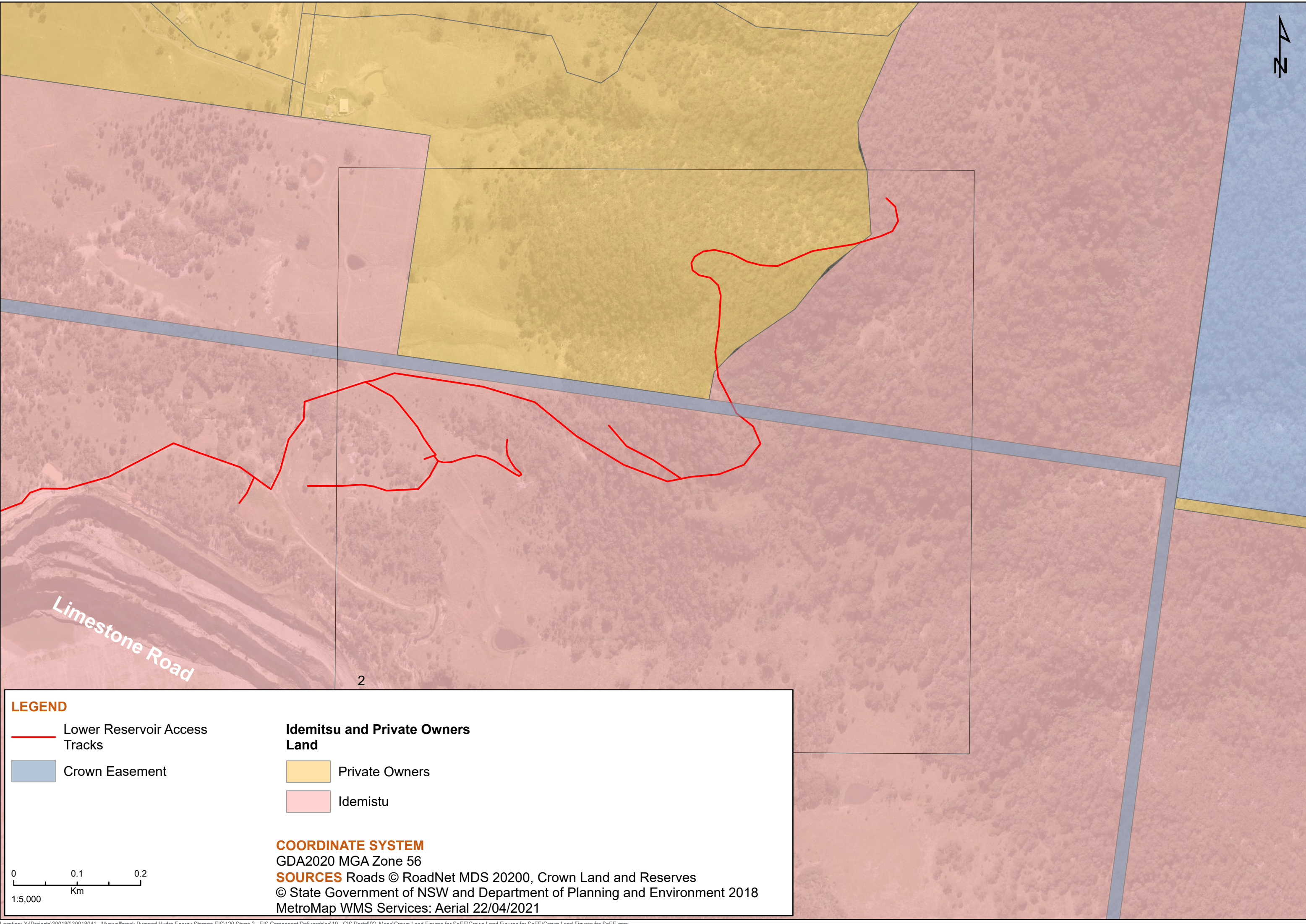
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LEGEND

