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SMEC INTERNAL REF. 30018041

Statement of Environmental Effects

Muswellbrook Pumped Hydro Energy Storage Upper Reservoir Geotechnical Investigation

Client Reference No. 30018041
Prepared for: Muswellbrook Pumped Hydro Company Pty Ltd
5 July 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 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 upper reservoir geotechnical investigations (characterised as "earthworks") within private rural landholdings atop Bells Mountain in Muswellbrook NSW. The site of these proposed geotechnical investigations adjoins the Muswellbrook Coal Mine site. The geotechnical investigations will inform the feasibility and design of a broader Pumped Hydro Energy Storage (PHES) project. The operator of the adjoining mine, Muswellbrook Coal Company Limited (MCC), has ceased mining operations at the Site and is currently undertaking rehabilitation works. Whilst the MCC land would form part of the future PHES project site, the geotechnical investigations which are proposed within this SoEE would largely avoid the MCC landholdings.

It is considered that these geotechnical investigations can be undertaken with only minimal environmental impacts. They would have a capital investment value of about $1.8M (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 11 borehole sites (BHs 12, 4, 6, 7 and 10, as well as BHUs 1-5). A total of four testing pits (Test Pits 8-12) generally between 1 m – 5 m (AHD) will 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. At one section of the access track alignment, one of two options will be constructed to access a switchback configuration (refer to options shown on Figure 3-2 in Section 3.2)
- Creation of new access tracks involving vegetation removal
- Borehole creation using a drilling rig, reaching depths of up to 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 four test pits using a track mounted excavator digging pits up to approximately 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 access tracks 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.

Vegetation described as Upper Hunter Box-Blakelys Red Gum Grassy Forest would be cleared as part of these geotechnical investigation works, for which no Threatened Ecological Community (TEC) status is relevant under the *Environment Protection and Biodiversity Conservation Act 1999* or the *Biodiversity Conservation Act 2016*. This clearing would be undertaken primarily at borehole pad sites, and also to extend access for borehole pad sites off existing access tracks where required. However, the small-scale extent and temporary nature of the proposed works is unlikely to result in significant impacts for local biodiversity (refer to Section 6.1).

The Site contains various ephemeral waterbodies (online dams and tributaries of Sandy Creek). 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 a private, rural landholder, with one property owned by MCC. Drilling works are proposed to occur 24/seven.

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	AGL	Appendix E
Preliminary Cost Estimate	SMEC	Appendix F

1.1 Synopsis of Proposed Geotechnical Investigation

Table 1-2 provides upper 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	Lot 126 DP752444, 250 Dolahentys Road McCullys Gap 2333 Lot 5 DP1178473, 250 Dolahentys Road McCullys Gap 2333 Lot 1 DP113760, 250 Dolahentys Road McCullys Gap 2333 Lot 167 DP752444, 250 Dolahentys Road McCullys Gap 2333 Lot 85 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 84 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 23 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 24 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 93 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 100 DP666041, Coal Road Muswellbrook 2333 Lot 1 DP134665 Muscle Creek Road Muscle Creek 2333 Lot 1 DP398873 Muscle Creek Road Muscle Creek 2333

Matter	Details
Relevant Statutory Provisions	*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 Environment Operations Act 1997* *Water Management Act 2000* *Heritage Act 1977* *Local Land Services Act 2013* *Coal Mine Subsidence Compensation Act 2017* *Muswellbrook Local Environmental Plan 2009* *Muswellbrook Development Control Plan 2009* *State Environmental Planning Policy (Resources and Energy) 2021* *State Environmental Planning Policy (Transport and Infrastructure) 2021* *State Environmental Planning Policy (Resilience and Hazards) 2021*

2. Planning Context

2.1 Planning History

The site is entirely subject to the *Muswellbrook Local Environmental Plan 2009* (MLEP) and the *Muswellbrook Development Control Plan 2009* (DCP 2009).

A search of MSC's DA Tracker on 17 April 2023 did not return any results for previous DAs having been approved on the land parcels to which the proposed geotechnical investigations relate. The DA tracker data may not be accurate for DAs that might have been assessed several decades prior. Land uses may also have occurred within the site which do not ordinarily require consent from MSC, or which did not require such consent at their time of commencement.

2.2 Pre-Application DA 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 upper reservoir area. The investigation was wholly within the Muswellbrook Coal Mine site. The current geotechnical investigation will require boreholes in locations solely within the upper reservoir site atop of Bells Mountain, which is the site of some future PHES proposed infrastructure.

A Pre-Application meeting was held at MSC'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 (which are currently being progressed as standalone DAs with MSC)
- Geotechnical investigation completed in 2020 (DA 2020-40)
- Similarity of proposed upper reservoir investigations 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.

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 upper reservoir geotechnical investigation
- Provision of scope of works and detailed description for the upper 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 upper 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 upper reservoir geotechnical investigation area and consultation with Crown Lands to confirm permitting and landowner consent (not relevant to this upper reservoir Geotechnical Investigation)
- 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 $1.8M (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.

Department of 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 upper 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 gird 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 suitably 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 in the near vicinity of the 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).

Aberdeen
Dartbrook Road
New England Highway
Rouchel Road
Rouchel Gap Road
Mccullys Gap
Sandy Creek Road
Kayuga Road
Wybong Road
Muswellbrook
Sydney Street
Muscle Creek Road
Scrumlo Road
N

LEGEND

Project Area

Road

0 1 2
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

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

3.2 Parcel Details

The geotechnical investigations comprise works within, or access gained via the lots outlined in Table 3-1. Figure 3-2 provides a map of land ownership within the upper reservoir portion of the overall proposed PHES project, which is primarily located on private rural landholdings. The proposed geotechnical investigations will not traverse any crown land lots, however access will be gained to the test sites along tracks which are in the near vicinity of mapped crown lands (Figure 3-2).

Table 3-1: Parcel Details

Nature of works	Parcel details
Access	Lot 126 DP752444, 250 Dolahentys Road McCullys Gap 2333 Lot 5 DP1178473, 250 Dolahentys Road McCullys Gap 2333 Lot 1 DP113760, 250 Dolahentys Road McCullys Gap 2333 Lot 167 DP752444, 250 Dolahentys Road McCullys Gap 2333 Lot 85 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 84 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 23 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 24 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 1 DP134665 Muscle Creek Road Muscle Creek 2333 Lot 1 DP398873 Muscle Creek Road Muscle Creek 2333
Geotechnical works	Lot 93 DP752484, 250 Dolahentys Road McCullys Gap 2333 Lot 100 DP666041, Coal Road Muswellbrook 2333

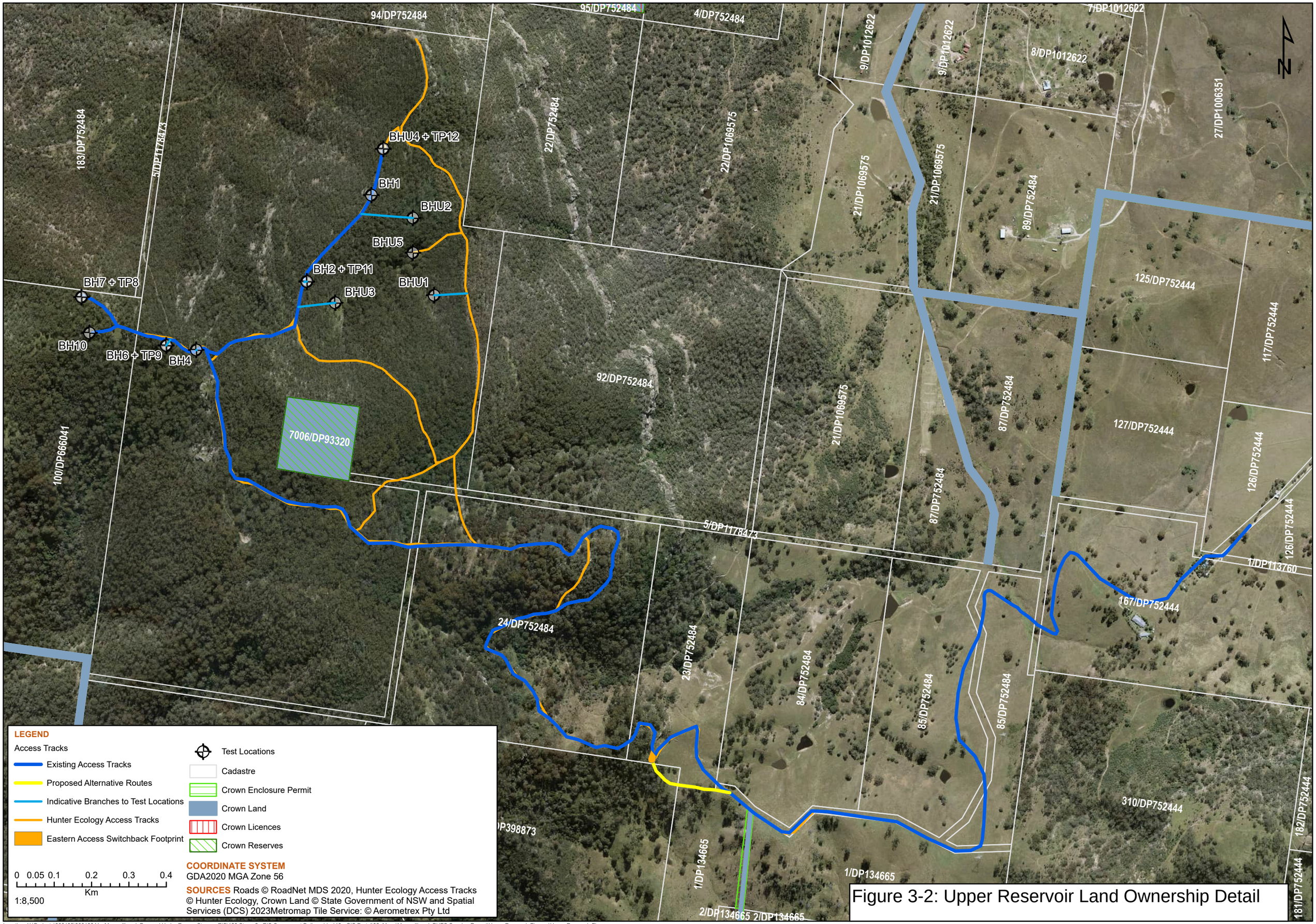

Figure 3-2: Upper Reservoir Land Ownership Detail

Location: X:\Projects\300180\30018041 - Muswellbrook Pumped Hydro Energy Storage EIS\120 Stage 2 - EIS Component Deliverables\19 - GIS Portal\02_Maps\Muswellbrook PHES Scoping Report\Upper Reservoir Figures\Upper Reservoir Figures.aprx

3.3 Existing Site Development

The site for geotechnical drilling works is wholly located on the upper slopes of Bells Mountain. Access will be via the New England Highway, Sandy Creek Road, Dolahentys Road and via a private property located at 250 Dolahentys Road, McCullys Gap (Lot 167, DP752444). 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 farm tracks will primarily be used for access and establishment of a drilling rig. As the access continues towards the upper slopes of Bells Mountain, some vegetation clearing would be required along discrete sections of the proposed access (Section 4.3).

3.4 Site Description

3.4.1 Site Conditions

Geophysical profiling will inform the geotechnical investigation within the area located atop Bells Mountain, a prominent feature of the broader landscape with an elevation of around 688 m above sea level. Bells Mountain is a prominent feature around 4 km northwest of Muswellbrook and 2 km southwest of McCully's Gap (Figure 3-1 in Section 3.1). The Mountain ranges in elevation from 550 to 650 m above sea level. The topography is moderately steep with an average slope across the Site of 18%. Slope varies widely throughout the site ranging from 0 to 76%. The study area covers a range of different aspects but is dominated by its northern and southern facets. This topography is overlaid by a relatively infertile soil landscape.

According to broadscale soil landscape mapping, study area comprises the Colonel, Rosevale and Scrumlo soil landscapes. The upper slopes are underlain by the Colonel soil landscape, which covers rolling hills and rolling mountains often with scree slope. It commonly has rocky outcrops and steeper slopes between 18-50%. The landscape type has generally been subjected to relatively little clearing across its range.

The lower slopes are underlain by Rosevale and Scrumlo soil landscapes. The Rosevale soil landscape covers rolling hills and slopes ranging from 15-20%, with some up to 60%. The Scrumlo soil landscape covers undulating to rolling hills with slopes varying from 9-16%.

The soils around the study area are characterised by poor structure and lower fertility. They are classified as Rudosols under the Australian Soil Classification schema (DPIE, 2022). As such, they are young soils with little to no pedologic structure and minimal development of horizons. Edaphic models (DPIE, 2022) indicate low soil fertility suggested by moderate soil organic carbon (1 – 1.5 %) and pH (5 – 5.5) and low salinity (0.05 – 1 dS/m), cation exchange capacity (5 – 10 mol/kg) and phosphorus levels (100 – 200 dS/m). This combination of pedologic, edaphic and topographic factors give rise to a range of vegetation types across the study area.

The study area is mostly surrounded by level and low undulating agricultural and pastoral land, with the recently ceased mining operation (currently progressing through rehabilitation), located on its southwest. It rises rapidly to a height of 688 m above sea level. The mountain is heavily forested with a mixture of native flora (including Ironbark, Red Gum and Spotted Gum) but some areas have been cleared to make way for dirt tracks and transmission lines. The study area is also 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 the potential for past Aboriginal habitation. The Hunter River is around 7 km to the west, fed by a number of creeks less than 2 km distant.

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 adjacent properties, and the Muswellbrook Coal Mine site and its buffer lands are also located in the near vicinity of the upper reservoir geotechnical investigations site. Nearby agricultural land uses primarily comprise 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 within the surrounding area 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. Proposal

4.1 Overview

This section 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 impact areas 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") atop Bells Mountain, Muswellbrook, to inform the feasibility study for a potential future PHES scheme using the Bells Mountain as an upper reservoir location.

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 access tracks where the existing ground has eroded to provide for safe access
- Borehole creation using a drilling rig, reaching depths of up to 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 four test pits using a track mounted excavator digging pits up to approximately 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 privately held rural landholdings during 24/seven hours.

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 areas atop Bells Mountain
- 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 m^3 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
- 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

The site for geotechnical drilling works will be wholly on the upper slopes of Bells Mountain. Access will be via the New England Highway, Sandy Creek Road, Dolahentys Road and via a private property located at 250 Dolahentys Road, McCullys Gap (Lot 167, DP752444). 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 farm tracks will be primarily utilised for the access and establishment of a drilling rig. As the access continues towards the

upper slopes of Bells Mountain, some vegetation clearing would be required along discrete sections of the proposed access in the following locations:

- Where one of the two switchback options is undertaken within Lot 23 DP752484 and/or Lot 1 DP398873 (refer to proposed alternative route and eastern access switchback footprint on Figure 3-2 above); and
- Where additional track branches are required to be formed off of the main track (refer to branch locations indicated in light blue on Figure 3-2).

Refer to Section 6.1 and Appendix A Biodiversity Assessment for further consideration of this proposed vegetation clearing. Sections 2.5 and 3 of Appendix D Traffic Impact Assessment also provide further context regarding the site's relationship with the surrounding road network (also refer to Section 6.5 below).

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.

BHU4 + TP12
BH1
BHU2
BHU5
BH2 + TP11
BHU1
BHU3
BH7 + TP8
BH10
BH6 + TP9
BH4

N

LEGEND

Access Tracks

- Existing Access Tracks
- Proposed Alternative Routes
- Hunter Ecology Access Tracks
- Indicative Branches to Test Locations
- Eastern Access Switchback Footprint
- Test Locations

0 0.05 0.1 0.2 0.3 0.4 0.5
Km

1:8,500

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020
Metromap Tile Service: © Aerometrex Pty Ltd

Figure 4-3: Upper Reservoir Access Tracks

Location: X:\Projects\300180\30018041 - Muswellbrook Pumped Hydro Energy Storage EIS\120 Stage 2 - EIS Component Deliverables\19 - GIS Portal\02_Maps\Muswellbrook PHES Scoping Report\Upper Reservoir Figures\Upper Reservoir Figures.aprx

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 m^3 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.

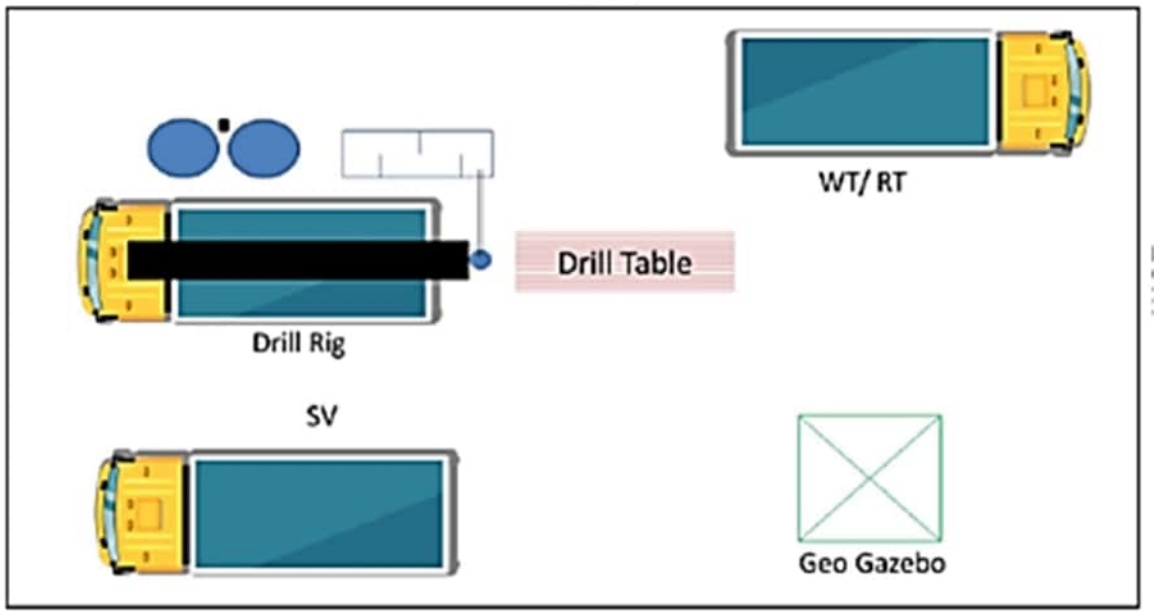

Figure 4-4: Typical borehole arrangement

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.

Typically, 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 Insitu Stem 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 Test Pitting

Four 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.

4.10 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.

4.11 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 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 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 2000

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, 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.

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

Lot/DP and Address*	Zone
Lot 126 DP752444, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production
Lot 5 DP1178473, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production C3 Environmental Management
Lot 1 DP113760, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production
Lot 167 DP752444, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production
Lot 85 DP752484, 250 Dolahentys Road McCullys Gap 2333	C3 Environmental Management
Lot 84 DP752484, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production C3 Environmental Management
Lot 23 DP752484, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production C3 Environmental Management
Lot 1 DP134665 Muscle Creek Road Muscle Creek 2333	RU1 Primary Production
Lot 1 DP398873 Muscle Creek Road Muscle Creek 2333	RU1 Primary Production
Lot 24 DP752484, 250 Dolahentys Road McCullys Gap 2333	RU1 Primary Production C3 Environmental Management
Lot 93 DP752484, 1056 Sandy Creek Road, McCullys Gap 2333	C3 Environmental Management
Lot 100 DP666041, Coal Road Muswellbrook 2333	C3 Environmental Management

*Note that land parcels included in this Table include some land parcels which are required to facilitate site access only.

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

Existing zones	
Zone C3 Environmental Management	
1. Objectives of the zone	• 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	
1. Objectives of the zone	• 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: – 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 – Detrimentally affect in any way the quantity, flow, and quality of water in either subterranean or surface water systems, or

Existing zones	
	– Visually intrude into its surroundings, except by the way of suitable screening. • To protect or conserve (or both): – 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.
2. Permitted without consent	Extensive agriculture; Home occupations; Intensive plant agriculture.
3. 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.
4. Prohibited	Any development not specified in item 2 or 3.