Lower Reservoir Access Tracks

Crown Easement

Idemitsu and Private Owners Land

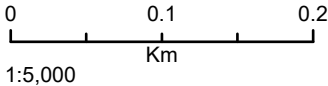
Private Owners

Idemitsu

COORDINATE SYSTEM

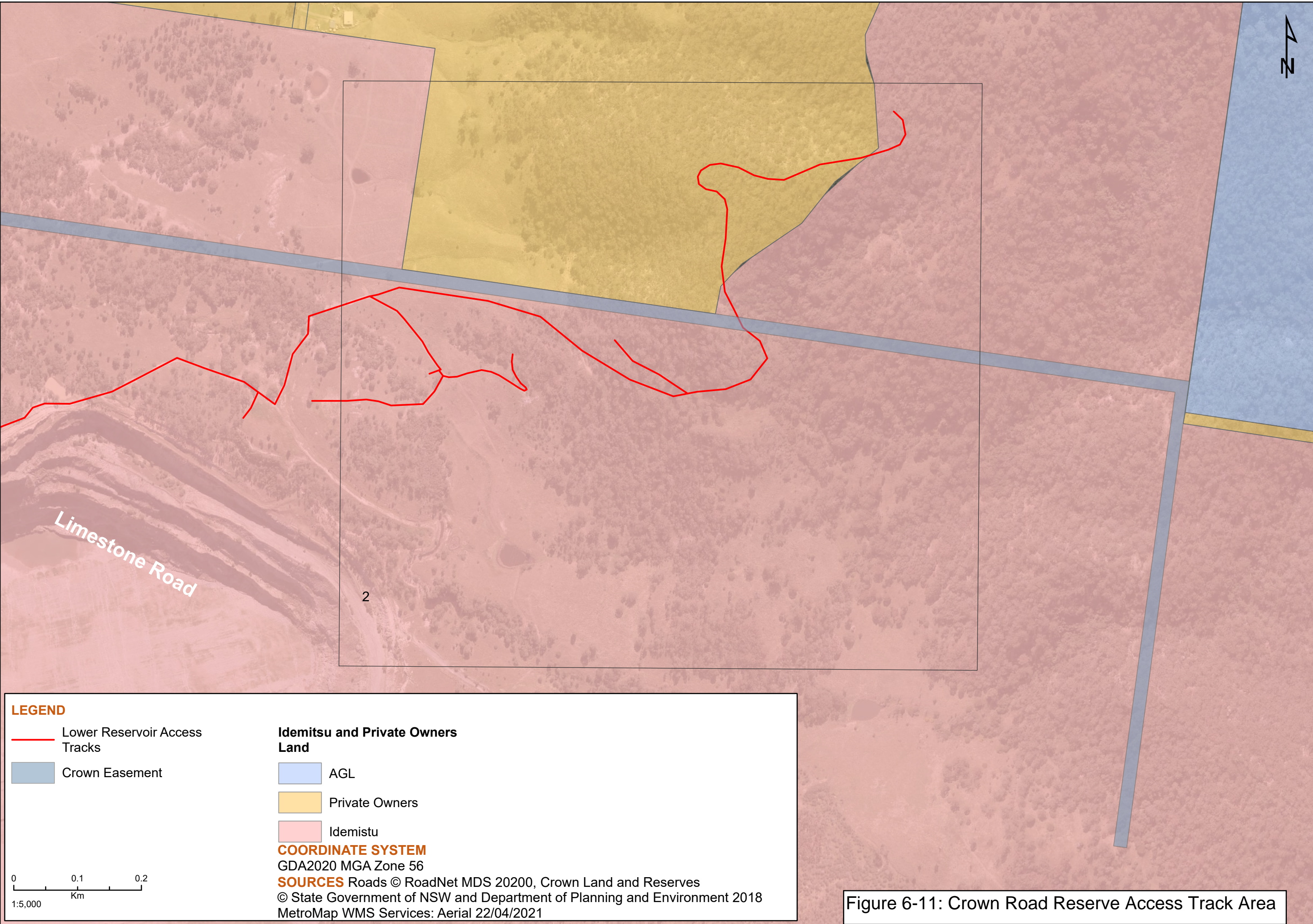
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 20200, Crown Land and Reserves
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MetroMap WMS Services: Aerial 22/04/2021



The Crown road reserve located on Limestone Road west of Pit 2 (identified in Box 1 Figure 6-11) is an unpaved road that connects to an internal unpaved mine road traversing northern section of Pit 2. Minimal to no work will be required in this location which will solely be used to transport geotechnical drilling equipment and associated services including water to site.

The Crown road reserve to the east of Pit 2 where the new access track will be developed (identified in Box 2 Figure 6-11) is located on the slopes of Bells Mountain.



LEGEND

Lower Reservoir Access Tracks

Crown Easement

Idemitsu and Private Owners Land

AGL

Private Owners

Idemitsu

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SOURCES Roads © RoadNet MDS 20200, Crown Land and Reserves
© State Government of NSW and Department of Planning and Environment 2018
MetroMap WMS Services: Aerial 22/04/2021

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Figure 6-11: Crown Road Reserve Access Track Area

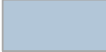
Figure 6-12 identifies the area where the access track will be developed on the Crown road reserve.


The approximate area of the Crown road reserve area site of access track is 560 m². Refer to Figure 6-12 Crown Road Reserve Geotechnical Works Area.



LEGEND

 Study Area

 Crown Easement

 Intesection of Crown Easement and Access Tracks

COORDINATE SYSTEM
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SOURCES Roads © RoadNet MDS 2020, Crown Land and Reserves
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MetroMap WMS Services: Aerial 22/04/2021

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Figure 6-12: Crown Road Reserve Geotechnical Works Area

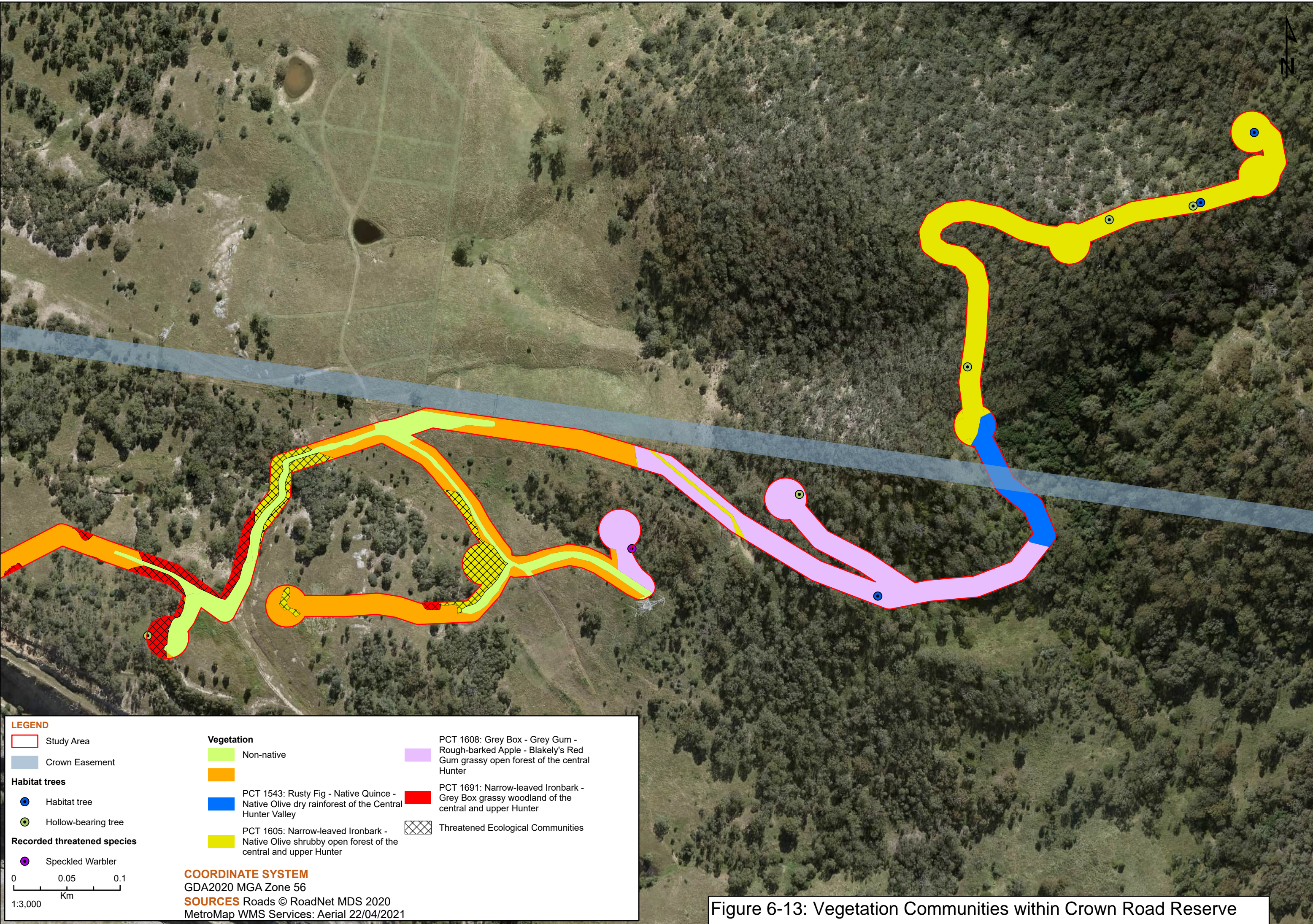
6.9.3 Assessment of Impacts

The following assessments of impacts are related to direct impacts to sections of a Crown road reserves located within the Muswellbrook Coal mine site requiring establishment of access tracks to allow geotechnical investigation vehicles and equipment accessing test pit and boreholes locations.

6.9.3.1 Biodiversity

The biodiversity assessment for the Crown road reserve was completed as part of the lower reservoir assessment. Figure 6-13 provides biodiversity assessment map for lower reservoir geotechnical investigation inclusive of the Crown road reserve. The vegetation community identified is within PCT 1543: Rusty Fig – Native Quince – Native Olive dry rainforest of the Central Hunter valley.

Clearing works for access track within the Crown road reserve, which also encompasses test pit TP5 (approximately 10 x 10 metres), will include clearing of vegetation community PCT 1543. No TECs were identified within the Crown Road reserve (refer to Section 6.1 and Appendix A).



LEGEND

Study Area

Crown Easement

Habitat trees

Habitat tree

Hollow-bearing tree

Recorded threatened species