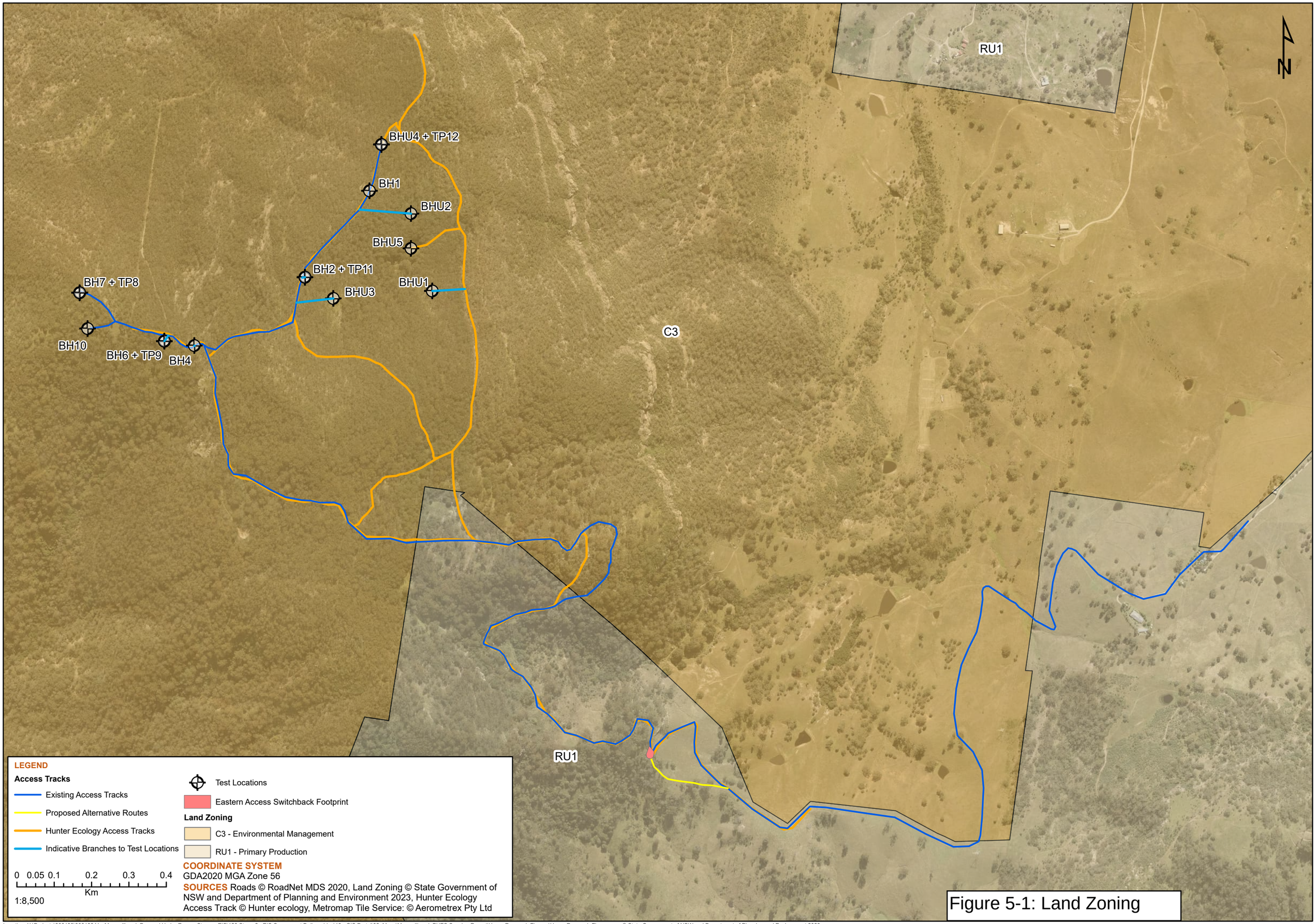

Figure 5-1: Land Zoning

Location: X:\Projects\300180\30018041 - Muswellbrook Pumped Hydro Energy Storage EIS\120 Stage 2 - EIS Component Deliverables\19 - GIS Portal\02_Maps\Muswellbrook PHES Scoping Report\Upper Reservoir Figures\Upper Reservoir Figures.aprx© State Government of NSW and Department of Planning and Environment 2023

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 currently being used for the purposes of sporadic cattle grazing, 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 approximately three months to complete.

Section 6.4 advises 'The nearest residential building has been identified to be approximately 1.2 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 6-4 and are not expected to result in vibration levels above the human comfort criteria.' Resonate 2020.

Sections 6.7 and 6.9 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)). Sections 6.1.4 and 6.9 set 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 6.9 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 recent thermal coal mining operations at the adjacent site. 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 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 earthworks 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 the Clause 7.6 of the MLEP 2009.

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

- The proposed development can be undertaken without causing any detrimental impacts to the existing drainage patterns or soil stability of the locality (Section 6.7, 6.8 and 6.9)
- The proposed development 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 proposed development
- Around 60 tonnes of dirty water and drill cuttings is expected to be removed from the site and disposed of offsite by a licensed contractor (Section 6.6)
- It is considered that the proposed development can be undertaken without causing any significant noise impacts for surrounding receivers (Section 6.4)
- The proposed development 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 proposed development (Sections 5.2.1 and 6.2). The proposed development would not impact on any non-Aboriginal heritage items (Section 6.3).
- It is considered that the proposed development can be undertaken in compliance with Section 120 of the POEO Act (Section 5.2.5). 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 Muswellbrook Shire Council to consent to the proposed development.

5.1.2.2 Muswellbrook Development Control Plan 2009

An assessment of the proposed development 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 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 1,000m^2.	These matters are dealt with in a comprehensive Environmental Management Plan which is being prepared to support the proposed development	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 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 6.9 explains how erosion and sediment controls would be installed at this site to manage surface runoff. This would be done in accordance with *Blue Book (Managing Urban Stormwater, Soils and Construction, Volume 1 (NSW Government 20004) and Volume 2E, Mines and Quarries (*DECC, 2008)). Section 6.9 furthermore 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 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 and Appendix A set out how existing, native vegetation at the site has been surveyed and identified as belonging to three separate Plant Community Types corresponding with related 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	This DA seeks consent for clearing *Upper Hunter Box-Blakelys Red Gum Grassy Forest*, for which no TEC status is relevant under the EPBC Act or the BC Act.	Yes

	Detail	Proposed	Complies?
	Authority (CMA) in regard to the Native Vegetation Act 2003.		
	(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 (Section 6.1). Moreover, both the DoEE and DPE have confirmed that no approvals would be required under the EPBC Act or the BC Act 2016 (Sections 5.1.4 and 5.1.5).	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 proposed development does not propose such a clearing.	Not applicable
	(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.	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 5.2.7, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the site.	Yes

	Detail	Proposed	Complies?
	(ii) Avoid undertaking works within riparian buffer areas where other options are available. Any proposed development within the riparian buffer area is accompanied by a detailed consideration of the environmental impacts associated with the proposal and alternative options considered and reasons why those alternatives are not viable.	As set out in Section 5.2.7, 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	The proposed development would not involve any in-stream works and would therefore not impact directly on watercourse 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: - • 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 gravel beds, snags, aquatic macrophytes etc. • Protect water quality • Implement rehabilitation and	As set out in Section 5.2.7, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the site. However, as the proposed development comprises temporary works only (around six-eight weeks in length) which would be rehabilitated once finalised, and as the streams at the site are ephemeral only, it is considered that the proposed development would not impact on surround surface water systems in terms of water quality or their hydrodynamic functionality. Section 6.9 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)).	Yes

	Detail	Proposed	Complies?
	restoration measures following disturbance		
	(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 proposed development 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 the *Fisheries Management Act 1994*.	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 (Section 5.2.7).	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 proposed development comprises temporary works only (around six-eight weeks in length) which would be rehabilitated once finalised, and as the streams at the site are ephemeral only, it is considered that the proposed development would not impact on surround surface water systems in terms of water quality or their hydrodynamic functionality.	Yes

	Detail	Proposed	Complies?
	(ii) Large scale or high-density developments to be located in areas located alluvial zones.	The proposed development does not constitute a large scale or high-density development	Not applicable
	(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 proposed development comprises temporary works only (around six-eight weeks in length) which would be rehabilitated once finalised, and as the streams at the site are ephemeral only, it is considered that the proposed development 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 proposed development 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 5.2.7, this DA seeks a Controlled Activity Approval to undertake works within 40 m of ephemeral waterbodies at the site.	Yes

5.1.2.3 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.

5.1.2.4 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 in the near vicinity of a recently 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.

5.1.2.5 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 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).

5.1.3.2 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 not known whether previous Section 94 Contributions have already been paid for the site of these proposed geotechnical works. In any event, the proposed geotechnical investigations are not a category of works for which contributions are ordinarily paid for.

5.1.4 Environment Protection and Biodiversity Conservation Act 1999

Matters of National Environmental Significance listed under the EPBC Act and relevant to the proposed works comprise one Critically Endangered Ecological Community, 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 Matters of National Environmental Significance.

5.1.5 Biodiversity Conservation Act 2016

The geotechnical investigations work would occur in areas of known threatened communities, listed as Endangered Ecological Communities 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 (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.

5.2 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 (Table 6-6).

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 the JV and landowner 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
- Removing 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.

5.2.1 National Parks and Wildlife Act 1974

Aboriginal objects, whether recorded or as yet undiscovered, are afforded statutory protection under the *National Parks and Wildlife Act 1974* (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 (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.

5.2.2 Local Land Services Act 2013

This DA seeks consent for clearing of vegetation considered to be equivalent to *Upper Hunter Box-Blakelys Red Gum Grassy Forest*, for which no TEC status is relevant under the EPBC Act or the BC Act. This is clearing for which no exemption is provided for under Schedule 5A of the *Local Land Services Act 2013.* The DA for the proposed geotechnical investigations would therefore seek approval to clear vegetation.

5.2.3 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*.

5.2.4 Rural Fire Services 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.

5.2.5 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 may be encountered/intercepted during the geotechnical investigations. However, given the 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.

5.2.6 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 of 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).

5.2.7 Water Management Act 2000

The 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 furthermore defined under the WM Act to include:

(a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and

(b) any tributary, branch, or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and

(c) 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:

(a) any watercourse, whether perennial or intermittent and whether comprising an artificial channel that has changed the course of the watercourse,

(b) 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. These water features at the site are ephemeral. This is confirmed by one of the field work mobilisations which was undertaken to support this SoEE, which found no standing water present in the vicinity of the proposed geotechnical works in August 2022. The Hunter River is around 7 km to the west and is fed by a number of creeks which are less than 2 km from the proposed geotechnical works. The ephemeral streams onsite have been characterised as 1st, 2nd, and 3rd order streams (refer to Figure 6-8 in Section 6.7.3 below). Minor filling works are also required to be undertaken around existing culverts at the site where the existing ground has eroded. Figure 6-8 in Section 6.7.3 below shows where the geotechnical access tracks would cross one existing first order stream and one existing second order stream.

One proposed borehole pad location (BHU5) may be situated within around 40 m from an existing, mapped firsts/second order stream (refer to Figure 6-8 in Section 6.7.3 below).

As such, a controlled activity permit to carry out works on waterfront land would 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.*

Therefore, even though groundwater is likely to be intercepted at the site, an aquifer interference approval should be easily obtained from DPE to support the geotechnical investigation works. 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.

Subclause 7(2)(f), Part 1 of Schedule 4 to the *Water Management (General) Regulation 2018* further 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 are 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 that is taken for which the exemption is claimed, and
- Make the record no 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 5 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.

As the minor culvert upgrade works and potential interaction with BHU5 would also take place within the E3 Environmental Management zone at the site (refer to Figure 5-1 in Section 5.1.2.1 above), it is also considered that these works cannot be considered exempt under Clause 23, Part 1 of Schedule 4 to the *Water Management (General) Regulation 2018*. Rather, approval is sought for these minor culvert upgrade works as part of this DA.

Overall, a controlled activity approval to undertake works on waterfront land would be required under Subsection 91(2) of the WM Act, as would an aquifer interference approval under Subsection 91(3) of the WM Act. These would be sought as part of the Integrated Development referrals process during the DA assessment. This DA also seeks consent for the minor culvert upgrade works.

5.2.8 Coal Mine Subsidence Compensation Act 2017

Part 3 of the *Coal Mine Subsidence Compensation Act 2017* provides that development within a mine subsidence district requires under that Act. This DA will be undertaken as Integrated Development with the understanding that approval also needs to be obtained under the *Coal Mine Subsidence Compensation Act 2017* due to previous mining activities having occurred in the near vicinity of the site.

5.2.9 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.

5.2.10 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 the location of nearby records and observation dates, and the 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 23-24 August 2022 and by three ecologists from 12-15 December 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 surveys, spotlighting, call playback and opportunistic sightings. Some species were excluded from survey where their presence can be assumed (e.g., microbats) or where the habitat assessment provides a more accurate prediction of their presence based on the impact area in comparison to the species' home ranges and limited survey period available (e.g., some diurnal bird species and Spotted-tailed Quoll).

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
- 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).

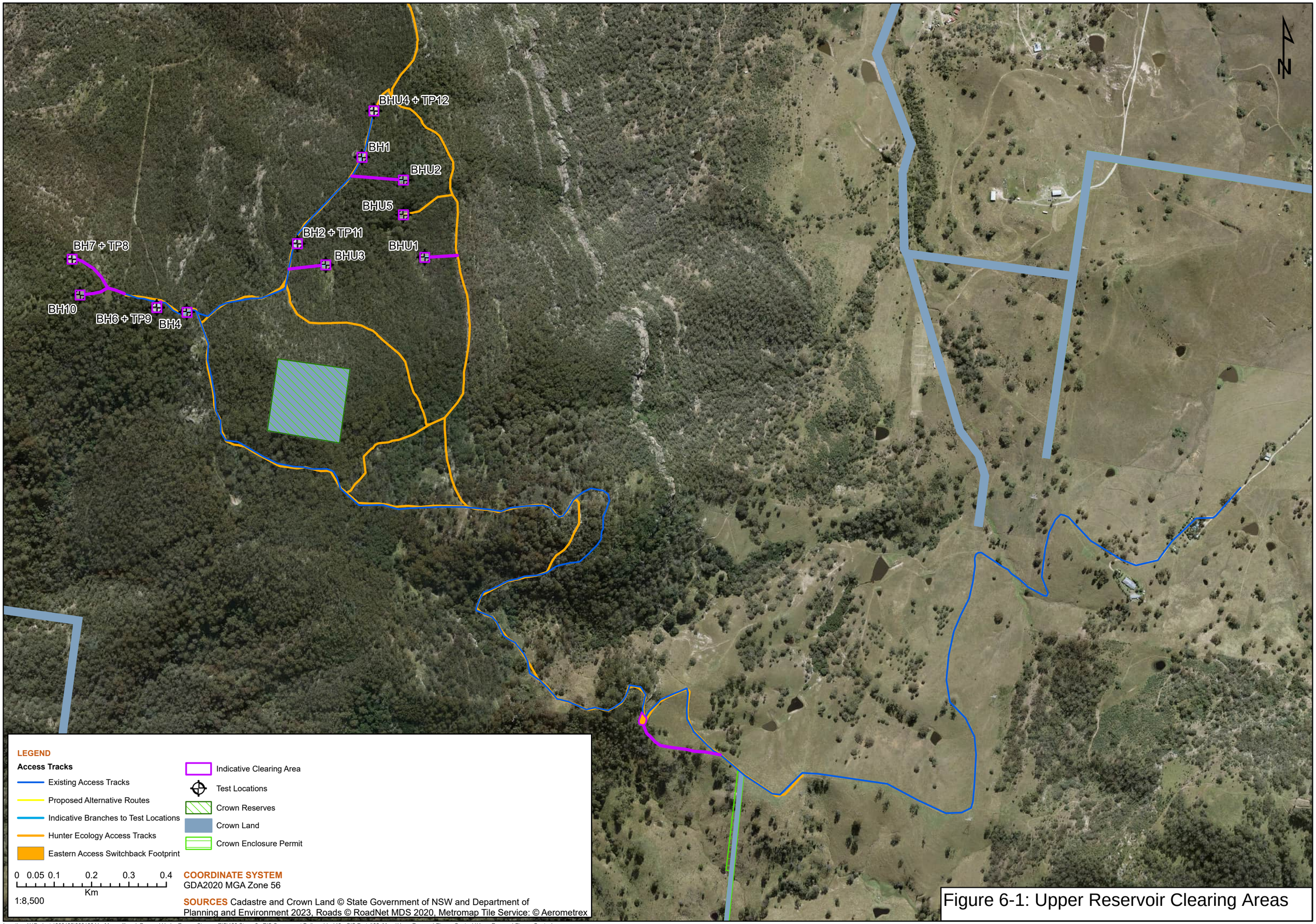

Figure 6-1: Upper Reservoir Clearing Areas

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

6.1.2 Existing Environment

6.1.2.1 Vegetation communities

Six native vegetation communities were identified in the study area:

- PCT 3525: Upper Hunter Box-Blakelys Red Gum Grassy Forest
- PCT 3120: Hunter-Peel Ranges Dry Rainforest
- PCT 3851: Upper Hunter Hills Rocky Scrub
- PCT 3439 Hunter Escarpment Grey Gum Forest
- PCT 796: Derived Grassland of the NSW South Western Slopes
- PCT 3240 Lower North Escarpment Red Gum Grassy Forest.

6.1.2.2 Threatened Ecological Communities

Two PCTs described in Section 6.1.2.1 above have associations with the following Threatened Ecological Communities (TECs):

- PCT 796: Derived Grassland of the NSW South Western Slopes
- PCT 3120: Hunter-Peel Ranges Dry Rainforest.

However, neither of the following PCTs are considered to meet characteristics of any of their associated threatened communities. Moreover, no vegetation clearing is proposed to occur within either of these PCTs.

6.1.2.3 Threatened flora

The desktop assessment identified four 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

Nine 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 recorded in the study area. Fallen logs also occur in areas with more mature vegetation. An overview of the microhabitat features present at each of the survey sites is outlined in the table below.

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 (Figure 6-2).

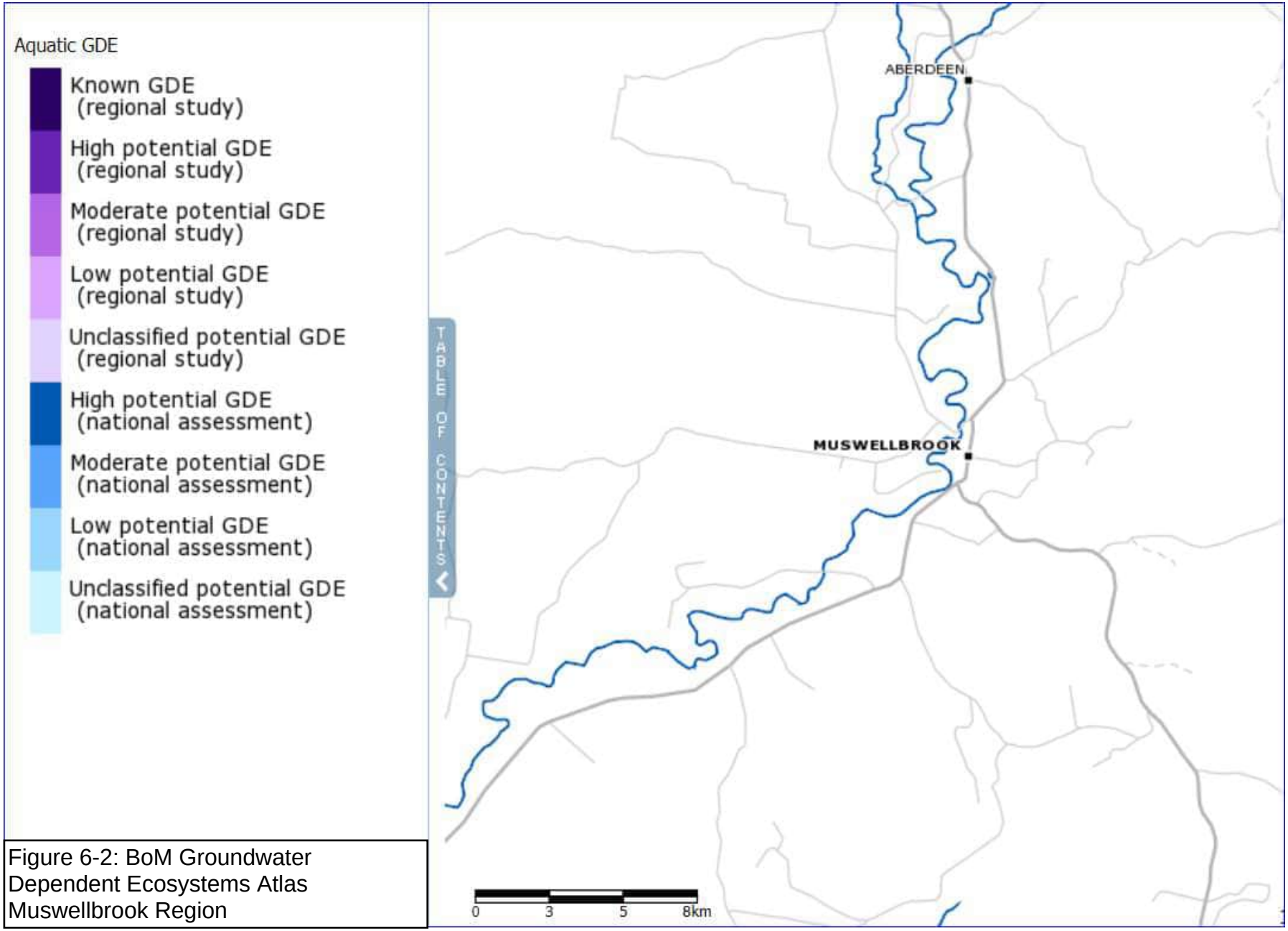

Figure 6-2: BoM Groundwater Dependent Ecosystems Atlas Muswellbrook Region

6.1.3 Assessment of Impacts

6.1.3.1 Direct impacts

The geotechnical investigations will result in the following direct impacts:

- Clearing of between 0.94 ha and 0.98 ha of native vegetation (depending on which switchback access route is used – refer to Figure 4-3 and Section 4.3 above). This clearing would not include any TECs as currently listed under the BC Act or the EPBC Act
- Removal of threatened species 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 direct 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.

Measures to prevent and mitigate direct and indirect impacts on adjacent vegetation and threatened species habitat is outlined in Section 6.9, including Table 6-6.

6.2 Aboriginal Cultural Heritage

6.2.1 Assessment Methodology

An assessment of the impacts from geotechnical investigation works and associated 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. This assessment was required to take into consideration the potential Aboriginal heritage impacts of these geotechnical activities in the upper reservoir area in accordance with the *NSW Minerals Industry Due Diligence Code of Practice of 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 NP&W 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 upper reservoir site having regard to above mention legislation, in particular the NP&W Act. The investigation based on desktop research and supported by observations made during field work at and around the upper 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 upper 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 2023.