Speckled Warbler

Vegetation

Non-native

PCT 1543: Rusty Fig - Native Quince - Native Olive dry rainforest of the Central Hunter Valley

PCT 1605: Narrow-leaved Ironbark - Native Olive shrubby open forest of the central and upper Hunter

PCT 1608: Grey Box - Grey Gum - Rough-barked Apple - Blakely's Red Gum grassy open forest of the central Hunter

PCT 1691: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter

Threatened Ecological Communities

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020
MetroMap WMS Services: Aerial 22/04/2021

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Figure 6-13: Vegetation Communities within Crown Road Reserve

Location: X:\Projects\300180\30018041 - Muswellbrook Pumped Hydro Energy Storage EIS\120 Stage 2 - EIS Component Deliverables\19 - GIS Portal\02_Maps\Crown Land Figures for SoEE\Crown Land Figures for SoEE\Crown Land Figures for SoEE.aprx

6.9.3.2 Aboriginal Heritage

Refer to Section 6.2. The eastern access track traverses within the Crown road reserve, and is located in areas that have historically undergone minimal ground disturbance with much never been cleared and as such have elevated potential for Aboriginal objects. If during civil works to create access tracks artefacts are identified, alternative access arrangements would be considered in consultation with the relevant authorities. If it is not possible to avoid damaging the Aboriginal object, only then would an AHIP application be progressed.

6.9.3.3 Noise and vibration

A noise and vibration assessment for the lower reservoir geotechnical investigation works including drilling and creation of access tracks was undertaken by Resonate to also including the eastern access track within Crown Road. Refer to Section 6.4 and Appendix C.

The noise assessment for lower reservoir geotechnical investigation found that predicted noise levels are not expected to exceed the standard hours noise management levels (Resonate, 2022).

6.9.3.4 Surface water

East and north-west of the eastern access track within Crown road reserve are two Strahler stream order 3 drainage lines. Surface water runoff from civil access track works can lead to sediment runoff into these existing ephemeral drainage channels. Refer to Figure 6-8 Strahler stream order lower reservoir geotechnical investigation site.

6.9.4 Mitigation and Management Measures

The following sections outline the mitigation and management measures for geotechnical access track civil works within Crown road reserve.