6.2.2 Existing Environment

At the time of the fieldwork inspection in March 2023, the area had experienced significant rainfall over the preceding three years, after prolonged dry seasons. Hence, the grass and vegetation cover were thicker than that which characterised the site during an earlier due diligence survey conducted in December 2020 by Reiner Mantei (Extent Heritage). During a follow up survey in May 2023, the underbrush had begun to die off due to drier weather, improving access and ground surface visibility.

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 also includes rocky overhangs that have the potential for past human habitation. In other words, the wider area has high potential for archaeological evidence of Aboriginal habitation.

Although Aboriginal occupation of an area 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 arial 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, 1989, 1993 and 1998 (refer to Appendix B).

The historical aerials indicate that parts of the study area have been largely undeveloped with the only works around the study area being vehicle tracks, and a small dam to the south of the study area. The biggest change in the immediate surrounds of the study area is the tree removal on the western slopes of Bells Mountain from 1964 onwards. Although the top of Bells Mountain appears to undergo thinning sometime between 1972 and 1989, the study area had been mostly maintained tree cover with only some sections of tree removal for tracks, transmission lines and livestock herding within the proposed borehole and test pit locations. Significantly larger sections of clearing all occur on part of or outside of the access tracks at this time.

A search of the Heritage NSW AHIMS database was carried out on 25 January 2023 (Client ID: 748209) (refer to Appendix B of Appendix B Aboriginal Heritage Assessment). There are no registered Aboriginal sites within the 'upper reservoir' study area (Figure 6-3).

A previous search of the study area shows that four registered AHIMS sites are located more than 2 km from the 'upper reservoir' proposed project footprint. They are within close proximity to the 'lower reservoir' (<100 m), but all those sites are outside the proposed project footprint and the planned geotechnical works program.

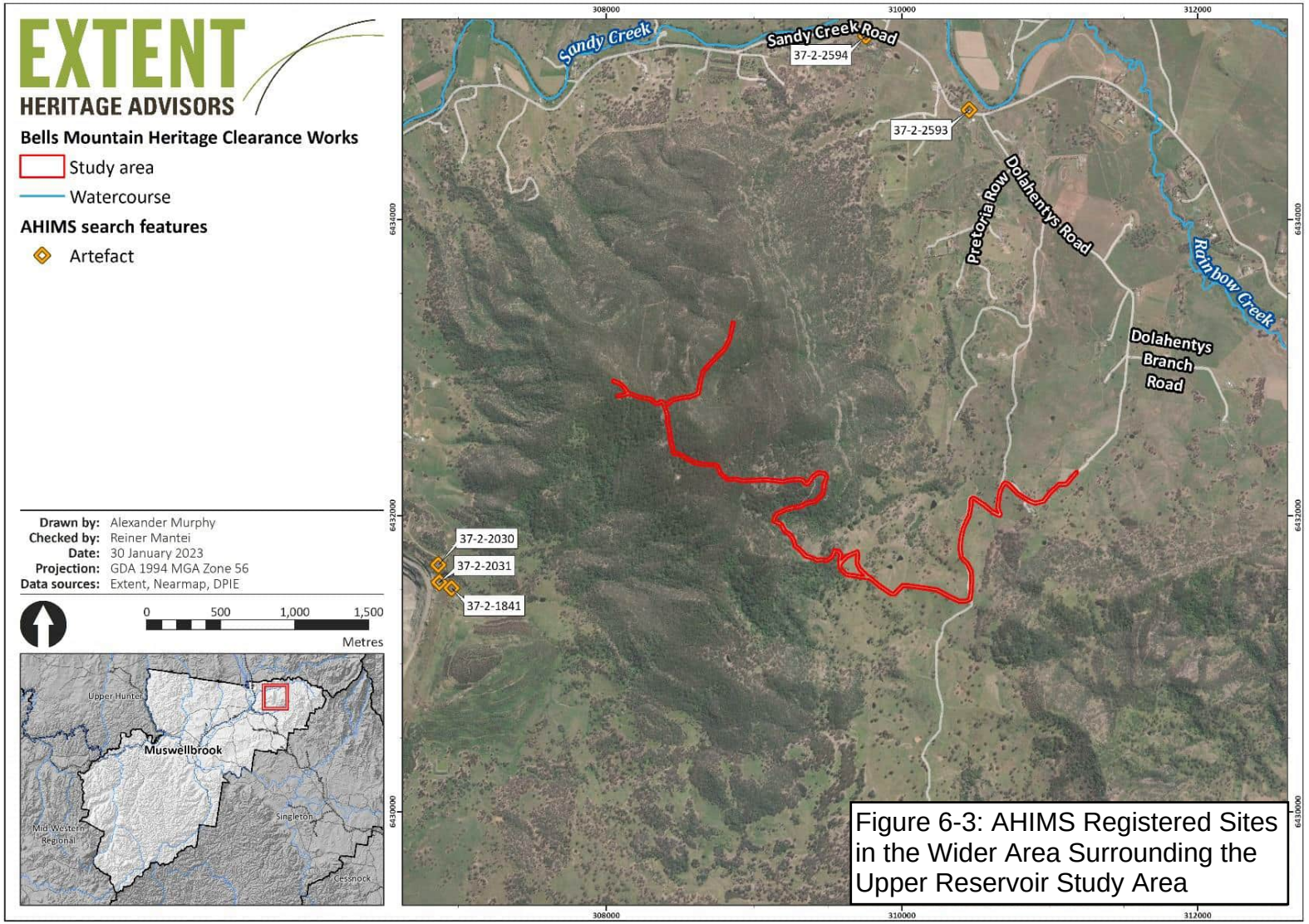

Figure 6-3: AHIMS Registered Sites in the Wider Area Surrounding the Upper Reservoir Study Area

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

6.2.3 Assessment of Impacts

A site inspection was undertaken on 15 March 2023 by Hannah Craig-Ward (Archaeologist/Heritage Advisor, Extent Heritage) and Lisa Flemwell (fieldwork assistant, Extent Heritage). Following revision of the borehole locations and improved site access, a follow-up survey was conducted on 18 May 2023 by Hannah Craig-Ward. The site inspections involved a surface survey of the upper reservoir atop Bells Mountain. The surveys were conducted as a pedestrian and visual survey only, with no excavations being conducted during the fieldwork.

Exposed ground surfaces were inspected to identify whether or not any surface artefact scatter or shell midden deposits are present. Mature native trees were identified and inspected for any potential cultural modifications. To ensure full coverage during the cultural heritage survey a buffer was placed on all project works. Where possible, a 30 m x 30 m area was surveyed for all drilling locations and a 10 m corridor for all tracks. Applying this buffer ensured that the entire disturbance footprint was surveyed for potential sites, including any within close proximity.

The upper reservoir study area was overgrown with thick grass and other vegetation and cut by a number of rills and gullies created by surface water. Within the study area, there were several human-made tracks, which were previously cleared for transporting livestock through the area. Some areas within the private rural landholding showed clear signs of previous ground disturbance such as clearing, the establishment of fence lines, and the movement of vehicles using the tracks to move around the boundary. Cattle were not present at the time of the survey. However, the study area had been used in the past for grazing as evident from the fence lines and presence of a molasses lick feeder.

The field survey of the upper reservoir study area on 15 March 2023 also encountered overgrown land with thick vegetation cover, including long grass and low shrubs. However, during the survey on 18 May 2023, dense vegetation was still present in some areas but in others the sticky bush and grass had reduced due to drier and colder weather, allowing some previously inaccessible areas and areas with low ground surface visibility to be surveyed.

Off track, the vegetation cover significantly reduced ground surface visibility to approximately 10-20% in some areas, which constitutes a limitation on this report and its conclusions. Ground surface visibility varied at boreholes located away from pre-existing tracks with around 80% ground surface visibility at best and <10% at worst. Preceding the May survey, the main access track had been slashed, removing the sticky bush and grass cover, therefore improving ground surface visibility significantly.

Unfortunately, due to dense vegetation coupled with steep terrain, BH6, BH7, BH10, TP8 and TP9 could not be accessed. The proposed branch to BHU2 was also densely vegetated, limiting access, and the borehole location was accessed from the eastern track instead. In the surveyed parts of the study area, no Aboriginal artefacts or places were identified.

Appendix B Aboriginal Heritage Assessment provides photos which were taken during the field survey by the Extent Heritage team. The photos capture the upper reservoir study area on the top of Bells Mountain taken on 15 March 2022 and 18 May 2022. Figures 14 – 17 of Appendix B Aboriginal Heritage Assessment illustrate the conditions of the study area during the March survey. Figures 18 – 21 of Appendix B Aboriginal Heritage Assessment exemplify the conditions during the May survey.

A sampling strategy was adopted for the field survey in the upper reservoir area. One hundred percent coverage of the wider study area was not achieved. In those areas that were accessible and surveyed, ground surface visibility was poor (with occasional exceptions). Even in good conditions, it is likely that ground surface visibility in the study area will remain fairly poor. Later survey in drier conditions may improve the survey results to a degree but it is unlikely that survey will ever be able to achieve highly accurate results.

No Aboriginal objects were identified in the surveyed parts of the study area.

There are no sites registered on AHIMS located in the study area's general vicinity. The area is in the vicinity of watercourses and has formerly been characterised by abundant flora and fauna, which is likely to have made it attractive for Aboriginal occupation. There are stone resources that were suitable for the manufacture of stone implements by Aboriginal people. Notwithstanding levels of ground disturbance caused by tree clearing, and pastoral, and agricultural activities, there remains potential for Aboriginal archaeology (surface and sub-surface) to exist within the study area generally.

If such archaeology were to exist, it would be likely to comprise isolated artefacts and surface scatters in disturbed contexts, of low scientific significance. If sub-surface artefacts were identified, in undisturbed contexts, these would be likely to be of higher scientific significance.

However, the potential for such sites to exist is relatively lower. The trees in the study area could not be fully assessed. There were a number of mature specimens observed. There is some potential for culturally scarred trees to exist in the study area.

Within the study area of the upper reservoir, no rocky overhangs were observed, however there are cliffs on the eastern face of Bells Mountain that could not be accessed during the survey. Rocky overhangs in and near the study area could not be accessed during the survey. Rock shelters were favoured locations for Aboriginal people and where they were utilised for shelter there is high potential for scientifically significant archaeology to be present.

All existing track locations were surveyed and demonstrated to be disturbed and to contain no surface artefacts. The proposed tracks extending west to BH7 and TP8, and BH10 could not be surveyed due to dense vegetation and rough terrain. A proposed access track to BHU2 could also not be surveyed due to the same reasons, although the borehole was accessed from the east. A small branch providing access to BH6 and TP9 could also not be surveyed fully due to dense vegetation. However, these amount to only approximately 300 m of track. Given that several kilometres of track were surveyed during the fieldwork underpinning this report, in directly analogous environmental conditions, and no artefacts were identified along them, this report concludes that there is low potential for Aboriginal archaeology to exist along these proposed tracks also.