6.9.4.1 Biodiversity

Refer to Section 6.1.4 Mitigation and management measures for biodiversity and Table 6-4.

6.9.4.2 Aboriginal Heritage

It is recommended that before works commence in this area, the Registered Aboriginal Party (RAP) be consulted, observing statutorily defined processes. If during civil works to create access track artefacts are identified an AHIP may be required to proceed with works.

6.9.4.3 Noise and vibration

Refer to Section 6.4.4 Mitigation and management measures for noise and vibration and Table 6-4.

6.9.4.4 Surface water

Refer to Section 6.7.4 Mitigation and management measures for surface water and Table 6-4.

6.10 Summary of Environmental Management Measures

A comprehensive EMP will be prepared to support the geotechnical investigations. Safeguards and management measures proposed to be implemented to avoid or minimise impacts to environmental and cultural values are provided in Table 6-4.

Table 6-4: Safeguards and management measures

Aspect	Management Measures
Biodiversity	<ul style="list-style-type: none"> Disturbance will be kept within the geotechnical investigation areas and access tracks as delineated in Figure 6-1 Clearing extents will be clearly staked and marked with flagging tape

Aspect	Management Measures
	<ul style="list-style-type: none"> • Minor adjustments to the position of test pads if feasible can significantly reduce impacts. In all cases pad positioning should be adjusted where feasible to minimising clearing of mature trees and avoiding excavating within their drip zone (canopy extent) • Recommendations for avoidance measures when refining test pad positions are as follows: <ul style="list-style-type: none"> – BH12: Adjustment is to remain within cleared grassland and avoid encroachment into the drip line of any mature trees. Stated reason is to completely avoid impact to any trees and TEC by utilizing non-native grassland – TP1: Adjustment is to position pad on disturbed grassland. No encroachment into the dripline of mature trees. Stated reason is to avoid all trees representing a TEC. An existing Geotech pad site is located here visible in Figure 6-1 – TP2: Adjustment is to avoid encroachment under drip line of mature trees. Stated reason is to avoid impact to the mature trees within a TEC area south of access track – TP4: Adjustment is to shift this location around 10 metres south to avoid boulder outcrop. Stated reason is that large boulders are potential fauna habitat and would also make levelling difficult • Disturbance to other key habitat features such as fallen logs or ephemeral soaks should also be avoided • Ensure machinery is free of weed material before entering and exiting the investigation areas to avoid the introduction or spread of weed species. Implement appropriate hygiene including wash down and/or disinfection measures for vehicles, machinery and equipment where practical, to minimise the introduction or spread of weed propagules or plant/animal diseases • Should any of the priority weeds – Fireweed (<i>Senecio madagascariensis</i>), Coolatai grass (<i>Hyparrhenia hirta</i>) or Common pear (<i>Opuntia stricta</i>) be found to occur during vegetation clearance – these weeds should be removed and disposed of appropriately • Ensure that a spill-kit is on hand to address any fuel or oil spillages from plant and equipment undertaking the proposed works • Backfilling of any holes associated with drilling or excavation associated with the cut and fill bench should utilise soil excavated onsite as this soil is likely to contain native seeds enabling the re-establishment of native species following completion of the proposed works • All waste material and rubbish associated with the proposed vegetation clearing and excavations, are to be removed from site and properly disposed of upon completion • Rock and soil excavated for the construction of access track cuttings, when not reused in the agreed impact area must be disposed on the Muswellbrook Coal excavation site • Erosion and sediment control measures are to be implemented around the works area to prevent sediment or sediment-laden water from moving offsite and affecting adjacent vegetation communities, species habitat or watercourses. • Works should be carried out outside of the Speckled Warbler breeding season. If works are to occur during the Speckled Warbler breeding season (August to January), an Ecologist must undertake a pre-works survey to determine the presence of Speckled Warbler nests before vegetation is to be cleared. If Speckled Warbler nests are found, timing of works and mitigation must be reconsidered • Should any threatened fauna species be observed during the Proposal, works will cease, and an Ecologist will be notified. The Ecologist will advise whether it is appropriate to allow the animal to self-relocate or whether further intervention is required to relocate the animal. If the species cannot be relocated, works must stop, and mitigation must be reconsidered • If any native fauna is encountered during the proposed works, stop and allow the individual to self-relocate. If injured, contact WIRES (1300 094 737) to rescue the animal and remove it from the Site