In relation to the proposed test pits and borehole locations, 10 of the 15 locations were surveyed. Dense stands of sticky hop bush greatly impacted the ability to access several locations. There is low potential for Aboriginal archaeology to exist at the ten surveyed test pit and borehole locations. Based on the survey of two-thirds of the 15 locations, all being in directly analogous environments and where no artefacts were identified, this report concludes that there is low potential for Aboriginal archaeology to exist at the five unsurveyed locations.

Therefore, subject to the qualifications noted above (regarding poor ground surface visibility, access difficulties etc):

- There is low potential for Aboriginal objects to exist on the existing and proposed access tracks, which might be impacted during the proposed works. If any were to exist, they would likely be isolated surface artefacts of low scientific significance
- There is low potential for Aboriginal objects to exist at the proposed borehole locations and their immediate surrounds, which might be impacted during the boring process.

Nevertheless, given the qualifications identified above, the recommendations set out in Section 6.2.4 below adopt a cautious approach.

Table 6-1: Details of the cultural heritage survey over geotechnical locations

Geotechnical location	Cultural heritage survey
BH1	Location was fully surveyed and has been subject to significant ground disturbance and vegetation clearance in the past due to the establishment of a track.
BH2 and TP11	Location was fully surveyed and has been subject to significant ground disturbance and vegetation clearance in the past due to the establishment of a track.
BH4	Location fully surveyed and has been subject to significant ground disturbance and vegetation clearance in the past due to the establishment of a track.
BH6 and TP9	Unable to be accessed and surveyed due to dense vegetation. Area has not been cleared in the past however experienced some thinning in the 1980s.
BH7 and TP8	Unable to be accessed and surveyed due to dense vegetation. Area has not been cleared in the past however experienced some thinning in the 1980s.
BH10	Unable to be accessed and surveyed due to dense vegetation. Area has not been cleared in the past however experienced some thinning in the 1980s.
BHU1	Location was fully surveyed. Area has not been cleared in the past, however, has been used for grazing cattle.
BHU2	Location was fully surveyed. Area has not been cleared in the past.

Geotechnical location	Cultural heritage survey
BHU3	Location was fully surveyed. Area has not been cleared in the past.
BHU4 and TP12	Location was fully surveyed and has been subject to significant ground disturbance and vegetation clearance in the past due to the establishment of a track.

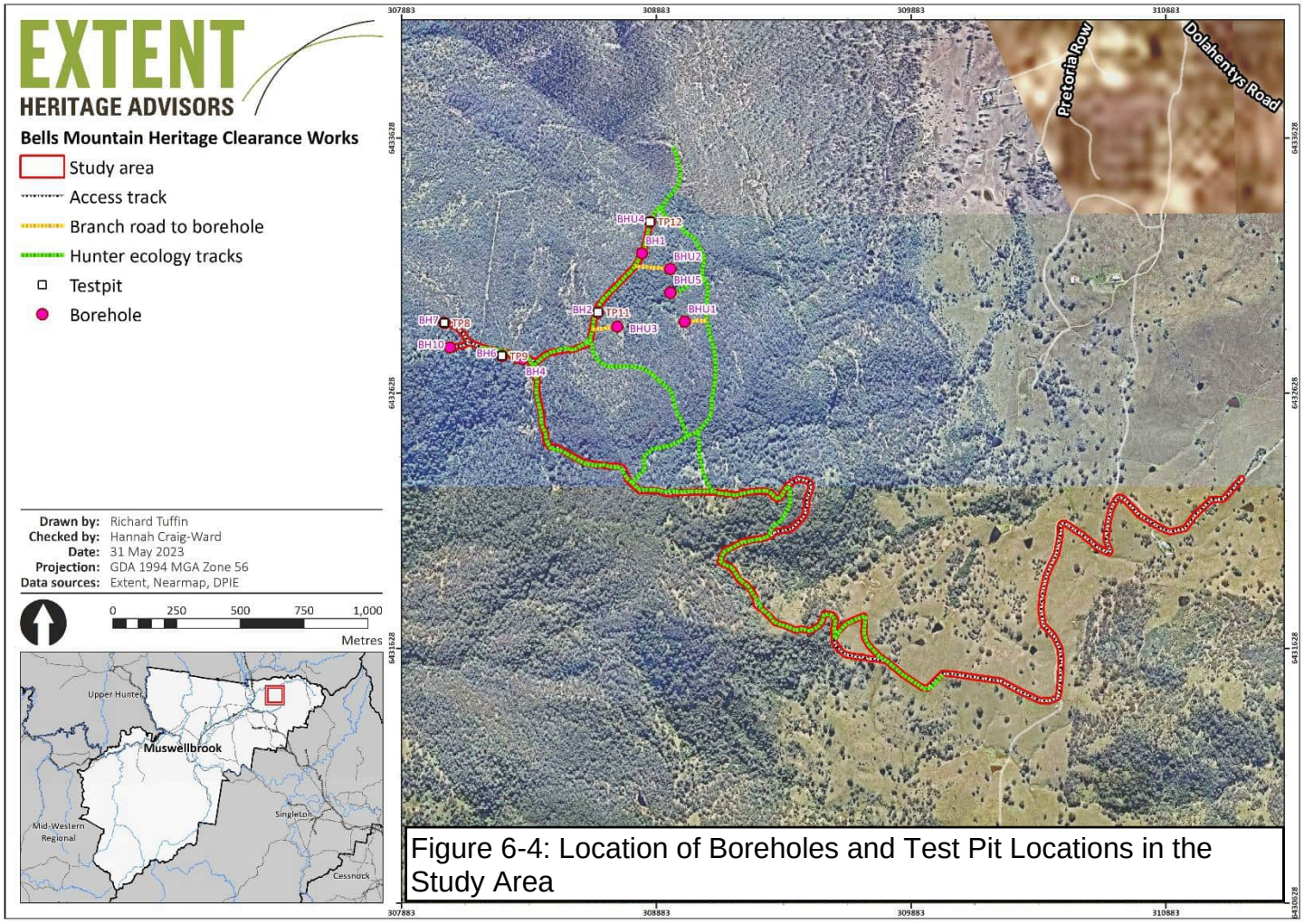

Figure 6-4: Location of Boreholes and Test Pit Locations in the Study Area

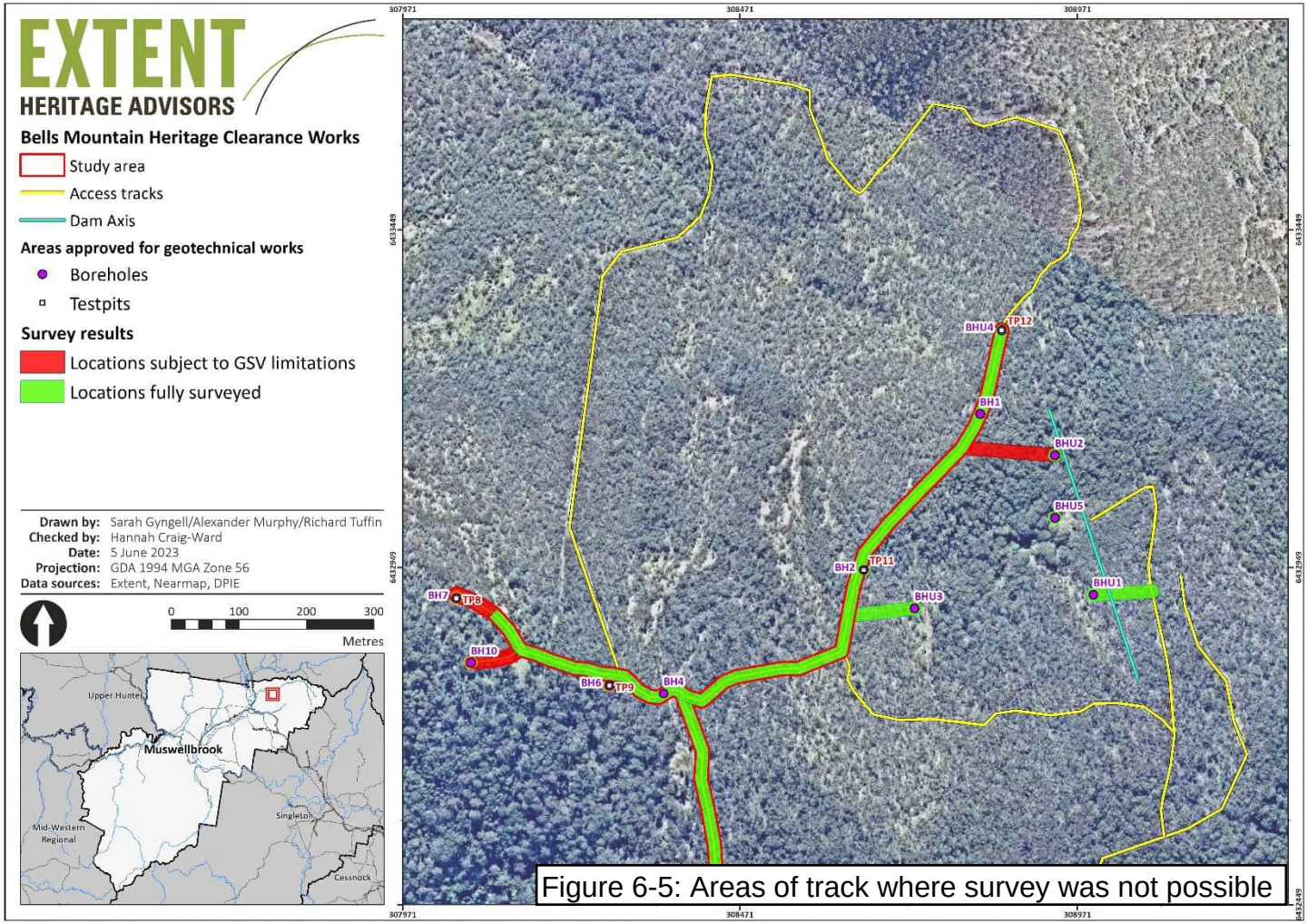

Figure 6-5: Areas of track where survey was not possible

6.2.4 Mitigation and Management Measures

It is appropriate for the proposed works to proceed in the study area. In relation to those few locations and stretches of track that could not be fully accessed/surveyed, a cautious approach should be adopted, including a Chance Finds Procedure and monitoring by a qualified archaeologist. If unexpected artefacts are identified during project works, an AHIP may be required to proceed with the works.

Due to limited access, dense vegetation and poor ground surface visibility across the top of Bells Mountain, the locations of BH6 and TP9, BH7 and TP8, and BH10 were inaccessible. These areas have historically undergone low levels of ground disturbance with much of the area appearing to have never been cleared or otherwise disturbed. However, given that they are in directly analogous environments to those locations that were accessed, and where no artefacts were identified, it is reasonable to conclude that these locations also have low potential for Aboriginal artefacts to exist there. It would be appropriate for works to proceed there without engagement with Registered Aboriginal Parties. However, if unexpected artefacts were identified during project works at any of these locations, an AHIP may be required to proceed with the works. Further, the works in these locations should only proceed subject to a Chance Finds Procedure that would include allowance for the monitoring of ground disturbance works by a qualified archaeologist.