Aspect	Management Measures
	<ul style="list-style-type: none"> • Limit work during excessively wet or muddy conditions, where ground disturbance may be exacerbated • Following finalisation of geotechnical investigation sites and access track locations, and prior to carrying out the works, an Environment Management Plan is to be developed that considers all biodiversity values and plans to avoid and minimise risks to these retained values. This should include measures such as re-positioning logs or hollows, pre-clearance surveys, timing of clearing works to avoid fauna breeding or dormancy, sediment and erosion control measures and invasive weed control and management • Avoid loss of mature eucalypt trees over 50 centimetres in diameter, including all mature trees with hollows where possible by avoiding direct felling or earthworks within their root zone – i.e., the main canopy extent or “dripline” • Keep vegetation clearing to the minimum extent practicable required for the Proposal, not exceeding the maximum extent assessment in this report • Areas of TEC to be retained should be clearly marked on maps and provided to the geotechnical investigation supervisor • Any indirect or indirect impact to TECs outside the designated clearing area should be immediately reported to the nominated Proposal Ecologist.
Non Aboriginal Heritage	<p>In the event item/s of non-Aboriginal heritage significance are discovered or uncovered on MCC mine site during site establishment or access track works the geotechnical investigations site manager will cease work and obtain advice from MCC for further instructions.</p>
Aboriginal Heritage	<p>Refer to Section 6.2.3 Mitigation and management measures and Figure 6-5 illustrating where it would be appropriate for the proposed works to proceed immediately and those areas where additional steps are recommended (the RAP consultation process). Additional steps are:</p> <ul style="list-style-type: none"> • Before works commence in this area, the Registered Aboriginal Party (RAP) be consulted. An archaeologist be present to monitor the works in that part of the study area from test pit 4 (TP4) to test pit 7 (TP7) inclusive borehole (BH2). <p>For all lower reservoir geotechnical investigation works:</p> <ul style="list-style-type: none"> • Should Aboriginal objects be identified in the surface or subsurface deposits, works are to be halted at that specific location until such time a heritage professional can perform an onsite inspection. If the site cannot be avoided the heritage professional will organise consultation with the local Aboriginal representatives and the relevant State government agencies such as DPIE • If artefacts are identified during geotechnical investigations on any access tracks, an AHIP may be required to proceed with the works • If human skeletal material less than 100 years old is discovered, the Coroners Act 2009 requires that all works should cease, and the NSW Police and the NSW Coroner’s Office should be contacted. Traditional Aboriginal burials (older than 100 years) are protected under the NPW Act and should not be disturbed • In the event skeletal material is found an appropriate skilled anthropologist should be contacted to recommend course of action and if Aboriginal remains, notification of OEH and the Local Aboriginal Land Council will be required.
Noise and Vibration	<p>The drilling contractor would undertake all reasonable and feasible measures to reduce noise impacts and minimise these impacts through the programming of works to minimise their duration, as well as by liaising with the affected landholders and receivers (refer to Appendix C Noise and Vibration Assessment). During the planning and scheduling of construction works, the predicted noise levels should be considered in establishing work site locations, construction techniques and on-site practices.</p> <p>Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to</p>

Aspect	Management Measures
	<p>reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions. The following principles and proactive noise management measures are to be considered for implementation:</p> <ul style="list-style-type: none"> • Fixed and mobile construction plant and equipment shall be located to maximise separation distance from nearest noise and vibration sensitive and residential receivers • Construction plant shall be orientated away from nearest receivers where possible • Where practical, simultaneous operation of dominant noise generating plant shall be managed to reduce noise impacts, such as operating at different times or increasing the distance between the plant • Where possible and in compliance with occupational safety and health standards, reversing beepers on trucks would be replaced with low pitch non-tonal beepers (quackers). Alternatives to reversing beepers include the use of spotters and designing the site to reduce the need for reversing may assist in minimising the use of reversing beepers • Ensure that all works comply with the ICNG standard daytime period's start and finish times • Where feasible and practicable, surrounding residences shall be notified of potential construction works at least two weeks prior to the commencement of works • Construction noise and vibration management practices are to be provided to all staff and contractors and be included during site inductions and daily tool-box talks. The tool-box talks should include as a minimum, the permitted hours of construction work, work site locations, site ingress/egress and the required noise management measures for each construction phase. <p>In the event of justified adverse community response or complaint to construction noise, monitoring of construction noise is recommended to confirm construction noise levels at the complainant's property. All noise monitoring would be undertaken by suitably qualified practitioners with consideration to guidance provided in the ICNG and relevant regulatory and statutory guidelines. Non-conformances for noise and vibration during construction works may include:</p> <ul style="list-style-type: none"> • Exceedance of adopted receiver specific construction noise management levels; triggering the requirement for noise management measures • Exceedance of annoyance and structural vibration objectives. • Justified community complaints relating to noise and vibration. <p>The construction works shall be immediately assessed to review operation of noise generating plant, required construction activity and current on and off-site noise mitigation measures in place.</p> <p>Any non-conformances and subsequent corrective actions shall be resolved with consideration to the project's Community Consultation Strategy. The Environment Manager and Site Supervisor shall determine where corrective action is required and implement necessary mitigation measures.</p> <p>All adopted noise mitigation measures should be updated in work method statements and identified as part of routine tool-box talks to inform staff of current construction noise and vibration issues and required mitigation measures.</p> <p>Consistent with the noise mitigation measures presented in this report; examples of corrective actions to be implemented by the Environment Manager include:</p> <ul style="list-style-type: none"> • Implementing alternative construction methodologies utilising low noise or low vibration generating plant • Replacing excessively noisy equipment • Fitting additional acoustic controls to minimise emissions from machinery

Aspect	Management Measures
	<ul style="list-style-type: none"> Increasing separation distance between noise generating plant and nearest sensitive receivers. Consider respite periods where construction noise impacts include potential tonal, low frequency or impulsive annoying characteristics at nearest receivers.
Traffic Assessment	Management of traffic inflows into Limestone Road off Sandy Creek Road will be managed during site mobilisation of geotechnical drilling equipment and upon completion of works and removal of drilling equipment offsite. A traffic control management plan will be prepared and implemented during these periods.
Surface water	<ul style="list-style-type: none"> Erosion and sediment controls would be installed in accordance with Managing Urban Stormwater, Soils and Construction, Volume 1, (Landcom 2004) and Volume 2E, Mines and Quarries (DECC 2008). All water produced during geotechnical investigations would be contained, removed from site and disposed of at a registered facility. Hydrocarbons and other hazardous substances required for the geotechnical investigations: <ul style="list-style-type: none"> Would be stored in a designated area, and in a manner that any unintentional spills would be contained (e.g., bunded area). An environmental spill kit would be readily available. Management of site activities through: <ul style="list-style-type: none"> Would be stored in a designated area, and in a manner that any unintentional spills would be contained (e.g., bunded area), An environmental spill kit would be readily available. Management of site activities through: <ul style="list-style-type: none"> Minimising the ground disturbance footprint so as to maintaining existing roots and ground level vegetation (i.e., grass, shrubs and undergrowth) as much as possible. Minimising extent and duration of disturbance. Early clean water diversions around the Site (i.e., minimising run-on). Control stormwater flows onto through and off the Site Use erosion control measures to prevent onsite damage. Use sediment control measures to prevent offsite damage. Stabilise distributed areas quickly and following completion of the drilling. Regular inspection and maintaining controls measures Monitoring weather forecasts and limiting unnecessary site access during periods of heavy rainfall A sediment and erosion plan would be included in the Environmental Management Plan.
Groundwater	Geotechnical bores, works or activities (the latter as listed in AS 1726) intersecting the water table if they are decommissioned in such a way as to restore aquifer isolation to that which existed prior to the construction of the bore, work, or activity and that the decommissioning is conducted within a period of 28 days following completion of the bore, work or activity.
Erosion and sediment control	<p>Prior to commencement of drilling works:</p> <ul style="list-style-type: none"> Installation of appropriate sediment and erosion control measures. Refer to Surface Water Management Measures. <p>During drilling:</p> <ul style="list-style-type: none"> Monitoring of sediment and erosion controls