As future programs of development are refined, this due diligence assessment should be refined through further surface survey by archaeologists when better conditions (especially improved ground surface visibility) exist.

The area along the top of Bells Mountain is assessed as having an elevated potential for Aboriginal objects due to the presence of a ridgeline and cliffs along the eastern face, applying the relevant NSW guidelines. This area has historically undergone minimal ground disturbance, with much of the area never being cleared (aside from the establishment of access tracks). This area has been used for cattle grazing in some parts, fence lines have been established, and ground disturbance has occurred with the construction of a dam and a well, but it is otherwise quite undisturbed.

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 NP&W 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.

The above observations are confined to the scientific significance of potential archaeological sites within the study area. To ascertain other kinds of heritage that the study area might embody (e.g., ceremony places, places of spiritual significance) it would be necessary to engage with the relevant Traditional Owners.

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 was not 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 6-2.

Table 6-2: Heritage Registers Search Results

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

Searches for Non-Aboriginal or European heritage did not discover item/s in the area of geotechnical investigation works. However, if during establishment of access tracks and borehole drilling pads an item is uncovered which may

have heritage significance, works in the vicinity of said item would temporarily cease and suitable advice would be obtained.

6.4 Noise and Vibration

Resonate Consultants (Resonate) were engaged to conduct a noise and vibration assessment for the geotechnical drilling works for the upper 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 proposed geotechnical investigations would occur 24/seven and would have an expected duration of 12 weeks. These works at the boring sites in the upper reservoir location would also be undertaken consecutively and not concurrently.

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).

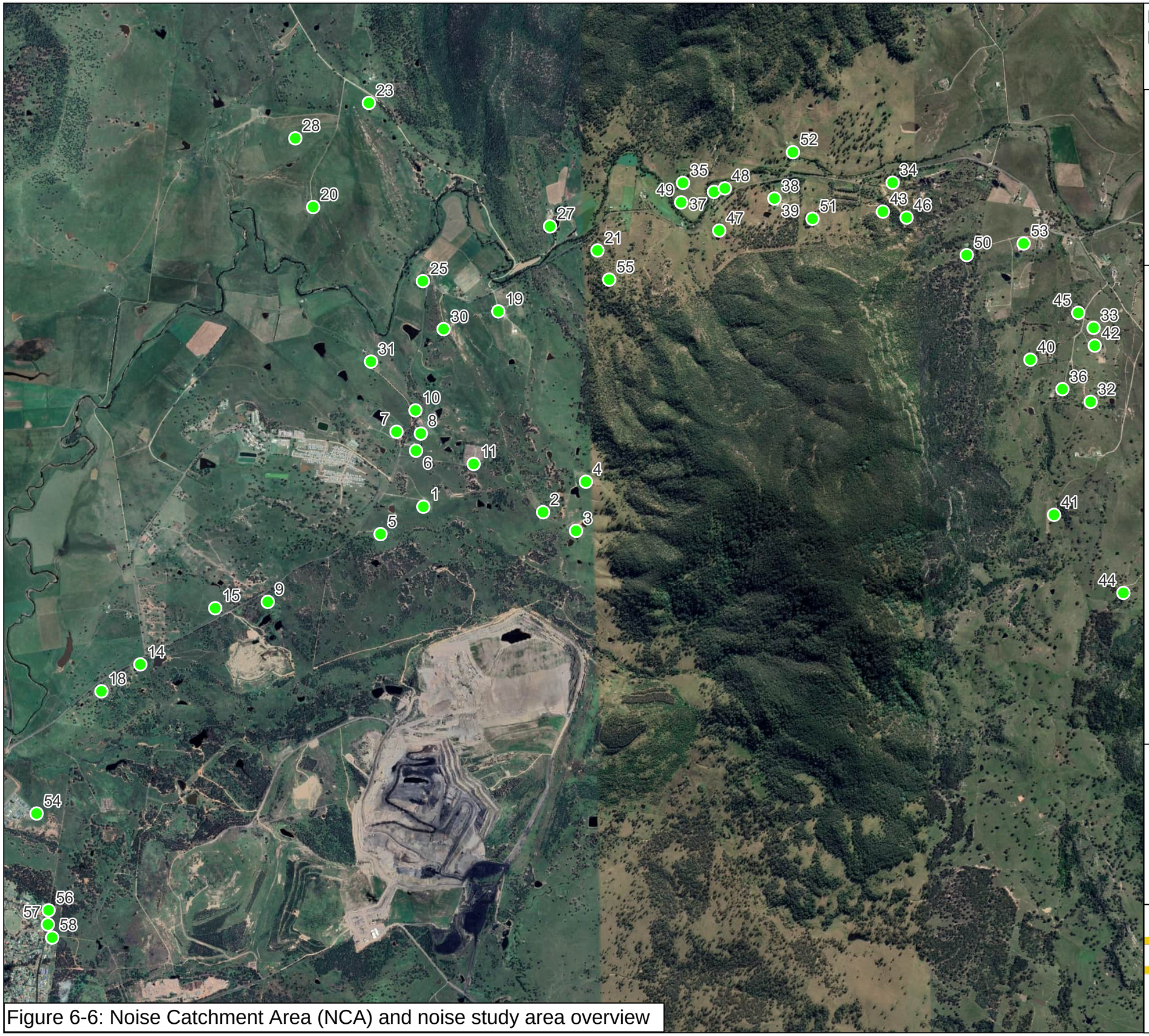

Figure 6-6: Noise Catchment Area (NCA) and noise study area overview

Bells Mt, Muswellbrook Geotech Investigations

Noise sensitive receivers

PROJECT NUMBER	S210514
DRAWN BY	AS
DATE ISSUED	February 2023

Legend

- Noise sensitive receivers

N

0 500 1000 1500 2000 m

Datum GDA 2020, Projection UTM ZONE 56

Resonate

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 would be undertaken within the proposed upper reservoir location on the upper slopes of Bells Mountain. The surrounding land-uses of the proposed drilling site are detailed below:

- North – Distant noise sensitive receivers scattered to the north of the site. Nearest sensitive receiver is at a distance of approximately 1.2 kilometres
- West – Distant noise sensitive receivers scattered to the west of the site. Nearest sensitive receiver is at a distance of approximately 1.2 kilometres
- East – Distant noise sensitive receivers scattered to the west of the site. Nearest sensitive receiver is at a distance of approximately 1.2 kilometres
- South – Vegetation and hills are located to the east of the site with no noise sensitive receivers.

6.4.3 Assessment of Impacts

The sound power levels set out within Table 6-3 were used in the assessment of geotechnical borehole drilling works to determine predicted noise levels (PNLs):

Table 6-3: 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
	Daymakers	1	98
Total Lw			109

The modelled PNL $_{Leq}$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 6-4 provides the recommended safe setback distances.

Table 6-4: Recommended Safe Setback Distances for Relevant Vibration-Generating Plant (Resonate, 2023)

Plant Item	Rating/Description	Minimum Working Distance-Cometic Damage (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 1.2 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 6-4 and are not expected to result in vibration levels above the human comfort criteria (Resonate, 2023).

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 6.9.

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 (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
- 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 upper 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
- Assuming an average of 21 working hours each day, that there would be 24 one-way heavy vehicle movements per day (around one x one-way heavy vehicle movement per hour) during the site mobilisation and demobilisation phases and eight x one-way heavy vehicle movements per day (around 1 one-way heavy vehicle movements every 2 hours) during the geotechnical investigation works. In addition, that the proposed works would generate 16 one-way light vehicle movements per day.

6.5.2 Existing Environment

Proposed access to the upper reservoir site is primarily gained from the New England Highway, Sandy Creek Road, Dolahentys Road and via a private property located at 250 Dolahentys Road, McCullys Gap (Lot 167, DP752444) then dirt tracks would be used as shown in Figure 6-7 below.

The New England Highway is a State Road that forms part of the inland Sydney to Brisbane road link. The proposed access route passes through the township of Muswellbrook where a mixture of light, heavy and active transport users frequently mix.

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.

Dolahentys Road is a two-way, two-lane local road with a north-south alignment. The road intersects with Sandy Creek Road at its northern end and a private property at its southern end. Dolahentys Road is relatively narrow and unsealed for the majority of its length.

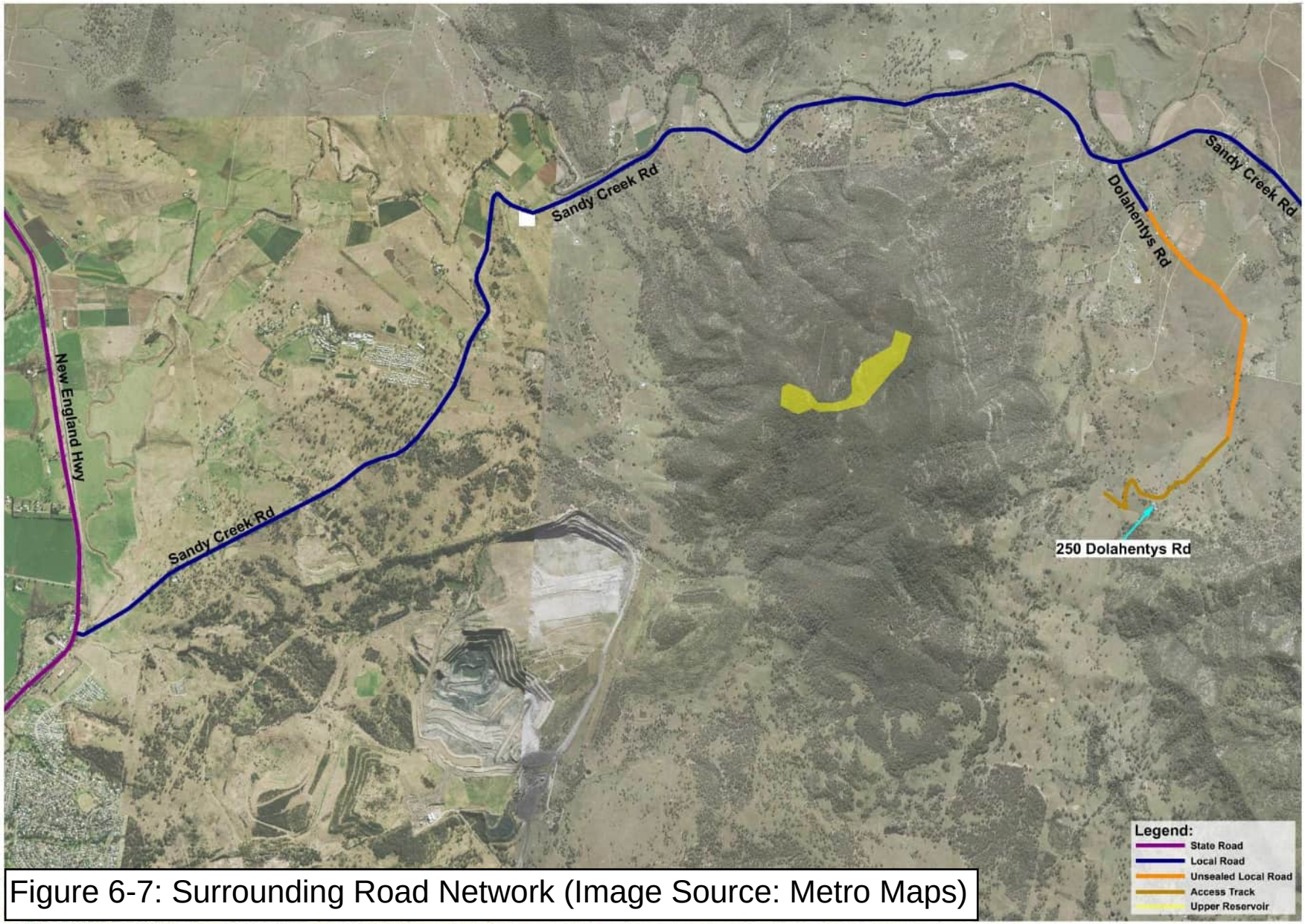

Figure 6-7: Surrounding Road Network (Image Source: Metro Maps)

6.5.3 Assessment of Impacts

In regard to New England Highway, project traffic would travel to site before the AM peak (08:00-09:00) and would leave the site after the PM peak (15:00-16:00). 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. Thus, project traffic would have minor impacts on the operation of the highway, which already carries a high proportion of heavy traffic.