Aspect	Management Measures
	<ul style="list-style-type: none"> • Modifications to sediment and erosion controls if required upon completion of drilling and demobilisation: • Site rehabilitation of disturbed areas: or Restoration of cut/fill pads to near original condition, including reseeding of grass to prevent erosion of temporary access works, if any • Removal of all drilling equipment including laydown area
Air quality	<p>When accessing the Site along unsealed roads:</p> <ul style="list-style-type: none"> • Maintain a speed within posted speed limits that limits dust generation behind moving vehicles. If dust plumes are observed to be above the height of the vehicle, slow down • Accelerate and decelerate slower than on sealed roads, to avoid wheel spinning that could generate dust <p>During construction and maintenance of the drilling cut/fill pad:</p> <ul style="list-style-type: none"> • Limit the size of exposed material within practicable safe limits • During periods of hot, windy weather, spray clean water on the exposed material to limit dust generation potential
Rehabilitation	The investigation sites and access tracks would be rehabilitated and reinstated as per provisions detailed in the geotechnical investigation works EMP.
Waste	Drilling works wastewater and vegetation will be collected for disposal by licensed waste contractor.

7. Conclusion

The geotechnical investigations demonstrate compliance with the relevant Environmental Planning Instruments and would allow Muswellbrook Pumped Hydro Company Pty Ltd to fully consider its option to develop a PHES scheme at Muswellbrook Coal Mine as to repurpose the Site as mine rehabilitation activities progress.

This would have the benefit of allowing the JV and mine site to meet its responsibilities under the Regional Plan, to:

- Diversify and grow the energy sector by working with stakeholders, including councils, communities, and industry, to identify and support opportunities for smaller-scale renewable energy initiatives such as using bioenergy or waste coalmine methane
- Promote new opportunities arising from the closure of coal-fired power stations that enable long term sustainable economic and employment growth in the region.

The geotechnical investigations are considered critical if Muswellbrook Pumped Hydro Company Pty Ltd is to meet its responsibilities for relevant actions under the Regional Plan for diversifying and growing the energy sector. The geotechnical investigations are also considered to be wholly aligned with the Pumped Hydro Roadmap. It is also a direct response to Action 1 of the Pumped Hydro Roadmap, which is bringing forward private investment, described as “supporting the commercialisation of new, large-scale on-demand electricity projects.”

The geotechnical investigations would assist the JV in verifying the Site’s suitability to generate pumped hydroelectricity, by providing a range of geotechnical data which is prerequisite to finalising this feasibility. The geotechnical investigations would therefore allow the JV to better understand how to direct its resources into future planning to meet the needs of NSW’s energy demand. Moreover, the geotechnical investigations can be undertaken with only minimal environmental impacts. Overall, the geotechnical investigations are considered to be in the public interest and is therefore recommended for MSC’s approval.

The geotechnical investigation works are required to inform the design of the overall PHES project which is essential for future financial and construction planning. Overall, the broader PHES project will allow the Company to directly respond to Action 1 of the Hydro Roadmap, which supports the NSW Government’s aim of bringing forward private investment to support the commercialisation of new, large-scale on-demand electricity projects.

As the geotechnical investigations constitute works to inform a feasibility assessment, the purpose of the project itself is to confirm the suitability of the Site for a future potential PHES scheme.

The Site is considered to be suitable to support the current geotechnical investigations as:

- The geotechnical investigations constitute earthworks, a deemed development type which is permitted in any land zone
- There are no relevant matters under SEPP (Resilience and Hazards) 2021 which require further considerations to support the geotechnical investigations
- The geotechnical investigations comprise a temporary package of works which would not create lasting amenity impacts or other land use conflicts within the locality
- The geotechnical investigations can be undertaken with minimal environmental impacts, and a comprehensive EMP setting out the measures listed in Section 6.10.

The potential environmental and amenity impacts of the geotechnical investigations are also considered to be minimal while its public benefit holds great significance. The Site is moreover considered to be suitable for the geotechnical investigations.

Accordingly, it is recommended that MSC grants favourable consideration to the geotechnical investigations.

8. References

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Appendix A – Biodiversity Assessment

Appendix B – Aboriginal Heritage Assessment

Appendix C – Noise and Vibration Assessment

Appendix D – Traffic Impact Assessment

Appendix E – Title Searches

Appendix F – Preliminary Cost Estimate



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