Sandy Creek Road and Dolahentys Road provide local access to a number of properties and are expected to have low traffic volumes. While the capacity of these roads is able to accommodate the additional traffic generated by the Project, additional traffic on Dolahentys Road would need to be managed using speed restrictions and two-way communication protocols.

New England Highway is a designated heavy vehicle route and the section of Sandy Creek Road (approximately 2 km from the intersection of New England Highway) is an approved 19 m B-double route with travel conditions, therefore the nominal increase in heavy vehicle traffic on these roads is not expected to have any adverse impacts. In regard to Dolahentys Road, this is an unsealed gravel road between Pretoria Row and the start of the access tracks, therefore it is recommended to monitor its condition during use and repair, as necessary.

Heavy vehicles are likely to travel at lower speeds than other vehicular traffic. The access route via Sandy Creek Road has one lane in each direction. It should be noted that very low traffic volumes are expected to use this road, as it provides local access only and the impacts of Project related traffic on average travel speed are therefore considered to be minor.

The access route via New England Highway between north of Aberdeen Street has one lane in each direction except at the interception of Sandy Creek Road, where an overtaking lane is provided on the northbound carriageway. South of Aberdeen Street, the access route carriageway varies from two to four lanes. New England Highway/ Bridge Street is a designated B-double route and there is already a high percentage of heavy vehicles using this road. The impacts on average travel speed along the highway is anticipated to be minimal.

Existing property access will be maintained during the whole period of the works and no impacts are anticipated due to vehicle movements associated with the project.

6.5.4 Mitigation and Management Measures

Sandy Creek Road and Dolahentys Road provide local access to a number of properties. However, 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 6-6 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 6-5 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 upper reservoir geotechnical investigations will be defined in the EMP inclusive of waste disposal options.

Liquid waste would be removed from site by a licensed contractor and taken to an appropriate facility that is licensed to receive the relevant waste streams.

6.6.3 Mitigation and Management Measures

The management of waste streams generated from the upper 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 6-5 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 along the lower and upper 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 (around 2 km to the north-east), the Hunter River (around 10.2 km west) and Muscle Creek (about 3.2 km south).

Mapped surface water features (Spatial Services (DCS, 2022) within the Site include numerous ephemeral drainage channels, comprising 1st and 2nd order streams. No standing water was present in these at the time of site surveys in August 2022. Further information is provided in Section 5.2.7.

6.7.3 Assessment of Impacts

As explained in Section 5.2.7, two minor stream crossings may be required to be stabilised in order to safely facilitate site access during the geotechnical investigations as existing access tracks traverse one first order and one second order stream. Often this is undertaken by placing inert materials, such as clean gravel, in the area of the stream which is proposed to be crossed. Furthermore, one proposed borehole pad location (BHU5) may also be situated around 40 m from an existing, mapped first/second order stream (Figure 6-8). As such, a controlled activity permit to carry out works on waterfront land would be required (Section 5.2.7).

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 2 km north-east of proposed drilling works. Surface water drainage features are represented in Figure 6-8. One first order stream and one second order stream would be crossed by access tracks which are used to facilitate site access.

BHU4 + TP12
BH1
BHU2
BHU5
BH2 + TP11
BHU1
BHU3
BH7 + TP8
BH10
BH6 + TP9
BH4
1
2
3

LEGEND

Access Tracks
- Existing Access Tracks
- Proposed Alternative Routes
- Hunter Ecology Access Tracks
- Indicative Branches to Test Locations

Strahler Stream Order
- 1
- 2
- 3

Test Locations

Eastern Access Switchback Footprint

0 0.05 0.1 0.2 0.3 0.4
Km
1:8,500

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020, Strahler Stream Order © Water NSW, Hunter Ecology Access Tracks © Hunter Ecology,Metromap Tile Service: © Aerometrex Pty Ltd

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

6.7.4 Mitigation and Management Measures

A Controlled Activity approval would also be sought for works under the WM Act as the proposed interactions for geotechnical access tracks and potential interaction with the BHU5 pad could trigger a Controlled Activity Permit under the WM Act (as these works would also be situated within the C3 Environmental Management Zone).

The following management measures would be followed to mitigate potential impacts to surface water as a result of the proposed geotechnical investigations:

- 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:
  - 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
  - An environmental spill kit would be readily available
- Management of site activities through:
  - 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.

6.8 Groundwater

6.8.1 Methodology

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

- 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

The NSW SEED mapping of groundwater vulnerability in the Muswellbrook region identifies a vulnerable groundwater area within the Aberdeen area, approximately 8 km from the top of Bells Mt (Figure 6-9).

Specific details on existing groundwater conditions atop Bells Mountain are not available at this time. It is considered that the proposed geotechnical investigations would provide information to inform this knowledge gap and would therefore have a slightly beneficial impact to groundwater in the area by increasing this understanding of its existing nature.

LEGEND

Access Tracks

- Existing Access Tracks
- Proposed Alternative Routes
- Hunter Ecology Access Tracks
- Indicative Branches to Test Locations
- Test Locations
- Groundwater Vulnerability
- Eastern Access Switchback Footprint

0 1 2
Km
1:40,000

COORDINATE SYSTEM
GDA2020 MGA Zone 56

SOURCES Roads © RoadNet MDS 2020, Groundwater Vulnerability © State Government of NSW and Department of Planning and Environment 2014, Hunter Ecology Access Road © Aerometrex Pty Ltd,Metromap Tile Service: © Aerometrex Pty Ltd

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

Location: X:\Projects\300180\30018041 - Muswellbrook Pumped Hydro Energy Storage EIS\120 Stage 2 - EIS Component Deliverables\19 - GIS Portal\02_Maps\Muswellbrook PHES Scoping Report\Upper Reservoir Figures\Upper Reservoir Figures.aprx

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 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 6-6.

Table 6-6: Safeguards and management measures

Aspect	Management Measures
Biodiversity	• Disturbance will be kept within the geotechnical investigation areas and access tracks modifications delineated in Figure 6-1 • Clearing extents will be clearly staked and marked with flagging tape • 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) • Disturbance to other key habitat features such as fallen logs or ephemeral soaks should also be avoided • 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 (*Senecio madagascariensis*) or Common pear (*Opuntia stricta*) 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 • Erosion and sediment control measures are to be implemented around the works area during the Proposal to prevent sediment or sediment-laden water from moving off-site and affecting adjacent vegetation communities, species' habitat or watercourses. • 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 • Limit work during excessively wet or muddy conditions, where ground disturbance may be exacerbated • Following finalisation of geotechnical investigation sites, 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.

Aspect	Management Measures
	• 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 of assessment in this report.
Non Aboriginal Heritage	In the event item/s of non-Aboriginal heritage significance are discovered or uncovered onsite during site establishment or access track works, the geotechnical investigations site manager will cease work in that location and obtain advice from a qualified heritage professional.
Aboriginal Heritage	In relation to those few locations and stretches of track that could not be fully accessed/surveyed, a cautious approach should be adopted, including a Chance Finds Procedure and monitoring by a qualified archaeologist. If unexpected artefacts are identified during project works, an AHIP may be required to proceed with the works. For all upper reservoir geotechnical investigation works: • 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 NP&W 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	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

Aspect	Management Measures
	• 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.
Surface water	• 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: – 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:

Aspect	Management Measures
	– 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	Prior to commencement of drilling works: • Installation of appropriate sediment and erosion control measures. Refer to Surface Water Management Measures. During drilling: • Monitoring of sediment and erosion controls • 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	When accessing the Site along unsealed roads: • 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 During construction and maintenance of the drilling cut/fill pad: • 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 Bells Mountain.

This would have the benefit of allowing the JV to meet its responsibilities under the Regional Plan, as follows:

> ***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.'*

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 6.9.

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

Blue Book (Managing Urban Stormwater, Soils and Construction, Volume 1, (Landcom 2004) and Volume 2E, Mines and Quarries (DECC 2008)

Department of Planning and Environment. (2022a). Biodiversity Values Map and Threshold Tool. Available at https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap [Accessed 27 September 2022].

Department of Planning and Environment. (2022b). Soil Landscapes of Central and Eastern NSW - v2.1 (OEH 2020). Available at https://datasets.seed.nsw.gov.au/dataset/published-soil-landscapes-of-central-and-eastern-nsw37d37 [Accessed 26 September 2022].

Extent Heritage Pty Ltd (2023) Muswellbrook Pumped Hydro Energy Storage – Upper Reservoir Aboriginal Heritage Management

HLA. (2002). *Indigenous and Non-Indigenous Heritage Study, Muswellbrook Coal Company No.1 Open Cut Extension. Pymble NSW: HLA-Envirosciences Project No U888-4.*

Landcom (2004). *Managing Urban Stormwater: Soils and Construction* (4th edition), NSW Government, Sydney.

Resonate Consultants (2023) Muswellbrook Pumped Hydro Upper Reservoir Geotechnical Investigation Noise and Vibration Assessment

SLA Consulting Australia Pty Ltd (2016). Muswellbrook Coal Company Continuation Project Groundwater Assessment.

SMEC Australia Pty Ltd (2023) Biodiversity Assessment – Muswellbrook Pumped Hydro Energy Storage Upper Reservoir Geotechnical Investigation

SMEC Australia Pty Ltd (2023) Traffic Impact Assessment Report – Muswellbrook Pumped Hydro Energy Storage Upper Reservoir Geotechnical Investigation

State Government of NSW and Spatial Services (DCS). (2022). NSW Hydrography. Available at https://datasets.seed.nsw.gov.au/dataset/nsw-hydrography [Accessed 12 October 2022).

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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